Northeast Fisheries Science Center Reference Document 05-11

Expanding Opportunities in Oceanic and Atmospheric Sciences III

Proceedings of the Third National Conference to Strengthen the Links among HBMSCUs, NOAA, Business, and Graduate Studies in Marine and Atmospheric Sciences

Held at Jackson State University
Jackson, Mississippi
April 1-3, 2001

A. Jearld, Jr., and D. Peloquin, compilers

August 2005

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

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Dedicated to the Memory
of

Dr. Nancy Foster
1941 - 2000

A champion and leader
who embodied and fully embraced
the vision that by
expanding opportunities,
NOAA could become more diverse and inclusive

Nancy, "Expanding Opportunities" is your epitaph

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FOREWORD

This, the third *Expanding Opportunities in Oceanic and Atmospheric Sciences* Conference was significant in several ways. First, it was a follow-up and extension of the work of two previous *Expanding Opportunities Conferences* held in 1995 and 1999. Second, it provided a forum for the dedication in memory of Dr. Nancy Foster who championed the Expanding Opportunities cause beginning with the first Conference in 1995. Third, the number of participants in attendance exceeded each of the first two Conferences which indicates that the issues of diversity and true equal opportunity are crucial for all in our schools and businesses, and, more generally, in society and our nation. Thus, Conference participants came to work actively on developing strategic actions to expand diversity and opportunities for individuals from traditionally under-represented ethnic groups in the marine, atmospheric, and environmental fields.

In commissioning this document, the Conference Steering Committee hopes that it will serve not only as a source of information about the Conference, but also to bring fruition to the call for action. To meet the challenges of the 21st Century, America must mobilize and take full advantage of all its human resources. This means that the American workforce who contributes to oceanic, atmospheric, and environmental sciences must be representative of the diversity that is present in the American society. As minority underrepresentation in these fields is a complex and pervasive issue, a simplistic approach to increasing the numbers of minorities in the occupational and educational sectors will not work. What is needed to produce a workforce which reflects the diversity in the general population are long-term, system-wide, and permanent changes. The implementation of such fundamental changes is essential to attract, educate, employ, and retain minorities in the occupational and educational sectors.

This document may serve as a resource for policymakers in educational and occupational sectors, educators at all levels, historians, and other parties interested in expanding opportunities for minorities in the marine and atmospheric sciences. In addition, many of the issues discussed and recommendations which emerged during the Conference reflect broader social, political, and economic issues related to minority funding, support for structural change, and retention of minority employees. Consequently, the document has potential utility and relevance that extend beyond this Conference to individuals, groups, and organizations who share an interest in and commitment to increasing the participation of traditionally under-represented minorities in the oceanic, atmospheric, and environmental sciences. The Conference produced a number of substantive and far-reaching discussions, recommendations, and subsequent actions. While details of these are presented in the body of this report, the themes and concerns that were raised most frequently are highlighted below.

The Need for Clearer Communication

The need for greater and clearer communication continuously emerged throughout the Conference. One panelist expressed his dismay that with all the programs NOAA had available to students, very few of the students present at the Conference knew about them. Greater communication was called for to publicize the activities of NOAA and its Line Offices so that the larger public is aware of what these agencies do. It was also called for in creating more effective

partnerships between MSIs, private industry, and the government. Finally, more communication is needed at the legislative level to convince Congress that these programs deserve to be funded. This concern, the need for greater communication, was expressed more frequently than any other in the Conference. It remains a real obstacle for increasing and improving diversity as this is the third Conference, and the call for greater communication has been made at each one. There have been improvements —a central NOAA web-page for diversity has been created, and there is a feeling among students that their mentors are communicating well—but there is much work to be done.

The Need for More MSI Initiative

MSIs and HBCUs need to take a greater initiative in establishing partnerships, understanding business arrangements, and developing science majors. MSIs need to objectively assess their strengths and weaknesses, market their advantages, and seek partnerships that will produce mutual benefits.

The Need for Partnering Support

Many participants talked about the difficulties of establishing partnerships. The most frustrating partnership experiences were those that had been developed through a single contact person. If that contact person left, the entire project fell apart. Several Conference participants advocated advisory councils for partnerships so that the long-term interests of the collaborative work would be promoted, regardless of individual commitment, and incorporated within the structure of the host partner.

The Need For Faculty Support

A number of faculties expressed frustration at being overworked, trying to put together partnerships, write proposals, do significant research, write articles, and teach class. Faculty enthusiasm for and participation in increasing and sustaining diversity must be supported. As much as feasible, faculties could be provided opportunities by university administrations such as short-term leaves of absence to participate in faculty exchange; a faculty's mentoring of disadvantaged students and involvement in outreach programs should count toward tenure; and faculty members should have support in writing grant proposals.

The Need For Money

"Money is nice," said one participant. And more money is nicer. With the federal budget facing more severe cutbacks than ever, several participants talked about the practical side of getting money. They advocated that the search for money be personal. Faces, real people from NOAA, from the HBCUs, from partnering industries must lobby Congress in person. In addition, most Congressional members are unaware of the deep commitments NOAA has made to education and

diversity. Congressional members must see the practical workings of NOAA and must understand that the research NOAA does is enhanced by this attention to education and diversity.

The Need For Student Support

This area has seen improvement since the first Expanding Opportunities Conference. Participants spoke more of the retention with an eye to very practical concerns. For instance, internships are valuable to students, but little accommodation is made for housing or for travel costs to and/or from the internship location. Without a secure way of finding affordable, short-term housing, many students must turn down opportunities. Likewise, minority students often have needs that are not acknowledged or addressed by program directors.

The Need for Outreach

Outreach needs to happen at all levels—community, pre-school to post-graduate, internationally, and among scientific disciplines. Outreach that emphasizes collaboration, communication, and cultural awareness forms the basis for ethical work—work that supports not just the diversity of people but their well-being as well—work that increases knowledge while respecting land and culture.

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Acknowledgments

This conference like the previous two was a cooperative undertaking. As with all undertakings, there are many people who, without their help and dedication, the enormous success of the conference would not have been realized. For their singular commitment and work, the Expanding Opportunities Steering Committee from start to finish was a network of "can doers" second to none. I am mindful that the NOAA Conference Planning Committee was very helpful and instrumental in the linkages among NOAA, JSU, and other sponsors and institutions.

We are tremendously grateful for and indebted to Jackson State University for hosting the conference. I would like to especially acknowledge the unparalleled work and commitment abundantly demonstrated by members of the JSU Planning Committee in hosting an outstanding conference. Words are not sufficient alone to describe the tone and quality of the conference environment when one considers the history of this Mississippi University. There was excitement, enlighten anticipation and un-yielding commitment from start to finish by the entire Jackson State University family. The spillover of excitement in the wider community included Jackson's Mayor Harvey Johnson, and state Congressional representatives led by Hon. Bennie B. Thompson. We are grateful to all for their participation in the conference. From the University President, Ronald Mason, Jr. on through the administrators, faculty, staff, students and friends of the university, it was clear that the NOAA-led conference was special and welcomed. There was no doubt about it, the entire JSU community let it be known in its Mississippi style, greeting throughout the conference, it was a fine time and pleasure to host NOAA and other Federal agencies, visitors from academia, industry, NGOs, state, regional and city officials during the three day conference. Everywhere one looked there were signs, banners and personnel to help one know that this was a NOAA Conference and how to find one's way on and about the campus.

Special tribute is due to Dr. Paulinus Chigbu, Assistant Professor, Dept. of Biology, Dr. Paul Croft, Meteorology Program Coordinator, Dr. Abdul K. Mohamed, Dean, School of Sciences and Technology, Mr. Shelton J. Swanier, Director, Office of Strategic Initiatives, and Ms. Carolyn S. Fletcher, Administrative Assistant/Coordinator School of Science & Technology, Jackson State University; Jackson, MS; Dr. Brian Bingham, Associate Professor, Faculty Supervisor for Minorities in Marine Sciences Undergraduate Program, Shannon Point Marine Center, Western Washington University, Annacortes, WA; Ms. Emily Miller, Editor, Stow, MA; Dr. Joyce Payne, Director, Office for the Advancement of Public Black Colleges, NASULGC, Washington, DC; Dr. Bradford Brown, NOAA, NMFS, (Retired); Mr. Robert Stockman, Director, Strategic Management Staff, Office of Finance and Management, NMFS/NOAA, Washington, DC; Mr. Benjamin Watkins, Physical Science Administrator, NOAA/NESDIS, National Climatic Data Center, Asheville, NC; Ms., Natalie Huff, Program Manager for EEO and Diversity, NOAA/NMFS/ Planning and Development Division, Silver Spring, MD; Ms. Teri Frady, Chief of Communications, Ms. Helen Mustafa, Program Analyst, and Ms. Denise Peloquin, Secretary, NOAA/NMFS/NEFSC, Woods Hole, MA.

Finally, we gratefully acknowledge the invaluable assistance of Dr. Emorcia V. Hill, Director, Excellence Through Diversity Program, New England Board of Higher Education, Boston, MA, and Ms. Carmella Davis Watkins, Meteorologist NOAA/NESDIS, National Climatic Data Center, Asheville, NC, in organizing and orchestrating this conference. Their personal commitment made our undertaking the tremendous success that it was.

Expanding Opportunities Mission

The overriding mission of the *Expanding Opportunities Conferences* is simple:

To actively encourage minorities to pursue careers in the fields of Oceanic/Marine and Atmospheric Sciences. To that end, participants at each of the Conferences have worked to establish strategic alliances among the government, academic, and business communities.

The purpose of *this* Conference, the third of its kind, was three-fold:

1. Develop new sustainable alliances
2. Evaluate and strengthen previously established alliances
3. Identify impediments to progress and strategize to overcome these impediments

I. OVERVIEW OF THE CONFERENCE PROGRAM

The third *Expanding Opportunities in Oceanic and Atmospheric Sciences Conference*, sponsored by the National Atmospheric and Oceanic Administration's (NOAA) Line Offices, was held April 1-3, 2001 at Jackson State University (JSU), Jackson, Mississippi. Representatives from the NOAA offices, together with faculty and administrators from JSU, other Historically Black and Minority-Serving Colleges and Universities (HBMSCUs), other Higher Education Institutions and federal agencies, and industry participated in planning the Conference under the leadership of Dr. Ambrose Jearld, Jr. of NOAA's National Marine Fisheries Service (NMFS). More than 400 people, drawn from federal, state, and academic institutions, as well as industry were in attendance. Most importantly, there were a large number of students from a cross-section of colleges and universities.

The Conference provided opportunities for people from different institutions and business to network. A pre-Conference reception gave participants an opportunity to get acquainted and "loosen up" before the work began. At the end of the reception, alumni of the Jackson State University Atmospheric Sciences Program presented a cake to recognize the 25th anniversary of the initiation of the program. Several alumni were in attendance as well as NOAA personnel who were in some way involved in the program's development. Mr. Freddie Ziegler and Mr. Bill Parker coordinated the celebration with current JSU Meteorology staff. A business, technology, and career trade fair was held in conjunction with the Conference where representatives of NOAA and the industry presented their diverse research and employment interests, and students could get first-hand information on career paths in the marine and atmospheric sciences. Organizations that participated in the trade fair are listed in Appendix D.

Conference participants were welcomed by Dr. Ronald Mason, Jr., President, Jackson State University; The Honorable Harvey Johnson, Jr., Mayor of Jackson, Mississippi; and Rear Admiral Evelyn J. Fields, Director, Office of Marine and Aviation Operations, NOAA. The charge to the group was jointly given by Rear Admiral Fields and Dr. N. Joyce Payne, Director, Office for the Advancement of Public Black Colleges, National Association of State Universities and Land Grant Colleges (NASULGC). Four other featured speakers addressed the group: Dr. Ronald Mason, Jr., Dr. Michael Sissenwine, Ms. DeLois A. Cutter, and Dr. Darrell Jay Grimes.

In a panel presentation, NOAA Line Office representatives presented overviews of their programs and discussed career opportunities. A lively question and answer session followed. Four concurrent workshops, focused on academia, student life, private and public sector business, offered participants an opportunity to examine successful models of increasing diversity and to learn from others' experiences. A plenary session concentrated on identifying and developing untapped resources in the effort to build sustainable alliances. Five working groups were asked to assess the realistic implementation of recommendations and to distribute responsibilities among academia, the public and private sectors to maximize success.

The Conference was dedicated to the memory of Dr. Nancy Foster who championed the Expanding Opportunities cause beginning with the first Conference in 1995.

II. DEDICATION: To the Memory of Dr. Nancy Foster, NOAA

Captain Ted I. Lillestolen
Associate Deputy Assistant Administrator, NOS/NOAA

Captain Lillestolen dedicated the Conference to the memory of Dr. Nancy Foster who "was an advocate and pioneer in the area of diversity" and fairness for all. Dr. Foster was a remarkable person. During her 23 years with NOAA, Dr. Foster's vision, courage, and belief in the individual changed the cultural climate of NOAA to hold diversity as a priority in the workplace. She was known as well "nationally and internationally for her conservation work on protected areas, stewardship of the National Marine Sanctuaries Program, the leadership of NMFS, the creation of NOAA's Habitat Restoration Center, and numerous other pioneering works in marine conservation. In 1999, then President Clinton honored Dr. Foster with the rank of Distinguished Executive for leadership exemplifying the highest standards of service to the public."

Dr. Foster received many other awards and commendations, including three Department of Commerce Bronze medals, and the Department's Gold medal for her leadership in marine conservation. Former Vice President Gore praised her vision and directorship, writing that "much of the success of the National Marine Sanctuaries Program, a treasure to the American people, is attributed to her tenure as director."

On April 26, 2000, NOAA and the National Ocean Service (NOS) dedicated the Dr. Nancy Foster Florida Keys Environmental Center in Key West, Florida in honor of her lifetime commitment to our national coasts and oceans.

NOAA was also honored to announce the *Dr. Nancy Foster Scholarship Program*. Its purpose is to recognize outstanding scholarship and to encourage independent graduate-level research, particularly by female and minority students in oceanography, marine biology, and maritime archeology. Information about the scholarship is available at http://fosterscholars.noaa.gov/.

Captain Lillestolen ended the dedication by reminding everyone that Dr. Nancy Foster embodied courage, commitment, and dedication to service. He thanked the Conference participants for the great honor of Dr. Foster's scholarship and urged anyone who could take advantage of the scholarship to do so.

III. GREETINGS AND WELCOME

The Honorable Harvey Johnson, Jr.
Mayor of Jackson, Mississippi

Dr. Ronald Mason, President
Jackson State University, Jackson, Mississippi

After being introduced by Dr. N. Joyce Payne, Director, Office for the Advancement of Public Black Colleges, National Association of State Universities and Land-Grant Colleges (NASULGC), Mayor Johnson and President Mason each spoke briefly, welcoming the Conference participants to Jackson, Mississippi.

The Honorable Harvey Johnson, Jr. welcomed the attendees on behalf of the people of the City of Jackson. He then spoke about the importance of Jackson State University. "We're so proud the Conference is being held here at Jackson State University, the very heart of Jackson, Mississippi, the capital of our great state. We are working together to make Jackson the best of the New South, and Jackson State University is our most important partner as it builds programs to serve future generations through educational excellence."

Dr. Ronald Mason first acknowledged the hard work that so many had done to make the Conference possible. He welcomed everyone to Jackson State University, and he talked about the new construction occurring at the university. The Conference was held in the new Liberal Arts building, and work on new buildings for the School of Business, School of Engineering, and a new e-Center for computers and remote sensing would begin in the next year. Dr. Mason offered to host the next Conference as the entire campus, including a new pedestrian mall, would be finished. As Dr. Mason would be the speaker at the Conference banquet, he kept his remarks brief, concluding, "Welcome to our campus, enjoy the Conference, and we'll be seeing you all later this evening."

IV. CHARGE TO THE CONFERENCE

Rear Admiral Evelyn J. Fields
Office of Marine and Aviation Operations, NOAA

Dr. N. Joyce Payne, Director
Office for the Advancement of Public Black Colleges, National Association of State Universities and Land-Grant Colleges (NASULGC)

Rear Admiral Fields, in her charge to the participants from the NOAA perspective, reminded participants that "the Expanding Opportunities effort is directly related to NOAA's attempt to diversify its workforce and to develop access to the talent needed for the fulfillment of its mission." She urged that "as we develop NOAA's vision for the 21st Century, it is critical to develop a NOAA workforce representative of the diversity present in this country," encouraging participants to discover and use the potential talent in communities that are still under- represented. Rear Admiral Fields charged the participants "to build a model of what makes partnership work."

Dr. Payne had the responsibility of charging the Conference from the perspective of the higher education community. She thanked JSU for hosting the Conference and commended Dr. Jearld for his "tremendous tenacity" in his commitment to equality and fairness. She began her charge with stark words, "inequality for minorities in the sciences is profoundly pervasive," acknowledging that from the academic perspective there are still not enough minorities in marine and atmospheric sciences. She charged the Conference participants "to reaffirm commitments to making a radical change in expanding opportunities" by building sustainable alliances and "removing those policy and programmatic impediments that undermine the nation's ability to produce a central intellectual capital for the world marketplace." Dr. Payne went on to say, "We must leave this Conference with the renewed commitment to strengthen partnerships between colleges and universities, Commerce and NOAA, and scientific enterprise. We must leave this Conference with the renewed commitment to create a foundation for inclusion, innovation, and investment—three very basic elements to extending equal educational opportunity." Dr. Payne concluded by asking everyone at the Conference to commit to equality and fairness not just in their professions, but in their entire lives.

V. EVENTS AND KEYNOTE PRESENTATIONS

The Honorable Bennie G. Thompson, United States House of Representatives, Dr Joseph Stevenson, Jackson State University, Vice President for Academic Affairs and Provost, Mr. John Oliver of National Marine Fisheries Service, NOAA, and the Conference Chairman, Dr. Ambrose Jearld, Jr. were among those welcoming the Conference participants and setting the tone for the Conference at a pre-Conference reception, Sunday evening.

Ms. DeLois A. Cutter, owner and President of Tal-Cut Company, was Keynote Speaker at lunch on Monday. Her presentation was on leadership and perseverance. Ms. Cutter, who has held a number of executive management positions with major corporations, stressed that "increased diversity is everyone's job."

Dr. Ronald Mason, Jr., President of Jackson State University, was the Keynote Speaker at the Monday night banquet. The theme "expanding opportunities and building alliances," he said, "could easily be both the history and mission of Jackson State University." The development of JSU, "Mississippi's only urban university," relied on alliances with government, neighborhoods, and churches. Dr. Mason talked about the unconscious racism in the United States, a racism driven by capitalism, of trying to emulate not just the ideas of the designers of our nation but also their ethnicity and social standing. We must understand, Dr. Mason said, that forming alliances and expanding opportunities is "not so much about doing favors for minorities" as it is "about human beings working together to put things back in balance."

Dr. Darrell Jay Grimes, Dean, Institute of Marine Sciences, The University of Southern Mississippi, was Keynote Speaker at the luncheon on Tuesday. He said expanding opportunities for minorities in the oceanic and atmospheric sciences is a "most worthy goal." He pointed to the continuing lack of minorities in these fields and the continuing need for minority role models. Dr. Grimes talked about both successful current projects and discoveries yet to be made, noting that money is indeed "the major solution to expanding opportunities." He concluded that it is important "to figure out how to excite and engage young people," particularly "under-represented young people," into marine and atmospheric fields.

Programs of events are featured in Appendix B.

VI. PANEL SESSION

PERSPECTIVES FROM NOAA'S LEADERSHIP:
Progress and Impediments: Building Sustainable Alliances

This panel session provided Conference participants with an overview of the current progress and impediments in NOAA's work to sustain diversity and to foster relationships with the HBMSCUs. The panelists described effective strategies and realistically assessed the structures that need to be implemented. After all the panelists spoke, the floor was opened for a question and answer session.

Moderator: Dr. William White, Associate Dean, School of Science and Technology, JSU
Panelists: Mr. John Oliver, Deputy Assistant Administration
National Marine Fisheries Service, NOAA
Ms. Louisa Koch, Deputy Assistant Administrator
Office of Oceanic and Atmospheric Research, NOAA
Captain Ted Lillestolen, Associate Deputy Assistant Administrator
National Ocean Service, NOAA
Ms. Mary Glackin, Deputy Assistant Administrator, National Environmental
Satellite, Data and Information Service, NOAA
Dr. Edward Johnson, Director of Strategic Planning and Policy
National Weather Service, NOAA

NOAA: A Good Place to Work, Committed to Diversity

All the panelists began by extolling the praises of a career in the service of NOAA, asking those Conference participants who were not yet employed to consider a career in public service. "We've got it all," said Mr. Oliver, "career opportunities in every state and almost every field you can imagine from weather meteorology to satellite technology to undersea research." NOAA's mission—to describe and predict changes in the Earth's environment, and to manage wisely the nation's coastal and marine resources—provides a broad range of exciting and important responsibilities.

All the panelists also emphasized NOAA's commitment to diversity, describing a history of NOAA's outreach to HBMSCUs, pledging their Line Office's dedication to NOAA's Minority-Serving Institutions Council, and recognizing the need for continued and sustained alliances and resources.

NOAA's Minority-Serving Institutions Council: A Financial Commitment

Ms. Louisa Koch spoke as the Chair of NOAA's Minority-Serving Institutions Council which "serves as the focal point for NOAA's leadership to work together to identify ways for NOAA to strengthen its partnership with MSIs." NOAA's partnership with MSIs increases the likelihood of a diverse workforce at NOAA. NOAA's work requires people with advanced degrees, particularly science and engineering, but "statistics from the National Science Foundation Science and Engineering Indicators 2000 Report illustrate that the number of minority students receiving

Doctoral and Master's degrees in science and engineering, continues to be well below the national average. The most recent National Science Foundation (NSF) data state that of the approximately 18,000 doctoral degrees granted in science and engineering, only 3% were granted to African Americans, 3.5% to Hispanics and 0.3% to American Indians and Alaska Natives. Since about 40% of minority students receive their undergraduate degrees at Minority-Serving Institutions, direct collaboration with Minority-Serving Institutions is an excellent way to increase the number of minority students with degrees in NOAA-related fields."

Ms. Koch announced, with great pleasure, that NOAA's budget for this year includes $15M for NOAA to partner with Minority-Serving Institutions. She praised the hard work of many people who made this funding possible: the faculty and administration of the MSIs themselves, Commerce Secretary Norm Mineta and former Deputy Secretary Robert Mallet, who made this program a top priority, and the current Acting Under Secretary of NOAA, Scott Gudes, whose leadership and vision turned a dream into reality. Ms. Jacqueline Rousseau with the Educational Partnership Program Office, OAR, also spent many hours building coalitions to ensure the program would be a success.

The New NOAA-MSI Partnership Program

There are four components of this program.

1) <u>Creation of Cooperative Science Centers</u>
Cooperative Science Centers will be created at select MSIs to support research in the areas of atmospheric, oceanic, and environmental sciences, and remote sensing. By developing these centers, we wish to improve opportunities for, and retention of, students and faculty from under-represented groups in the NOAA related sciences in order to increase the number of students graduating in NOAA Science areas. We are looking to enhance collaborative research opportunities and experiences for faculty and students with NOAA research facilities, stronger infrastructure at MSIs, and an increase in staff exchanges between NOAA and MSIs.

A Distinguished Professorship will be created at each of the Science Centers. These professors will be required to develop significant research projects for their respective Centers with other professors and students. Staff and faculty exchanges will also be part of this program, and there will be opportunities to participate in collaborative research. Where appropriate, NOAA staff may teach courses, develop curricula, or conduct joint research.

2) <u>Funding by the Environmental Entrepreneurship Program</u>
The Environmental Entrepreneurship Program will provide funds to MSIs to support training research, outreach and employment opportunities in effective management of natural resources in depleted environments. We hope this support will develop new and enhance existing academic programs in the environment and increase the number of students from under-represented groups to enter careers in environmental fields. These funds will also be used to support MSI faculty and students in demonstration projects on environmental restoration and protection that integrate education, outreach, and research focused on the application of sound methods and technology.

3) Establishing a Junior Year Scholarship Program
The goal of this program is to increase the number of students who undertake course work and graduate with degrees in NOAA related areas.

4) Graduate Scientist Program
This program is aimed at recruiting new NOAA employees and providing them with graduate level training in NOAA related areas.

National Marine Fisheries Service: Connect and Coordinate

Mr. Oliver described the role of NMFS or NOAA Fisheries: "We are the stewards of the nation's living marine resources and the environments in which they live." He noted that the research conducted at the five major science centers is done in cooperation with universities and other coastal partners, and this research is used both domestically and internationally to further conservation of living marine resources. This theme of cooperation was evident in NMFS's history of sustaining diversity. Mr. Oliver related a 25-year history of NMFS involvement with Minority-Serving Institutions (MSIs), sponsoring educational workshops, developing marine programs, and doing cooperative research, including its current funding of two JSU master's degree students working on red snapper. Most recently, NMFS has established a research cruise off the Chesapeake Bay for faculty and students from MSIs. Fulfilling the commitment made at the second *Expanding Opportunities* Conference, NMFS appointed Dr. Brad Brown (NMFS, Miami Laboratory) to coordinate all of the MSI activities. "We hope, with this appointment, we can take greater advantage of our research facilities and NOAA vessels to provide research platforms and internship opportunities for students and faculty from MSIs."

Office of Oceanic and Atmospheric Research: The Sea Grant Programs

Last year, Sea Grant called for proposals for innovative partnerships to strengthen the capacity of MSIs to foster student careers, research, and workforce competitiveness in marine and related sciences. Sea Grant made available $300,000 per year for three years.

Here are four of these programs:

1) Jackson State University received a three-year grant to strengthen their marine science program. This project is to increase the number of students receiving degrees in marine science and to enhance the capacity of JSU to train students in research. Students will be selected to gain field and laboratory research experience at JSU.

2) Morgan State University and the Smithsonian Environmental Research Center received a three-year grant to increase research and education opportunities in marine and related sciences. The partnership will include (1) field and laboratory work under the guidance of scientist mentors, (2) a series of short courses on topics ranging from the scientific method to experimental design (3) a biweekly seminar series and, (4) a series of marine and environmental science laboratory modules for infusion into undergraduate and graduate courses. The most talented and brightest participants will be selected to present their research at two regional Conferences each year.

3) Savannah State University received a three-year grant to use mariculture as a tool to encourage diversity in Marine Science careers. This project establishes a Research Fellowship Program to provide research opportunities and on-the-job training for under-represented students in areas such as aquaculture. It will also establish a sea grass nursery in partnership with the private sector. Savannah State University will partner with the James M. Waddell Research and Development Center, one of the country's largest facilities for aquaculture research.

4) South Carolina State University received a three-year grant to enhance experimental learning in marine sciences. This project focuses on organizing South Carolina State University's marine science resources to provide "hands-on" learning experiences, especially in aquaculture, to high school and undergraduate level students. It will provide research and development opportunities to students seeking graduate degrees in the marine sciences.

National Ocean Service: Partnerships to Develop Opportunities

Captain Ted Lillestolen reported that the NOS has created several partnerships over the years to increase awareness of and employment in oceanic and atmospheric sciences for women and minorities. He spoke about four current partnerships

1) NOS' Center for Coastal Monitoring and Assessment and Dr. Livingston Marshall, an Associate Professor of Biology at Morgan State University (MSU) entered into a partnership to focus one environmental studies class on concerns stemming from environmental sampling in the Chesapeake Bay. NOS is working with the National Aquarium in Baltimore, Maryland and MSU to train MSU students in the Reserve Systems Ecological Monitoring Program.

2) NOS' Estuarine Reserve Division and the Coastal Service Center are cooperating with professionals and volunteers at the Chesapeake Bay National Estuarine Research Reserves in both Virginia and Maryland.

3) NOAA committed $35 thousand during the fiscal year 2000, to the Chesapeake Bay National Estuarine Research in Virginia to train undergraduate and graduate students in data collection and analysis technologies currently employed at the Reserve.

4) NOS, through the Coastal Zone Management Program, is partly funding a project at Jackson State University. JSU is assisting the Mississippi Coastal Management Agency with the development of a geographic information system application incorporating attributes extracted from a digital permit database of regulated in-water activities of the Mississippi Gulf Coast.

National Environmental Satellite, Data, and Information Service (NESDIS): Multi-leveled Partnerships, Sustained Commitments

Ms. Mary Glackin began by summarizing NESDIS' mission: to develop and sustain the nation's environmental satellite systems and to provide stewardship of the nation's environmental data.

Ms. Glackin emphasized that NESDIS employs people with a wide range of skills, from oceanic sciences to remote sensing. NESDIS' approach to increasing and bolstering diversity is equally wide ranging, emphasizing broad coalitions among public, private, and academic sectors and supporting these coalitions through long-term, sustained commitment. She reminded Conference participants that long-term success requires initial leadership and support, citing NOAA's first-hand involvement in the establishment of the Atmospheric Sciences Department at JSU which will soon celebrate its 25th anniversary. Three other programs also demonstrate both partnership and commitment:

1) National Aeronautics and Space Administration (NASA) and Howard University partnered to bring graduate students in atmospheric sciences to Howard during the summer. This program provides students the opportunity to learn about our research and scientists the chance to meet and talk with students.

2) Wallops Island Summer Science Camp. This program, now in its second year, envisioned by Ms. Eveline Cropper and in partnership with the University of Maryland, Eastern Shore, helps middle school children stay involved in the sciences. At this science summer camp, students gain exposure to NOAA science, experience a campus setting, and get a chance to see scientists as role models.

3) NESDIS' New Coastal Data Development Center and scientists from JSU will partner to work on the use of satellite data and GIS technology. This $2.5 million grant was supported by Senator Thad Cochran of Washington, D.C. and approved by Congress.

National Weather Service: Impediments and Outreach

Dr. Edward Johnson began by reminding participants of California, "the most populous state in the nation which now has less than 50% non-Hispanic white population." The "minority" is the majority, and this change in demographics is the trend predicted for the future. Dr. Johnson then urged that if institutions do not take advantage of this nation's diversity, they simply would not survive. A commitment to increasing diversity is a commitment to the health and sustainability of NOAA and the National Weather Service (NWS). The NWS currently is committed to increasing the representation of minorities, women, and persons with disabilities by 1% per year in its workforce, which it did last year. Dr. Johnson lauded this, but acknowledged that 1% falls far short of what is needed to create a sustained diverse workforce.

The biggest impediment the NWS faces is that it is not currently hiring in great numbers. The workforce is "comparatively young" and NWS does not lack applicants for entry level positions, especially in meteorology. Nonetheless, the applicant pool is not representative of the diverse population of the United States. We are using outreach to build our applicants.

1) Outreach to Minority-Serving Institutions

One of our major activities is to establish partnerships with minority-serving institutions. We are using our nine national centers, which provide a variety of services from environmental modeling to weather forecasting, to make contact with MSIs. These contacts are not just with the

meteorology departments, but also any department related to Weather Service concerns, including physics, mathematics, and the social sciences. One of our challenges is to learn how to communicate more effectively to the decision-makers in this country. A clearer understanding of the relationships between the work of NWS and economic matters would benefit us.

2) Outreach to Primary and Secondary Educational Institutions

The Weather Service has a responsibility to support the atmospheric sciences and the physical sciences in general. We provide school visits for career days. Each of our weather forecast offices has a position called a Science and Operations Officer whose duty, in part, is to reach out to science programs at academic institutions, particularly elementary and secondary education.

3) Student Internships: Federal Employees and Non-Federal Employees

We have two types of student internships, both of which allow students to gain exposure to NOAA career paths. The first internship results in students becoming federal employees, either temporarily or on a direct career path. In our last fiscal year, 1999, we had 28 women and minority students under our student career employment program and 27 under the temporary employment program. We also take advantage of the non-FTE program under the Oak Ridge Institute for Science and Education (ORISE) to bring students on board through a contract approach. These internships are open to students at the high school level as well. They have the advantage of not being affected during times of administration change or hiring freezes.

4) A Central Web Site

A central web site identifies grant opportunities between the Weather Service and minority-serving institutions. (www.rdc.noaa.gov/~grants/index.html).

5) Two New Faculty Appointments

NWS has budgeted for two new faculty hires for the NOAA Faculty Student Research Participation Program. Positions are open for all faculty members from minority-serving institutions. The position announcements are available from the National Weather Service EEO Program Office at (301)713-0692.

QUESTION AND ANSWER SESSION

A lively question and answer session followed, marked by the openness of participants and panelists alike willing to share their expertise and knowledge. Three main questions were asked:

- Can we have more information about SBIR (Small Business Innovation and Research) in relationship to NOAA's programs?
- What are the general impediments to the progress of achieving diversity?
- What opportunities are there for juniors and seniors in college?

Small Business Innovative Research Program

NOAA is an active participant in the Small Business Innovative Research Program (SBIR), which is an excellent vehicle for small and minority-owned businesses to contract with NOAA. Every

year NOAA solicits proposals to fund innovative research and technology products. NOAA has made some special efforts within the Department of Commerce to put in place pre-completed contract vehicles with small businesses to support our operations. This is called the COMETS program and it has been very successful.

General Impediments to Progress

The greatest impediment is the lack of funding at HBMSCIs. There is not adequate financial aid for minority students and this directly impacts the number of minority students graduating with the needed degrees.

What NOAA is currently trying to do is to achieve parity between majority and minority institutions in terms of partnerships, business opportunities, and financial support. These partnerships are crucial because one of the primary ways any student is attracted to a given field is by personal contact, meeting and establishing a relationship with someone at NOAA.

Developing feeder programs, contracts, summer work opportunities at HBMSCIs allows minority students the opportunity to establish contact at an early point in their college career, possibly even during high school. These personal, direct contacts with NOAA employees are the single greatest way minority students are recruited to work at the various Line Offices. NOAA must continue a policy of direct promotion, visiting each and every one of the 117 HBMSCIs, despite the great time and personal commitment this takes.

Student Opportunities

There are a number of student opportunities in NOAA. The Line Offices of NOAA want to stress that NOAA hires a wide range of applicants, from those associated with oceanography to those interested in electronic technology. Currently, there is a program for those students who are interested in environmental studies in which NOAA will pay a salary and send the student to graduate school in a mutually beneficial area. Even the range of majors is open, as NOAA also needs grant writers and financial analysts. It is important to note that for those who are interested in oceanic studies, graduate programs tend to recruit from biology, chemistry, physics, and geology, but not environmental studies.

Student opportunities are created through a two-way process. Students and their institutions must be willing to contact NOAA, to impress upon NOAA the urgency of diversifying. NOAA is, after all, a public, government agency. Students can contact NOAA to see how their tax dollars are working. Likewise, NOAA also has to reach out and directly contact students. As an example of this, the Weather Office charged every one of its weather offices, all 121 of them, to identify within their area of responsibility minority-serving institutions. Last year 300 such contacts were made, and it is hoped that these types of contacts will spread across the country to become a network of long-term relationships between NOAA and minority-serving institutions.

VII. CONCURRENT WORKSHOPS

The Concurrent Workshops all addressed the larger theme of "Models that Work and Lessons Learned." Two sessions were held, each having four concurrent workshops representing Academia, Student Life, and the Private and Public Sectors. At each session, a group of panelists spoke on a specific topic within the theme. A moderated question and answer period followed.

ACADEMIA

Panel A—Achieving Educational and Occupational Goals

Moderators: Dr. Edward Thomas, Auburn University
Ms. Nikola Garber, National Sea Grant College Program, NOAA
Panelists: Dr. William Bonner, University Corporation for Atmospheric Research
Dr. Bradford Brown, NMFS, NOAA
Dr. Gleyn Bledsoe, Land Grant and Outreach, Northwest Indian College
Dr. Marin Robinson, Northern Arizona University
Ms. Letise Houser, Brown University
Dr. Mark Hardy, Jackson State University

A Reminder of NOAA's Goals

Dr. Bradford Brown opened the session, stating again the three-fold goal of NOAA:

- To increase the number of Black, Hispanic, and Native Americans in the scientific professions of NOAA's agencies.
- To enlarge the pool of qualified minority applicants to these positions.
- To support Minority-Serving Institutions in preparing students to enter the scientific profession.

Minority Institutions Must Initiate Partnerships

The key to achieving the above is partnerships. Through partnering, NOAA had a major role in helping to build the current capacity of majority institutions, much of which was done by direct financial support. While Dr. Brown has continually urged NOAA to seek out partners from minority institutions, he has noticed that most of the successful established partnerships were initiated by the majority institution. Institutions seeking to serve minorities must aggressively approach the issue of partnering with NOAA.

Working Programs for "The Forgotten Minority"—Native Americans

Dr. Gleyn Bledsoe reminded the audience that environmental sciences, particularly marine and oceanic sciences, have historically been critical for Native Americans since all tribes were tied to the land. The American Indian Higher Education Council put together a marine research program and now seeks partnerships with NOAA and other federal agencies for an environmental program.

Dr. Marin Robinson, who teaches at Northern Arizona University (NAU), a MSI with approximately 12% Native American student population, named some of the programs developed to support Native Americans' education in the scientific professions. She writes:

"The National Institutes of Health (NIH) funds an initiative to prepare minority undergraduates for entrance into medical school. The program involves research opportunities for targeted undergraduates as well as Supplementary Instruction sessions in the introductory sciences (General Chemistry, Organic Chemistry, Biochemistry, and Biology). Another science initiative at NAU includes a newly-funded *Bridges* program, which targets students from Diné College (formerly Navajo Community College) to conduct research in chemistry and biology at NAU the summer before they transfer to NAU. The program allows faculty to visit the Diné Campus and conduct workshops for students planning to participate in the program. NAU also is the home of ITEP, the Institute for Tribal Environmental Professions. ITEP was created in 1992, in cooperation with USEPA, to act as a catalyst among tribal governments, research and technical resources at NAU, various federal, state and local governments, and the private sector, in support of the environmental protection of Native American natural resources. Other programs related to the environment at NAU include the Merriam-Powell Center for Environmental Research, which focuses on long-range studies of sustainability on the Colorado Plateau, and the Center for Sustainable Environments, designed to coordinate programs across campus related to environmental issues. Last year, NAU added a Masters of Science degree to its Environmental Sciences program and projects an enrollment of 12 master's students by next fall."

Promoting Marine Science Programs at Land-locked Universities

Several participants mentioned the difficulty of promoting marine science programs at universities that are landlocked. This particularly affects MSIs because many MSIs are not located along the coast. Several speakers advocated that these programs needed to be promoted, with special attention paid to the research trips built into the curriculum.

Changing the Intellectual Infrastructure of Universities

Most of the questions in the follow up session involved required courses in math and science, e.g. "Do I have to take organic chemistry?" Many students expressed their frustration at courses not being directed towards their career goals, not demonstrating applied practical knowledge, and not reaching out towards different learning styles. All of the professors present agreed that these courses were important. These courses teach students how to organize and process complex information, how to assess importance, and how to construct a disciplined thought process. In short, the very rigor of these courses is important to prepare students for the rigors, and the opportunities, of the scientific professions. As Dr. Bonner said, "Marine biologists are a dime a dozen." But there is always need for marine biologists who are adept at serious math and science. In addition, the scientific field is a fluid one; scientific and technological knowledge constantly changes. A well-educated scientist can keep up with these changes.

Yet for all this, most professors remarked on how little teacher training they received; some professors acknowledged that they were not good teachers because they had never received any teacher training. In fact, teaching training was often considered by universities to be wasteful, only useful for those graduate students who were struggling in their course work. Preparing for good teaching, ironically, is often antithetical to preparing for good research.

The intellectual infrastructure of the university needs to change. Active research needs to be balanced with active, progressive, teaching. The combination of these two can keep students energized and focused, aware of both the rigor of research and the practical applications of it. This approach also allows for courses to retain their depth and difficulty while becoming more accessible for those students who may not be well prepared. A teaching style that does not consider students' needs simply reinstates the status quo—those students, often minorities, who have not benefitted from a strong secondary education, continue to be "second class citizens" in the university. Universities must reach out to these students, and, in reaching out, prepare students thoroughly, even if this means recognizing that for many minority students a five-year baccalaureate program may be critical.

Panel B—Investing in Building Capacity

Moderators: Dr. Larry Robinson, Florida A&M University
Ms. Margaret McBride, Chesapeake Bay Program, NOAA

Panelists: Dr. Joseph Okoh, University of Maryland Eastern Shore
Dr. Abdul Mohamed, Jackson State University
Dr. Michael Sissenwine, Northeast Fisheries Science Center, NMFS, NOAA
Mr. Kurt Shinkle, National Geodetic Survey, NOAA
Dr. Arthur Allen, University of Maryland Eastern Shore
Dr. Robert Stewart, Texas A&M University

A Brief Overview

Dr. Robinson began by mentioning that Dr. Allen had been called away, and reminded the participants of how important it is to build capacity, particularly within minority institutions. The roots of this Conference extend back to 1997 when a consortium of schools met with NOAA regarding the concern that there wasn't enough capacity within these institutions to serve NOAA's employment needs. That meeting led to NOAA's direct investment in minority-serving institutions to help build the infrastructure needed to do active oceanic and atmospheric research and educate students in the oceanic and atmospheric sciences. In the best situation, as Dr. Sissenwine said, building capacity is a win-win situation. The minority community and its academic institutions are expanded, able to fully participate in marine and atmospheric science, and the capacity of NOAA and its Line Offices is expanded, able to fully diversify its scientific workforce.

Philosophies to Consider in Building Capacity

Dr. Sissenwine offered his perspective as the Director of the Northeast Fisheries Science Center (NEFSC), which is a relatively small organization compared to NASA or NSF. Most of NEFSC's resources are dedicated to on-going operational activities; there is little grant money available. The capacity building strategies, then, must be intuitive, oriented towards small, on-going successes.

- **Managers Must Be Responsible For Success**
  Managers cannot let EEO committees do all the work towards diversity. Managers themselves must be committed and responsible for hiring, sustaining, and promoting under-represented people.

- **Great Successes Are Built On Many Smaller Successes**
  Not every plan needs to be grand in scope; in fact, small successes do add up to sustained success. For instance, the practice of recruiting for student positions in HBMSCUs has been quite effective. Looking back over the 25-year history of this practice, some of the minority students NEFSC hired are now people in prominent and powerful positions.

- **Be Creative, Look For Opportunities Everywhere**
  Opportunities abound if we look outside the box. For instance, a few years ago NEFSC planned an international conference on sea exploration. The conference was held in Baltimore, and NEFSC made a special effort to organize a pre-conference to introduce minority scientists from the Baltimore area to these international scientists. Tremendous contacts were made without expending a lot of money, just a bit of ingenuity. Similarly, we offer daylong research trips on our offshore research vessels for students from smaller institutions. These trips give students valuable exposure to scientists and research.

- **Have Modest Expectations**
  Most people are not superstars. We limit our chances for true change when we expect each minority student and every partnership with an MSI to be highly successful. Most people are average, whether they come from Jackson State University or Harvard, and that's fine. Take a chance on someone, on a partnership. Provide them the support they need to live up to their personal potential.

Capacity Building at the National Geodetic Survey

Like NEFSC, the National Geodetic Survey (NGS) is a smaller part of NOAA with a limited budget and no grant resources. Nonetheless, it works towards capacity building on several different levels, and in each case, NGS benefits by connecting with more people and entering more data into the National Spatial Reference System. (1) Through direct capacity building with San Diego State University, NGS trained students to use remote data sensing and rigorous metric measurement equipment. This training allows students to participate in the Tijuana River Basin Project. (2) Through the Cooperative CORS (Continuously Operating Reference Station) Program, upon request, NGS will help people set up their own GPS (Global Positioning Satellite)

reference station. NGS will provide the expertise, help to acquire the equipment, and run a central web site for access to data. (3) In the State Advisor Program, 22 states in the country have a NGS advisor assigned, whose job it is to help build capacity by dealing with questions of position and elevation. For instance, NGS helps teachers integrate science into lesson plans. This program is free for the asking.

Tremendous Infrastructure, But Few Students

Dr. Robert Stewart, a professor at Texas A&M University, spoke on the difficulty of finding any U.S. students, much less students from under-represented groups. Texas A&M is a large research university, well funded and well staffed with faculty. But it is "spectacularly unsuccessful in recruiting minorities." There are several reasons for this.

- **Most Students, Minority and Non-Minority, Choose Medicine**
  The vast majority of students in the sciences want to become doctors; the rest overwhelmingly are going into computer science or business. Out of Texas A&M's 44,000 students, only 900 are in the geosciences. Most of these students are international students from the People's Republic of China, Japan, and Korea.

- **A De-Emphasis on Geoscience**
  In the State of Texas, geoscience is no longer required past middle school, making it hard to acquire an interest in a subject that is not taught.

- **Legal Issues**
  In Texas and many other states, it is illegal to put together a special program to recruit, educate, or maintain minority students. This is the effect of the Hopwood decision in the federal district court. Other fields, particularly medicine and computer sciences, have more money to recruit minorities without "targeting" them; the geosciences simply can't compete.

- **Federal Monies Go to Top-End, Majority Universities**
  Most of the funding continues to go to the elite, majority institutions. One of the effects of this is to allow scientists more research time. At a majority institution, scientists may only have to teach one course per semester or per year, whereas at a minority institution, that same scientist might have to teach three courses per semester. Clearly, the opportunity to do research is limited by the amount of teaching required. Minority students deserve to have teachers who are actively engaged in research, since those same teachers become the role models for the career professions.

Two Ways to Strengthen Recruitment

- **Target Minority Students at the High School Level**
  If minority students, particularly African-American students, are in short supply at the college level, NOAA and the institutions that serve under-represented students need to reach out to these same students at the high school level. We must encourage students who do well to come into the geosciences.

- **Increase NOAA's Publicity**
  Everyone is aware of what NASA is doing. NASA has a publicity campaign to make sure there's a sound bite and a satellite picture ready for the TV news whenever weather news occurs. NOAA needs a comparable program to encourage students to come into the geosciences. NOAA needs to develop spokespersons, like the late Jacques Cousteau who did so much for oceanography, to talk intelligently and informatively about the work it does. The geosciences have fascinating stories to tell. Some of these are being told to middle-school students and their teachers through a web site called Ocean World (http://oceanworld.tamu.edu). Making sure all young people know about the wonderful world of geosciences is the first step to having them become scientists themselves.

PRIVATE SECTOR

Panel A—Building Mutually Beneficial Partnerships

Moderators: Ms. Pamela Neal, Sarkeys Energy Center, Oklahoma University
Mr. Robert Stockman, OFA, NOAA
Panelists: Ms. Jennifer Carfagno, The Weather Channel
Ms. Cathy Fore, Oak Ridge MEITP, Dept. of Energy
Ms. DeLois Cutter, President, Tal-Cut, Inc.
Dr. Edward Johnson, National Weather Service, NOAA
Ms. DeJonnette Grantham-King, Advance Environmental Consultant, Inc.

The Responsibility of Partnerships

Mr. Robert Stockman opened the discussion by emphasizing the word "partnership." Partnerships require the mutual sharing of interests; each party must benefit. The Minority-Serving Institutions, their graduates, and the private sector entities must pursue common goals in establishing a partnership. It is crucial to recognize this partnership with private industry because the government has limited capacity. NOAA is a relatively small organization; it can only hire a certain number of scientists. Much of the work of the federal government is already done by private contractors; in fact, the policy of the U.S. Government is to explicitly aid growth in the private sector. Dr. Ed Johnson reinforced this idea by giving an example from National Weather Service. NWS provides weather information to everyone for little or no cost. This allows a growth in the private industry—competing television meteorologists, for instance. And beyond television, a number of people consult with private industries to analyze and predict weather patterns and their effect on goods and services. This is a high growth area. In short, the private sector is where most of the jobs are, and increasing diversity requires that MSIs and HBCUs seek out and maintain partnerships with private industry.

The Weather Channel: Partnerships for Successful Business

Ms. Jen Carfagno works for The Weather Channel. She talks about partnerships as an extension of successful business practice. The Weather Channel, for instance, has expanded across the U.S. and into Latin America. It has a Portuguese and a Spanish on-air network, as well as web-sites. To meet the needs of its diverse customer base, it has been expanding the diversity of its workforce. To secure success for the future, the Weather Channel has decided to play a significant role in attracting and retaining people from under-represented groups to the atmospheric sciences. So, The Weather Channel has placed a high priority on building partnerships that help it increase representation— both within the company and in the field. Here are some of these ways:

- The Weather Channel sponsors the American Meteorological Society (AMS) Minority Scholarship.
- It sponsors a summer internship for under-represented students.
- In 2001, Penn State had its first annual Weather Camp, designed for middle-high school students of under-represented groups. The Weather Channel sponsored scholarships for a number of students to attend and participate at the camp, teaching students to make on-camera videos.
- The Weather Channel also partners with the College of Earth and Mineral Sciences at Penn State to actively recruit students from under-represented groups.
- Two senior vice presidents at the company make personal phone calls to these prospective students accepted into the College of Earth and Mineral Sciences at Penn State. They offer encouragement and answer questions about the job market for graduates of the atmospheric sciences.
- The Weather Channel representatives attended conferences, like this one, to promote the advancement of opportunities in the atmospheric sciences.
- The Weather Channel people actively participate in the AMS Board on Women and Minorities and, on a less structured basis, many of the women meteorologists at The Weather Channel act as mentors to other women interested in meteorology.

The Weather Channel, as a whole, is taking steps to increase representation in all departments. Ms. Carfagno ended by talking about the difference between diverse and well represented. Successful, sustained diversity in employment requires each group to be well represented.

Three Government Contractors: Tal-Cut Company, BWXT Y12 LLC, and Advanced Environmental Consultants, Inc.

Tal-Cut Company

Ms. DeLois Cutter, the President of Tal-Cut, which specializes in information technology and engineering services, spoke of being able to expand partnerships as the company grows larger. Tal-Cut was incorporated in Ohio and has several partnerships with high schools in Ohio. Now that it has an office in Mississippi, Ms. Cutter said, “My company would like to establish partnerships with not only NOAA but also Jackson State University, the City of Jackson, the State of Mississippi, and with any student of Jackson State University.”

BWXT Y12 LLC

Ms. Cathy Fore spoke about BWXTY12LLC, which is a merger between BWX technologies and Bechtel National. Three years ago, Ms. Fore was asked to develop a new business program centered around Minority Education Institutions. In doing so, she learned several valuable lessons about partnering with MSIs. More results are available on the company's web site: http://www1.y12.org/meitp

- **The University Must Be Knowledgeable About Partnerships**

Successful partnerships between private industry and academia come when the institution has not only a good research facility, but also a strong business sense. Does it understand the difference between a grant and a subcontract? What experience has the institution had with the business world? MSIs must take responsibility for becoming business savvy when they wish to form and sustain partnerships.

- **Form a Relationship with the Entire University**

It may be the engineering department that is critical to your business, but access, information, and change will come more swiftly if the entire university is recognized. Doing so allows single point contact—directly contacting the President of the Institution to expedite arrangements.

- **Consider a Consortium of Universities**

The State of Tennessee, where Ms. Fore lives, has six HBCUs, each with different strengths. "We put forth a strategy to create a technology-focused consortium of these six schools under the umbrella of the state economic development plan." Each school was consulted and joined in this cooperative venture, the first of its kind.

- **Establish a Mentor-Protégée Agreement**

Within the Department of Energy, these agreements are primarily with small businesses, the program was changed to include MSIs. BWXTY12LLC recently established a protégée-agreement with Tennessee State University in Nashville, helping TSU be more technologically capable in the global marketplace. For example, in TSU's College of Engineering, they want to create a Ph.D program in manufacturing. This will ultimately supply private industry with vitally trained students.

- **Focus on Emerging Technologies**

There are bigger rewards in concentrating on emerging trends in technology, when establishing partnerships. Pay attention to those aspects of research that have the potential to change society.

- **Advanced Environmental Consultants, Inc.**

Ms. DeJonnette Grantham-King owns Advanced Environmental Consultants, Inc, which is a minority- and woman-owned business. AEC provides a wide array of various technical services; for instance, AEC assesses and abates buildings that contain lead and asbestos. Ms. Grantham-King's sense of partnerships is that every client becomes a partner by providing valuable feedback and resources. Currently the company is exploring ways to be more available to students from HBCUs.

Question and Answer Session

A lively Question and Answer session followed. A few of the questions are reported here.

Question: What types of private industry are there in the weather business?

Dr. Ed Johnson answered this. He differentiated some of markets:

1) The media.
2) Information companies, producing and packaging information for use by the media.
3) Consultants to other industries, for example, the power companies are highly dependent on weather analysis. This last group is the largest. Most businesses can correlate sales against weather and thus predict profits. For instance, bad weather drives down fast food sales but increases pizza sales because pizza is delivered to your door.
4) Forensic meteorology.

Question: How do you respond to critics at federal agencies who say: "Well do these MSIs have the capacity to do what we really need?" With smaller federal funding and fewer alumni/ae at these agencies, how are MSIs realistically able to compete?

Dr. DeLois Cutter: "We just have to come up with innovative ways to create an infrastructure of a partnership to make these kinds of relationships work." Ms. Cathy Fore: "We must create centers of excellence and enterprise regionally, located across the country to share equipment, funding, and expertise. We must also take advantage of what we already have; we should be sharing more information through the Internet."

Question: What different paths can I take with a major in meteorology and an MBA? (Ms. Felicia Evans, Penn State University)

Mr. Lawrence Tynes responded that "The MBA in a meteorology degree is great, but you still want to concentrate also on research and computer sciences, particularly writing peer reviewed articles and learning C++." Mr. Robert Stockman added that the student might consider working for the State Department, consulting on meteorological and economic development in foreign countries.

Question: What creates a successful partnership?

- Be prepared with the right skills.
- Base the partnership on each party's competencies. Don't try to partner with everyone. Find the partnership in which the merger creates a well balanced, diversified, field of knowledge and resource.
- Remember to pay attention to motivation. A partnership works when each party feels it is serving its own self-interest.
- Make a long-term commitment.

- Attend to the needs of the partnership through networking, mentoring, and good communication.

Panel B—Converging Business and Academic Practices

Moderators: Dr. Mildred Ofosu, Delaware State University
Dr. Fred Thurberg, National Marine Fisheries Service, NOAA
Panelists: Dr. Barry Costa-Pierce, Mississippi-Alabama Sea Grant
Mr. Clinton Twilley, Concurrent Technologies Corp.
Mr. Eddie Hanebut, Digital Quest
Mr. George Brooks, University of Arizona
Mr. Gale Burkett, GB-Tech, Inc.
Dr. Kelton Clark, Morgan State University
Dr. Richard Gragg, Florida A&M University

A Primer on Aquaculture

Dr. Fred Thurberg gave a short talk on aquaculture. Aquaculture is the process of raising aquatic organisms for human consumption. NOAA, as a marine agency, is involved in the aquaculture of marine species, as opposed to fresh water species, and works with academia and the business community in a fashion similar to the way the Department of Agriculture works with land-based farmers.

Interest in marine aquaculture has increased recently in NOAA for four reasons:

- An increase in seafood consumption in the U.S.
- An increased awareness of the health value of seafood.
- A decline of wild-caught fisheries from overfishing and habitat degradation, including pollution and coastal development.
- An imbalance of payments as the U.S. imports more aquacultured products from abroad.

This interest in NOAA is not new; the Milford Lab was established in the 1930's to assist the oyster business community. This was an early partnership with the shellfish industry in Long Island Sound and Yale University. So the partnership that we discuss today has been operating at some level for a long time. Similar partnerships on the Gulf Coast and the West Coast with shrimp and salmon also have long histories.

Diversity, NOAA and Aquaculture

What is NOAA doing to actively involve minority communities in the business of aquaculture?:

- **Aquaculture in High Schools**

The Milford Lab has been involved in a partnership with two urban technical high schools in New Haven and Bridgeport, Connecticut; both schools have significant minority enrollment. We have been working with these schools and the shellfish industry in a joint venture to develop cost effective methods of shellfish production. The students obtain hands-on experience in the laboratory, classroom, and in the field, growing and harvesting shellfish. This program has been very successful and many of the students go on to post-graduate studies in the marine field.

- **Urban Aquaculture Initiatives**

There is a growing interest in recycling old industrial buildings, especially old mill and factory buildings abandoned as manufacturing left New England. These buildings provide the large spaces needed for aquaculture tanks and are available at a fraction of the cost of new construction. Many New England colleges and universities are now developing partnerships with fledgling aquaculture ventures in this effort. Sea Grant is also a major player in this area, and the urban setting offers many opportunities for minority participation.

- **NOAA Sea Grant Program**

Sea Grant offers many opportunities that encourage partnerships with government, business and the academic community. Five million dollars in competitive grant money is now available on a recent Sea Grant—administered Request For Proposal (RFP).

- **Native American Involvement**

Many Native American groups have been involved in aquaculture practices for hundreds of years as they have long recognized the wisdom of protecting and nurturing marine food resources. Tribes on Cape Cod and its Islands, on Puget Sound, and recent activity in Connecticut are but a few examples of very active Native American involvement in the business of aquaculture. Dr. Brooks described the role of Native Americans in aquaculture business activities in Arizona.

Mississippi-Alabama Sea Grant Consortium

Dr. Barry Costa-Pierce spoke about the Mississippi-Alabama Sea Grant Consortium. Sea Grant implements national ocean and coastal priorities at the national, state, and local levels. There's a Sea Grant program in every coastal and Great Lakes state in the country, including Puerto Rico and Guam. We use federal monies for sustainable coastal and ocean zone programs for direct public benefit. Sea Grant was modeled on the American dream of Land-Grant. Back in the 1800s, this wonderful system of Land-Grant universities was created to insure that Americans had access to a safe and reasonably costing food supply. Projections are that the U.S. economy will change in the 21st Century to yield as much of a gross economic product from the oceans and the coastal zones as from our inland agriculture areas. The Mississippi-Alabama consortium is a consortium of eight public research universities and laboratories that support education, marine research, and outreach for direct public benefit.

International Partnerships

HBCUs and MSIs can take the lead in forging international partnerships vital to the future of this country. Despite the calls for globalization, the U.S. is pulling back from international partnerships. But international partnerships are the key to development. Africa is particularly critical here. Three universities have already taken steps to focus on aquaculture: Makerere University in Kampala, Uganda, The University of Namibia, and Rhodes University in South Africa. These African universities have targeted marine and freshwater sciences and sustainability as their signature programs. Here is a tremendous opportunity for the Historically Black Colleges and Universities to develop real partnerships. In our hemisphere, the UABC in Encinada is very desirous that America sees beyond its borders and develops new kinds of partnerships for interns, undergraduates and graduate students with the HBCUs.

Tripartite Partnerships

It is quite easy to team an academic institution with a federal agency. However, to get a tripartite relationship among private industry, academia and the government is much more difficult. One of the things we need to look more closely at is requiring that some of our grants have an industry component from the outset.

Management Systems

There is an increasing number of regulations and standards required in business. Even the federal government has begun policing itself to make sure it implements its own environmental standards. The process of incorporating these environmental standards can be daunting. It is important, says Mr. Clinton Twilley, and to do this well, you must have the resources of understanding this business language. Concurrent Technologies Corporation provides the framework for implementing a management system to support quality and reduce environmental impact. Mr. Twilley says the key to designing and implementing a new management system is to keep it simple—always make sure the procedures are necessary, clear, and well communicated. Train for designing a new system by becoming familiar with new technology available. Get help from an outside firm that can see your company more objectively. Identify all the steps that are required in your business and document them. And finally, make sure you have a system for regularly improving and updating your procedures.

MSCI, the Mississippi Space Commerce Initiative

MSCI is a consortium of education, industry, and government agencies banded together for the commercialization of space. One of the things MSCI does is to promote GIS remote sensing technology in the schools, teaching students how to collect data and create maps of their own school neighborhoods. The development of three-dimensional maps, created through satellite information, is an emerging industry with a tremendous potential for growth. These maps can help students make connections between geographical features of their neighborhoods, countries, foreign lands with social customs and economic development.

Using this technology, weather patterns, environmental issues, even insurance assessments can be made. We can track data over the long term. And what is perhaps most exciting is that this technology is easy for students to use. They can quickly participate in the collection of data, and in the process of learning this, students are introduced to many more complex statistical and mathematical procedures. Our most successful programs are long-term, three years in which they analyze data from their own school area.

Synergistic Partnerships

There are opportunities for science, academia, the public sector and the private sector to work together toward common goals. Exercising such opportunities is common in engineering, but uncommon in biological sciences, ecology, and natural resource restoration. However, it can and should happen, says Dr. George Brooks. He gives an example from the situation of the Colorado River, which was designated by the Fish and Wildlife Service (FWS) to be extremely environmentally damaged, so damaged that unless restored, it could threaten future water diversions.

Considering that Los Angeles, San Diego, Las Vegas, Phoenix and Tucson all get significant portions of their water from the Colorado, the potential for a disruption in the water supply was great. An organization called the Lower Colorado Multi-Species Conservation Program or LC-MSCP was created to form an Environmental Impact Statement (EIS) on the plans to restore the river. In the mean time, FWS designated critical habitat on the river for four species of endangered native fish and mandated their restocking to preserve their populations until the river can be restored. In normal times one would go to a federal fish hatchery to produce enough fish to be stocked. These however were/are not normal times. Due to federal cutbacks and numerous other reasons, there are no hatcheries with the ability to "grow out" (grow to a certain size) one of these species, the bonytail chub.

With no federal or state facilities available, the challenge in obtaining enough bonytail for the interim conservation measures had presented scientists with a bit of a dilemma. This situation presented an immediate opportunity for a synergistic partnership. I proposed that a commercial fish farm on the Gila River Indian Community could be the key for producing the needed fish. Growing fish is their job, they do it every day, and they must do it well to stay in business. The response was, at first, less than enthusiastic. There were many concerns, for example, the need for Ph.D. level expertise and the concern that commercial farmers would attempt to breed and artificially modify the fish's genetics. There was also the philosophical problem of someone making money off of an endangered species. All of these problems were easily solved. I would provide the Ph. D. level supervision and the fish would only be grown out on site with no reproduction allowed. All fish stocked would be allowed to grow to size, thus preserving the genetic integrity. The philosophical challenge was addressed by the win-win situation. It would be less costly for the commercial farm to grow the fish, thus saving the government considerable funds. Conversely the commercial fish farm would be producing a product for a guaranteed market for a price far higher than any other product. In addition to a highly endangered fish being recovered, the fish farmers would have an opportunity to work with the federal government establishing the foundations for

future relationships. Further benefits would occur. Since the project was located on an Indian community, it would train minorities in fisheries and provide economic opportunity. It would also produce scholarly papers providing new information to the scientific community. Finally, this concept would bring together formally antagonistic parties into a synergistic working relationship with great future possibilities.

The most crucial lesson learned from this experience was that we need to train our scientists to embrace risk, to think outside of the box, to lead when others stumble.

Florida A&M University

Dr. Richard Gragg spoke about two successful models at FAMU which follow the corporate world. One is the FAMU industry cluster where about 70 corporations support FAMU financially. These corporations provide internships and scholarships for students and research sabbaticals for faculty. The second is a coop program where students intern for a semester. One that I'm particularly involved in is the Comprehensive Everglades Restoration Project. As the director of the Center for Environmental Equity and Justice, we've helped the Army Corps of Engineers in the South Florida Water Management District put together a socioeconomic environmental justice management plan for the Everglades Restoration Project.

In environmental justice we look at the disproportionate impact of environmental pollution and environmental stressors on low income and minority populations. Geographical information systems are a very important tool in understanding what those impacts are and in developing intervention and mitigation solutions. Carbon/nitrogen cycling is a very important long-term research project in which academia and business need to cooperate. Biotemediation is needed to assess and attempt to clean up the pollution without further harming the environment. And all of this work is predicated upon an understanding of environmental ethics. It's important not only for students, but also for business managers, owners, and workers to understand our role, the human role in relationship and responsibility to the environment.

Thus, we must be engaged in a collaborative partnership, diverse in its purpose and direction and attentive to creating sustainable resources for human activities and mitigating human impact on the environment in specific and important habitats. University scientists and engineers need to be more aggressive with regards to technology transfer. Industry, small and large, should acknowledge the diversity of universities – each research site comes with its own culture. FAMU has established an Office of Technology Transfer which provides training on patents and other issues of technology transfer. We have established in the environmental sciences a recognized center for environmental technology transfer. Industry should invest in the HBCUs in the same manner that they invest in majority institutions. They should establish research centers, build research laboratories, support Ph.D. students, establish endowed chairs—we must go beyond internships.

Conflicts of Value

Dr. Kelton Clark briefly discussed the ways in which business and science interact, specifically two cultural values which may lead to conflict in partnering.

- **Disclosure of Information**

One of the first values, in science, is the disclosure of information. Scientists believe we're here to add to the body of knowledge. That is our purpose. Once we unlock a mystery, we must disclose it to the rest of the world. The prestige and careers of scientists are based on the quantity and quality of information they have supplied. We have formalized the disclosure procedure through scientific journals, seminars, and meetings. In contrast, the business community has many reasons for limiting disclosure. The disclosure of such information as marketing strategies, product formulas, or source code can be devastating to a company's welfare. The knowledge a scientist discloses may be detrimental to business and that often causes conflicts between science and business.

- **Objectivity**

Another important value within science is objectivity. In academics, we see ourselves as the ones who are doing pure science. We can be purely objective because all we are interested in is the question. There's a sense, a perception from some scientists, that as we move away from this ivory tower, you move away from objectivity. When you go into policy or management, you have other pressures on you—political and social pressures. These other pressures may influence your objectivity. It is the backdrop of this hierarchy that scientists interact with business.

This is not to say that there's no way that these two institutions can work together. There are many models where they do. A very strong model, where ecological sciences and business work together, is aquaculture. Here both parties have similar interests in knowledge. For example, a biologist may want to know what physiological factors influence growth in fish; a fish farmer wants to know how to grow fish faster. There is no problem with disclosure; the fish grow faster and everybody's happy. In ecological and environmental sciences, there are also industries that are created by scientific disclosures. We have many people in mitigation, brownfield cleanups, and so forth that exist because some scientist made a disclosure and that knowledge created the need fulfilled by industry.

For our discussion here, perhaps the most crucial thing about academic and business partnerships is money. Science, in the African-American community, has been limited most often to medicine. When a child says, "I like to look at bugs," no one says, "Oh great, you can be an entomologist, an environmentalist, a biologist." They say instead, "Oh, you'll be a great doctor." Part of that is because the community doesn't see the economic incentives in being any other kind of biologist. It's important that all the opportunities in the biological sciences are made clear. Cooperation and partnerships between scientific and business entities can help this. With these partnerships, we can say to the community, "So, your child doesn't want to be a doctor? Well, let us show you that they can still make money in the ecological fields."

PUBLIC SECTOR

Panel A—Increasing Access to Public Resources

Moderators: Mr. Benjamin Watkins, NESDIS, NOAA
Ms. Rita Presley, Jackson State University

Panelists: Dr Jewell Prendeville, National Science Foundation
Dr. Robert Menzer, National Center for Environmental Research
Ms. Jan Kucklick, OAR, NOAA
Ms. Jacqueline Rousseau, USEC, NOAA
Mr. James Harrington, NASA
Mr. Anthony Overton, University of Maryland Eastern Shore
Dr. Teferi Tsegaye, Alabama A&M University
Ms. Julie Marcy, U.S. Army Corps of Engineers

Opening

In his opening remarks, Mr. Benjamin Watkins indicated that the public sector plays a major role in the atmospheric and ocean sciences, utilizing public resources to engage and build capacity. In this session, the diverse group of speakers would look at solutions that use the public sectors' resources in addressing issues of capacity building at minority institutions. All interested institutions that offer opportunities to grow in the diverse community, particularly the under-served communities, must be engaged and relationships between the public sector and the academic community should be encouraged.

Ms. Rita Presley welcomed attendees and introduced panelists.

U.S. Army Corps of Engineers

Ms. Julie Marcy, the strategic planning manager of the Vicksburg District, U.S. Army Corps of Engineers in Vicksburg, Mississippi indicated that the District encompasses portions of Arkansas, Mississippi and Louisiana, and covers approximately 65,000 sq. miles. There are also contracting offices in New Hampshire, Illinois, and Alexandria, Virginia. The mission is to provide quality engineering and other professional services in an economically and environmentally sustainable manner. The wide range of key products and services includes traditional flood damage reduction efforts where dams and other control facilities are built. Services also include environmental stewardship of 500,000 acres and the issuance of regulatory permits under the Clean Water Act, and Rivers and Harbors Act. Also provided is hydropower, water supply, and emergency response. Work is performed for the Army, Air Force, as well as local state, and federal agencies. Although the national goal of the Corps is setting aside about 5% of contracting efforts for minority institutions, the Vicksburg District tries to do 10%. The District has existing partnerships with Alcorn State University, Southern University, and Jackson State University and looks forward to working with more minority-serving institutions.

Alabama A&M University

Dr. Tsegaye-from Alabama A&M University discussed the University's mission to expand research and development and the primary science objectives for years 2000-2005.

NOAA's Coastal Services Center

Ms. Jan Kucklick works at NOAA's Coastal Services Center. Work is being conducted with state coastal resource managers to link people, information, and technology. Under the mission to make information accessible to people, the focus is on four theme areas—hazards, habitat, smart coastal growth, and national spatial data infrastructure. The Coastal Management Fellowship Program is in its sixth year. This program places post-graduate students to work for two years with state coastal zone management programs. The fellows are paid a stipend and per diem. It's a multi-step process where states compete to host the fellows and interested applicants compete to be placed as fellows. Local Sea Grant directors interview interested candidates and then submit two names for consideration. A national review panel then selects finalists from the Sea Grant nominations. After a week-long interview process, fellows are selected from the finalist pool. This program is a great opportunity for students to get experience on the state and local level.

The organization is in the process of trying to form a new program targeted to minority schools, but this is on hold pending funding. However, NOAA has several other programs including the Nancy Foster Scholarship Program and the Knauss Fellowship Program. Information on these fellowships and a number of other ones can be found on the web at http://www.csc.noaa.gov/cms/fellows/opportunities.html.

Cooperative Research Unit Program

Mr. Anthony Overton from the University of Maryland discussed the Cooperative Research Unit Program. The program is located in 37 states throughout the U.S. and was developed to provide a link between federal, state, and local governments to personnel at the university level through cooperative programs. Each unit represents a formal partnership with the U.S. Geological Survey (USGS). These units usually consist of a Wildlife and Fisheries Division. A host university generally provides space for unit personnel who teach classes at the university and serve as academic advisors for graduate students. Much of the funding is through federal and state agencies. Funding allows graduate students to interact with federal and state agencies. The unit program has been prospering and increasing the number of minorities involved in Wildlife and Fisheries—particularly, the units at the University of Maryland Eastern Shore, Grambling State University, and the University of Arkansas-Pine Bluff.

NASA Programs

Mr. James L. Harrington, Jr, Manager of the NASA–MU-SPIN (Minority University–SPace Interdisciplinary Network) Program indicated that NASA conducts relevant scientific investigations via its Earth Science Enterprise (ESE) which provides annual NASA Research

Announcements (NRA) for research and education in all the ocean/marine, environmental, and atmospheric (OME&A) fields for which academic institutions can apply.

The NASA Office of Equal Opportunities Programs of NASA Headquarters is the home of the Minority University Research and Education Division (MURED). This division's activities are targeted explicitly at HBCUs and MSIs. Additionally, each NASA Field Center hosts a MURED program office and support activities. The MURED program solicits opportunities for NASA research and education on an annual basis. The MURED Office entertains unsolicited opportunities when funding is available. The NASA Field Center MURED programs manage and support NASA research and education opportunities that are of particular interest to the activities conducted at the Field Centers on a solicited and unsolicited bases.

The MU-SPIN program funds, in collaboration with the City University of New York, a Metropolitan Weather Network (METNET) that spans from New York/New Jersey to Maine. This weather network has been supported by the Weather Service field office in New York as well as the Weather Service Office in Silver Spring, Maryland. The network consists of weather stations installed at predominantly minority attended K-12 institutions throughout the metropolitan area and Maine. The stations and the station data are calibrated and certified by the Weather Service personnel. The weather network provides a foundation for minority K-12 students to learn about weather and climate trends and the integrity of the data provides valuable information for university meteorologists and climatologists to study phenomena such as urban heat island and lake effect storms.

MU-SPIN has been very pleased with its collaborations with NOAA and the Weather Service in particular. The Weather Service participation brings a level of competency in the network that is required by everyone from the universities to the Mayor's office.

The Program is funded via a collaboration of MURED, ESE and the NASA Office of Space Science. The funding is very stable as long as the program continues to produce strong relationships between the funding sources and HBCUs and MSIs. The Agency's funding is allocated via the national discretionary budget for Science and Technology.

All of the NASA Enterprises depend heavily on the NASA world wide web sites and, to some extent, the Commerce Business Daily. World wide web sites are dedicated to the communication of the mission and goals of the enterprises, as well as announcements for opportunities (AO) and NRAs.

New programs include increased focus on developing partnerships through direct relationship building with mission managers and university researchers and students for teaming on future missions. The requests for proposals are developed in collaboration with ESE at NASA/HQ in partnership with the mission managers at the NASA Centers.

EPA Grants And Fellowships Programs

Dr. Robert E. Menzer, Senior Science Advisor, National Center for Environmental Research (NCER), explained that the U.S. Environmental Protection Agency (EPA) writes regulations that protect the environment. It is a research and educational organization composed of three parts: the Program Offices, i.e., Office of Water, Office of Air and Radiation, Office of Solid Waste and Emergency Response which are responsible for the translation of Federal legislation into environmental regulations and guidelines; the Regional Offices, which enforce regulations and provide service and assistance to local and state governments in environmental protection; and the Office of Research and Development (ORD), which provides the research support for the Program Offices and Regions to carry out their activities. NCER is ORD's extramural research arm. It supports research through its grants and fellowships programs. There are three fellowship programs with some fellowships specifically for minorities. Its grants and fellowships programs are known as the Science to Achieve Results (STAR) Program. Continuing areas of emphasis include ecological risk assessment, human health risk assessment, particulate matter, drinking water, endocrine disruptors, global change, children's health, pollution prevention, and socio-economic.

NCER supports a number of educational activities including both undergraduate and graduate fellowships, post-doctoral fellowships, and internships.

Graduate Fellowships are offered for study in accredited U.S. colleges and universities and provide a stipend for the student, tuition payment to the institution, and a research and expense allowance. There is a special set-aside program for fellowships that are tenable only at HBCUs, Hispanic-serving institutions, and Native American Tribal colleges. All of these graduate fellowships are highly competitive.

Undergraduate fellowships are available to students who plan to study at minority institutions, including HBCUs, Hispanic-serving institutions, and Tribal colleges. These support the last two years of undergraduate study and offer an internship at an EPA laboratory during the summer between the two years.

NCER is particularly committed to making the results of the research it sponsors available to the public. It provides the abstracts of all research grants it supports, annual and final reports of grants, and research summaries on special topics which are prepared from time to time. It also sponsors conferences and workshops on specific topics, including periodic progress reviews of the specific grant programs it sponsors. All of this information is posted on its web site and is fully searchable by keywords.

The NCER web site address is http://www.epa.gov/ncerqa. Register your e-mail address with the server to receive communications.

New NSF Program in Geosciences

Dr. Jewell Prendeville of the National Science Foundation is Staff Associate for Diversity and Education, directly under the Assistant Director for Geosciences. The program funds outreach and education programs. There are three program components—Opportunities for Enhancing Diversity in the Geosciences NSF 01-36, Geoscience Education NSF 01-42, Digital Library for Earth System Education (DLESE).

www.Geo.nsf.gov/Geo/diversity.org is the website where information can be found. This is the first year for the Diversity Program. There is about $3 million in funding to be funded under the OEDG Program Solicitation. Awards will be made for up to three years—$400K. The NSF has a lot of other programs it funds that may be viewed on the NSF web site at www.nsf.gov.

NOAA's Educational Partnership Program with Minority-Serving Institutions

Ms. Jacqueline Rousseau gave a presentation on NOAA's new Educational Partnership Program with Minority-Serving Institutions. The agency has been developing this program for the past three years and received $15 million in funding in FY 2001. The program has two principal objectives —to provide funding to increase the number of under-represented students who pursue and graduate in NOAA-related sciences, and to increase research collaboration between NOAA and the minority-serving institution community.

The National Oceanic and Atmospheric Administration (NOAA) has been collaborating with Minority Serving Institutions (MSIs) for the past twenty-five years. The agency has ongoing programs with schools such as Florida A&M University, Jackson State University, Hampton University, and the University of Puerto Rico. This new initiative, however, provides a consolidated partnership program with minority academic institutions to increase the number of individuals trained in the core programmatic areas of atmospheric, environmental and oceanic sciences.

Since approximately 40% of minorities receive their undergraduate degrees at MSIs, the agency has focused its FY 2001 initiative on working with the MSI community to build the capacity and increase graduate granting programs in atmospheric, earth and oceanic sciences and remote sensing at their institutions.

The NOAA Minority-Serving Institutions Initiative consists of four new programmatic components.

- Establish Cooperative Science Centers that will concentrate on Atmospheric Environmental and Ocean sciences and Remote Sensing.
- Develop an Environmental Entrepreneurship Program
- Establish an Undergraduate Scholarship Program to support the training of students attending MSIs and trained in NOAA-related sciences.
- Establish an NOAA Graduate Sciences Program.

The intent of the initiative is to support the development of quality education necessary to serve the interests of NOAA, and the nation at large, using natural and established linkages between MSIs and Federal government institutions, in conjunction with other research institutions and the facilities of NOAA. It will also provide opportunities and available programs for students and individuals in related professions to pursue research and educational programs in atmospheric, environmental, and oceanic sciences, principally among MSIs.

All four programmatic components have been initiated in FY01. The following provides the status of each sub-program.

Undergraduate Scholarship Program: Eight MSI .students are currently participating in this ten-week paid internship program initiated in May 2001. Funds will also be provided during the academic year and for ten weeks next summer for students who maintain an acceptable GPA and continue academic training in a NOAA-related field. ($221,000)

Graduate Science Program: Six MSI students will receive financial assistance for graduate level training in a NOAA mission related occupation beginning in September 2001. Five students completed their training under the program last year and have been placed in permanent positions at NOAA. ($525,000)

Environmental Entrepreneurship Program: Twelve grants will be awarded to MSIs in support of program development and environmental restoration activities in NOAA-related areas during September 2001. ($3.3 million)

Cooperative Science Centers: NOAA will announce the results of the competitive process to designate MSIs as Cooperative Science Centers in atmosphere, ocean and environmental sciences and remote sensing in August 2001. ($10 million)

For further information on this program, please contact: Scott Carter, NOAA Office of Legislative Affairs at (202) 482-5426.

Panel B–Sustaining Linkages for Social and Economic Development

Moderators: Dr. Arthur Allen
Dr. William Parker, National Weather Service, NOAA
Panelists: Dr. Ken Davidson, NESDIS, NOAA
Ms. Michelle McCoy, EASC, NOAA
Dr. Barbara Ousby, Mississippi Development Authority
Dr. Mack Felton, Dillard University
Dr. Darryl Keith, EPA
Mr. Donald Wernly, NWS

National Climatic Data Center

Dr. Ken Davidson, the Deputy Director of the National Climatic Data Center in Asheville, North Carolina, gave an overview of the Center. NCDC's mission is to acquire, ingest and provide access to all of the globe's climatological data. NCDC's data archives, which are required by law, hold over a petabyte. To get a sense of the work NCDC does, one routine project NCDC did for FEMA was to plot all the hurricane tracks that we had any record of, where they made landfall, what the damages were, and what kind of damage. NCDC also develops the climatologies for the country. These are passed on to the state climatologists in every state in the country.

The Office of Acquisition Management

OAM's mission is to provide an acquisition environment that promotes the achievement of program missions while protecting the public interest. Ms. Michelle McCoy is a small business specialist at The Office of Acquisition Management. She argues that in 2001, MSIs need to think like small businesses, to actively market themselves to potential partners. She offered the following list of questions:

- What services or products do you have to offer to the government?
- Do your products or services fill a need that the government has?
- Who or what is your competition?
- What is your advantage over other HBCUs and MSIs?
- Can you create a demand for what's going on in your environment?
- Who are your potential customers?

She also offered the following tips for MSIs and small businesses interested in marketing themselves:

- Network
- Contact the National Contract Management Association which provides free training
- Create a distinctive name/name brand
- Be competitive in pricing
- Form partnerships
- Follow through on contracts
- Offer excellent service
- Practice diversity marketing
- Provide quality goods
- Be innovative, competitive, and resourceful
- Use the resources of the SBIR and OSBDU (Office of Small and Disadvantage Business Utilization)

Ms. McCoy actively encouraged MSIs and small businesses to partner for contracts. In the past two years, her office awarded over $600 thousand to universities for contracts and purchase orders. She gave some examples of recent contracts: scientific diving and archeological services, ship time on the research vessel Cape Fear for the 2001 monitor expedition, acid rain study, analysis on

stable isotopes and salmon scales, and more. Many of these are advertised in the Commerce Business Daily. She urged MSIs not to overlook these resources and to check out the NOAA web site for more opportunities.

Mississippi Development Authority

Dr. Barbara Ousby talked about the vital role this state agency plays working with Institutions of Higher Learning in Mississippi: "We provide paid as well as unpaid internships with the universities, and we provide grants for energy-related research. One particular project I can highlight is with Jackson State University collaborating with the Department of Environmental Quality (DEQ). We provided funding for internships at DEQ for the oil and gas database. This database is vital to Mississippi because our state is number 12 in the nation for oil production as well as 16th in the nation for gas production, for economic development and for energy conservation." The Department of Environmental Quality was awarded a grant to pay students in the Computer Science Department at Jackson State University and Hinds Community College to participate in data collection, computing data, and inputting data in a specific model/format. We have unpaid internships with the Public Policy Program at Jackson State University where the students are assigned to MDA-Energy Division to perform tasks that are outlined in the agreement between the entities. Alcorn State University (ASU) is involved in several research projects funded by MDA. ASU is developing a Small Farm Database and conducting resource assessments specifically on Mississippi in GIS format. ASU has also received funding for the Center for Energy Resource Development (CERD) which will be housed on-site at the university. CERD has four major components: Comprehensive Energy Strategy, Utilizing the Fuel Cell, Development of Sustainable Technology and Power Quality and Reliability. Mississippi State University received funding to perform all pre- and post-analysis on water treatment and how energy efficient this innovative technology is that is housed a major swine facility in Mississippi. These are all examples of how the Mississippi Development Authority plays a role in Sustaining Linkages for Social and Economic Development."

Reflections on HBCUs

Dr. Mack Felton reflected on his long tenure with HBCUs. The following are ways he feels HBCUs can better improve the sustainability of social and economic development.

- Promote and offer adult education
- develop and improve programs in fisheries, environmental sciences and atmospheric sciences to compete with majority institutions
- Actively promote HBCUs' capabilities
- Cultivate industry – take an active approach to business partnerships
- Become centers of new research and new cultural activities to draw in the community
- Support partnerships that have good environmental practices

Environmental Protection Agency (EPA)

Dr. Darryl Keith, an oceanographer with the EPA, said the EPA depends upon contract work and outside research and actively seeks to develop cooperative relationships with universities to address problems of mutual interest. For instance, in the EPA National Center for Environmental Assessment (NCEA), they have a component where they do NSF style proposals and there's a competition for a pot of money as long as that research is related to an EPA problem. This allows the EPA to expand its range of activities by having basic research done that it's not able to do.

The EPA has made a vital change in its relationship with outside contractors and communities. Formerly, the EPA would come into your area, state what the problem was, and throw money at you to get it solved. "Now, the agency has developed cooperative relationships with local communities whereby we come in and we speak with local folks. We speak with the businesses. We speak with the academic side and we try to come up with what is the community perception of the environmental problem. And once we have identified the problem or problems, then we come up with agreed strategies to solve the problems."

This cooperative approach has also improved relationships with the HBCUs and MSIs. The EPA offers internships and research opportunities, and it has a summer hire program. The EPA signed a Memorandum of Understanding with NAFEO to set up a faculty exchange program where faculty at MSIs can come to EPA laboratories to work as colleagues or to conduct research at EPA institutions. And then there have been EPA initiatives, like Dr. Felton had mentioned, where EPA contributes along with other federal agencies to form alliances with HBCUs.

One of the questions posed at this Conference is "What characteristics must an institution possess to be competitive for funding?" The bottom line is you have to prove you can do the work that's being proposed. How can you prove that you can do the work? For data analyses, one sure indicator was if the laboratory at your institution participated in a round robin exercise with other laboratories and you met the quality control criteria that the agency standard has established.

National Weather Service: Communicating Uncertainty

Mr. Donald Wernly started his talk by showing a chart that listed the U.S. as the most hazard prone nation on the globe, except for China. He gave some examples of this. By 2010, the hurricane prone county populations will double to 75 million—that's just the counties along the immediate coasts, along the Atlantic and Gulf. This amounts to around $7 trillion of insured property value—and potential loss. What NOAA and NWS do are basically two things: One, the prediction of extreme events moves people out of harm's way. Two, the data collected enable people to keep themselves from harm's way. NWS is successful at these two things, but what we don't do well is to communicate what we know to the decision-makers. Forecasts have error. What NWS needs to do is to quantify the uncertainty in a forecast.

Let's give an example. How long does it take to evacuate New Orleans for a category 5 hurricane? Seventy-two hours. How far in advance do we issue a hurricane warning? Twenty-four hours. There's a problem with that gap. We need to figure out a way to gauge and communicate the

range of possibilities. The same thing is needed in the Advanced Hydrologic Prediction Service. We need ways to help city managers do their jobs. So there are many opportunities in this new area of assessing and communicating uncertainty.

STUDENT

Panel A—Creating Paths to Success in Marine and Atmospheric Sciences

Moderators: Mr. Jose Garcia, National Weather Service, NOAA
Dr. Dionne Hoskins, Savannah State University
Panelists: Dr. Michael Fogarty, National Marine Fisheries Service, NOAA
Mr. Ricardo Lopez, California State University, LA
Dr. Pace Wilbur, National Ocean Service, NOAA
Ms. Andrea Sealy, Pennsylvania State University
Dr. Randal Mandock, Clark-Atlanta University
Mr. M. Brandon Jones, university of Delaware

Every panelist addressed the same list of questions relating to student success. Dr. Michael Fogarty remarked that this session was the "heart and soul" of the Conference as the students were the people who would eventually carry on the social and scientific work already begun.

Pivotal Transition Points in Careers

Dr. Fogarty saw two pivotal transition points. First is the recognition that the career one envisions is not the career one will have – in other words, translating dreams to reality. In his case, he had envisioned his career to be like Jacques Cousteau, and although it has not been that, it has been deeply interesting. The second is the move from supervised research to independent, autonomous research, which requires one to carefully choose the questions to investigate.

Mr. Ricardo Lopez saw his greatest challenge as the transition after graduation to non-student life. Since life as a student is so structured, there was a sense of losing a safety net.

Ms. Andrea Sealy recognized that the transition points are not simply academic, but are cultural as well. She came from Barbados to attend school in the U.S., first at Jackson State University and then at Pennsylvania State University. Each time she had to adjust to a new culture, first from the Caribbean to North America, then from a HBCU, where the racial demographics were the same as Barbados, to a majority institution.

The Necessary Attributes and Skills for Success

Panelists mentioned several of the same qualities. Two of the most frequently mentioned were discipline and perseverance. The sciences require self-motivation, the ability to set one's own goals, and the dedication to pursue a constant path despite puzzling and unexpected research

outcomes. Everyone emphasized having strong analytical skills, including mathematical and statistical training, and good written and oral communication abilities.

Active patience is the term Mr. Ricardo Lopez uses to describe being patient with one's self, particularly during times of transition. Active patience means being patient but proactive, acknowledging that from difficult times comes personal growth. Another vital skill is always approaching one's work with a sense of professionalism.

Dr. Wilbur encouraged everyone to "think outside of the box," He advocated becoming a solid team player, one who enjoys solving problems with others. And he placed emphasis on learning about and from the community, particularly in coastal management and environmental sciences.

Ms. Andrea Sealy listed five vital requirements for success: (1) practicing time management, (2) having a strong mentor, (3) getting early experience with research, (4) developing strong computer programming and modeling skills, and (5) learning to be flexible in one's approach.

Dr. Mandock, in addition to seconding the skills Ms. Sealy listed, added two others: Clear thinking and having a solid ethical framework. Both of these allows one to recognize opportunities and pitfalls along the way.

Assessing Progress

There are obvious benchmarks in the sciences: success in publication, obtaining grants, and peer recognition, including having the support of colleagues. But less obvious assessments are critical as well, particularly having open dialogue with colleagues and mentors. Critical feedback, comments, and compliments guide one's process as a student and human being.

Opportunities for Training

There are a number of training opportunities for students. Panelists mentioned student internships and summer employment in government and private industry laboratories. Student assistantships for both teaching and research will provide training for those going into academia. Make sure to take advantage of professional organizations, particularly those geared towards supporting under-represented groups.

Emerging Issues

- The potential effects of global climate change on marine production properties of ocean ecosystems.
- The ecosystem effects of fishing.
- GIS (Geographic Information System) Technology

Panel B—Becoming a Professional in Marine and Atmospheric Sciences

Moderators: Dr. Brian Bingham, Western Washington University
Mr. Alonzo Hamilton, National Marine Fisheries Service–NOAA

Panelists: Ms. Pamela Lestenkoff, University of Alaska
Ms. Noelani Puniwai, Washington State University
Ms. Shawn Arellano, Woods Hole Oceanographic Institution
Mr. Ashton Robinson-Cook, Jackson State University
Ms. Wanda Jones, University of Florida, Gainesville
Mr. Anthony Overton, University of Maryland Eastern Shore
Ms. Essie Coleman-Duffie, National Marine Fisheries Service–NOAA
Mr. Lawrence C. Tynes, Sr.

Paths to Careers

The panelists entered the marine and atmospheric sciences through many different routes. Mr. Ashton Robinson-Cook told of a childhood experience with a tornado, Ms. Noelani Puniwai has had a life long fascination with the ocean, and Ms. Shawn Arellano was wondering what career route to take, when a professor suggested the marine sciences. In every case, self-motivation, support from a wide variety of people, a love of learning, and access to strong mentoring programs helped these panelists become professionals.

Opportunities for Students

Ms. Essie Coleman-Duffie compiled the following suggestions for students on their path to becoming professionals.

1. Student Appointments and Employment Programs
   - Student Temporary Employment Program (STEP)
     This program provides paid, flexibly scheduled, work experience not directly related to the student's field of study and career goals.
   - Student Career Employment Program (SCEP) (formerly the COOP Program)
     This program offers valuable work experience directly related to students' field of study and career goals. Students work flexible schedules, but must have a written agreement signed by the institution and Agency Supervisor. Pay is based on education and work experience and is available at all levels of schooling including graduate school. Students may be converted non-competitively to a career conditional or career appointment upon completion of their degree within 120 days. This has been one of the most successful programs that NMFS has used, especially as it relates to bringing new scientists on board.

2. Grant & Internship Opportunities
   There are a number of opportunities available within NOAA. The best sources for finding information are checking the website: www.noaa.gov and contacting one of the NOAA Administration Support Centers: www.rdc.noaa.gov/~hrmo/hr.contacts.htm. Some of the

internship opportunities available can provide valuable work experience in the marine and environmental sciences for this agency are the following:

- Nancy Foster Scholarship Fund, www.noaa.gov
- American Indian Science & Engineering Society (AISES), www.aises.org
- Student Conservation Association (SCA), www.sca-inc.org/vol/programs.htm
- Hispanic Association of Colleges & Universities (HACU), www.hacu.net
- Minority Access, Inc, www.minorityaccess.org
- Oak Ridge Associated Universities (ORAU), www.orau.gov/orise.htm
- NOAA Faculty & Student Intern Research Program, www.rdc.noaa.gov/civilr/studprog.htm
- Research Experience for Undergraduates (REU), www.nsf.gov/home/crssprgm/reu/reulist.htm

3. Professional Societies

It is essential to establish linkages with professional societies in this profession. They provide valuable resources and most have scholarships, internships, contacts. The good news is that student memberships are less expensive than regular memberships, so it is feasible to join more than one. A few of the organizations that may be of interest:

- American Fisheries Society (AFS)
- American Society of Limnology & Oceanography (ASLO)
- Gulf Estuarine Research Society (GERS)
- Minorities in Natural Resources Committee (MINRC)
- American Institute of Fishery Research Biologist (AIFRB)
- Ecological Society of America (ESA)
- Minority Professionals in Marine Science (MPIMS)
- American Meteorological Society (AMS)

4. Mentors

Good mentor relationships are critical. Everyone starting out in a career needs a good support system, including a good professional student /mentor relationship. Select a mentor who can provide the following:

- Intellectual support – to guide your professional research
- Professional support – to guide your publications
- Emotional support – to guide you during the difficult times

Related Careers

Wanda Jones reminded the audience that a love for the sciences can translate into many different career paths. Environmental and scientific journalism is crucial to communicate what scientists do to the larger public. Environmental law is another emerging career, particularly in the coastal areas. Other careers include the study of natural history, diplomatic work to form social policy regarding the environment, computer programming for scientific modeling needs, even environmental police work.

Preparing to be Competitive

Panelists emphasized the importance of dedication to the work, of choosing a field that they felt passionate about. Ms. Jones spoke about waking up very early in the morning to study dolphins, despite the fact that she was not a morning person. Mr. Robinson-Cook spoke of needing to take the initiative in achieving goals, even if this feels frightening at first. Ms. Puniwai spoke of the difficulty for many minorities of balancing the needs of the community with personal needs. She reminded the audience that many minorities attend school to fulfill the needs of the community—to be a doctor, to be a teacher—and that it is difficult to see career paths outside of these communal goals.

Communicating the Opportunities

There was a long and rich question and answer period. But one speaker noticed a troubling pattern about the questions, saying, "There are obviously lots of opportunities in NOAA, but from the questions we're getting from the audience, it seems very few students know about these opportunities. How can we communicate them more effectively?" The following were suggestions for NOAA:

- Become a part of the local educational structure
- Publicize the partnerships that exist
- Simplify the structure of NOAA's public relations
- Clarify the structure of NOAA's Line Offices to the public
- Use the Internet to email job listings and opportunities to HBCUs and MSIs
- Ask students who have participated to actively speak about their experiences
- Review for effectiveness and clarity the information that is sent out
- Link NOAA's websites to more popular web areas

VIII. POSTERS AND AWARDS

More than 70 posters by students, researchers, and research organizations were presented under three topics: Oceanic/Marine and Fisheries Sciences, Environmental Sciences, and Atmospheric Sciences (see Appendix C). Best Poster Awards were presented by Dr. Sheila Stiles at a Ceremony immediately following the luncheon on Tuesday April 3, 2001.

Organizers: Dr. Sheila Stiles, National Marine Fisheries Service. NOAA
Dr. Paulinus Chigbu, Marine Sciences Program, JSU
Dr. Paul Croft, Atmospheric Sciences Program, JSU

Judges:

Oceanic/Marine Fisheries Science	Environmental Science	Atmospheric Science
Dr. Paulinus Chigbu	Dr. Mack Felton	Dr. Paul Croft
Dr. Patricia Duncan	Ms. Donna Johnson	Mr. Jose Garcia
Dr. Sheila Stiles	Dr. Chet Rakocinski	Dr. Edward Thomas

AWARDS

OCEANIC/MARINE AND FISHERIES SCIENCES

First Place Graduate—Best Poster

(9)
THE HABITAT UTILIZATION OF JUVENILE HAWKSBILL SEA TURTLES *(ERETMOCHELYS IMBRICATA*) AT BUCK ISLAND REEF NATIONAL MONUMENT ST. CROIX, U.S. VIRGIN ISLANDS. Roy A. Pemberton Jr. and John A. Musick, College of William & Mary, Virginia Institute of Marine Science, Fisheries Science Lab., Gloucester Pt, VA 23062

First Place Undergraduate—Best Poster

(12)
PREY PREFERENCE AND FUNCTIONAL RESPONSE OF ADULT BLUE CRABS *CALLINECTES SAPIDUS* TOWARDS TWO PREY SPECIES. Ariel Settles[1], Anson Hines[2], Livingston Marshall[1] . [1]Morgan State University, 1700 Cold Spring Ln., Baltimore, MD 21251, [2]Smithsonian Environmental Research Center, 647 Contees Wharf Rd., Edgewater, MD 21037

Second Place Graduate

(3)
FISHERY TROPHIC LINKAGES IN THE CHESAPEAKE BAY ECOSYSTEM
Graves, R.H., Morgan State University and USGS Patuxent Wildlife Research Center, Baltimore and Laurel, MD, Marshall, L. S., School of Computer, Mathematics, and Natural Sciences, Baltimore, MD 21251, Keough, J. R., USGS Patuxent Wildlife Research Center, Laurel, MD 20708-4039

Second Place Undergraduate

(11)
EFFECTS OF SALINITY ON FOOD CONVERSION AND GROWTH OF JUVENILE RED SNAPPER *(LUTJANUS CAMPECHANUS)*. *Pamela Riley-Daniels, *Himabindu Remata, Chigbu, P.*, Ogle, J**., and Lotz, J.** *Department of Biology, Jackson State University, Jackson, MS 39217, **Institute of Marine Sciences, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566

ENVIRONMENTAL SCIENCES

First Place Graduate—Best Poster

(33)
IDENTIFICATION OF THE PHOTO-DEGRADATION PRODUCTS OF TNT INDUCED BY RIBOFLAVIN WITH GC/MS AND HPLC/MS/MS. Kui Zeng,, Department of Chemistry, University of Science and Technology of China, Hefei, Anhui 230026, P.R. China; Huey-Min Hwang, Department of Chemistry, Jackson State University, Jackson, MS 39217; Hua Cui, Hongtao Yu, Department of Biology, Jackson State University, Jackson, MS 39217

First Place Undergraduate—Best Poster

(18)
CELLULAR RESPONSE (CYTOTOXICITY AND P53 EXPRESSION) TO ARSENIC AND ATRAZINE BY HEPG2 CELL LINES. Reshuna Y. Durden, Paul B. Tchounwou, Barbara A. Wilson, and Ali B. Ishaque, Environmental Toxicology Research Laboratory, NIH–Center for Environmental Health School of Science and Technology, Jackson State University, 1400 Lynch St., PO Box 18540, Jackson, MS 39217

Second Place Graduate

(31)
PM-2.5 MONITORING IN FLAGSTAFF DURING THE PRESCRIBED BURN AND RESIDENTIAL WOOD BURNING SEASONS. Amanda Thompson and Marin Robinson, Northern Arizona University, Flagstaff, AZ

Second Place Undergraduate

(21)
BIOCONCENTRATABLE POLYCYCLIC AROMATIC HYDROCARBONS & QUINONE PHOTOPRODUCTS IN EVERGLADES CANALS C-11 AND C-111
Haynes, S. [1,2]; Gragg, R.D.[1]; Orazio, C.E.[2]; Lebo, J.A. [2]; R. [2]; Frederic Essien[1], Larry Robinson[1], and Maurice Eddington[3]. Florida A & M University, [1]Environmental Sciences Institute, and the [3]Department of Chemistry, Tallahassee, Florida; [2]USGS, Columbia Environmental Research Center, Columbia, Missouri USA

ATMOSPHERIC SCIENCES

First Place Graduate—Best Poster

(38)
INTER-COMPARISON OF REBS Q*7.1, PDS7.1, & THRDS7.1 RADIOMETERS'S PERFORMANCE CHARACTERISTICS
Dwayne C. Joseph & J. Quentin Cowans, Clark Atlanta University, 223 James P. Brawley Drive, Atlanta, GA 30314

First Place Undergraduate—Best Poster

(40)
GAS TRAPPING IN VAPOR DEPOSITED WATER-ICE FILMS (90-145 K)
Brian Raymond and Marin Robinson, Northern Arizona University, Flagstaff, Arizona

Second Place Undergraduate

(34)
A STUDY OF TORNADO FORMATION AND ASSOCIATED TOPOGRAPHY IN ARKANSAS. Ashton Robinson Cook, Jackson State University, Jackson, Mississippi 39217

IX. PLENARY SESSION

Untapped Resources and Opportunities for Building Sustainable Alliances

Moderator: Dr. Livingston Marshall, Associate Professor, Morgan State University
Keynote Address: Dr. Michael Sissenwine, Science and Research Director, NEFSC, NOAA

Panelists: Ms. Cathy Fore, Manager, MEITP, Dept. of Energy
Mr. Justin Ahanhanzo, Consultant, UNESCO/IOC
Dr. Russell Schneider, Chief, Science Support, Storm Prediction Center, NOAA
Mr. Eddie Hanebut, President, Digital Quest
Mr. Robert Shepard, Executive Director, Science and Engineering Alliance, Inc. (SEA)
Ms. Senayl Assefa, Project Coordinator, American Association for the Advancement of Science
Mr. Roy Pemberton, Graduate Student, Virginia Institute of Marine Science

Increased Interest in the Ocean and Environment

Dr. Michael Sissenwine began his talk by listing the ways in which interest in the ocean and environment has increased. Much of the attention comes through concern with declining resources, such as the decrease in salmon spawning, concern about marine mammals like whales, and the effect of pollution on the ocean. Other interest is garnered through popular media, including the growth of the Internet. The Internet provides easier and quicker access to essential materials. Scientific communities and laboratories can share materials through the Internet. The new interest in the environment comes with an interdisciplinary approach, combining business, government, and academic interests.

Current Protective Programs

These are programs that can capitalize on the interest in the ocean.

- The Ocean Act, a committee to govern how we use the ocean
- The Oceans Commission, a private sector analog supported by the Pugh Ocean Commission
- Ocean Exploration Proclamation passed by President Clinton, a program designed to capture the public's attention by focusing on the excitement of ocean exploration and discovery
- Census of Marine Life, headed by Dr. Fred Grassle
- HMAP, a program to learn more about marine life through historical documents.

National Marine Fisheries Service Fisheries Observer Program

Mr. Roy A. Pemberton spoke about NMFS' Observer Program, which he felt offered ways to involve MSIs and HBCUs. He found out about these programs while an undergraduate in the Marine Science Department at Hampton University through the Federal List Server and Dr.

George Burbanck and Dr. Robert Jordan. Information was sent directly to his department from Ms. Gladys Reese at the NMFS/SEFSC Lab in Pascagoula, Mississippi. The cruises were conducted in Gulf of Mexico, Mid-Atlantic Bight, Gulf of Maine, and Georges Bank. Mr. Pemberton participated in the Gulf of Mexico Groundfish Survey Cruise in July of 1993. It was a great learning experience and opportunity, as well as a welcomed break from the Copepod identification work he was doing on the microscope. These cruises can be presented in the form of an internship, volunteer work, or in paid positions. As it did for him, it can get students exposed to "at sea sampling" and an opportunity to see the type of work involved in the Observer Program."

The Fisheries Observer Program provides an important link between the scientists and the fishermen. Although this link is rough and strained at times, the sea sampling program provides a real time view of what is happening out at sea in the fishing industry. The Observer Program provides training in monitoring a variety of fisheries, including Long Lining, Scalloping, Otter Trawl, Haul Seining, and Gillnetting. Information from Observer trips provide scientists with information on catch rates, fishing practices, gear modifications, age and growth data, environmental conditions, and by-catch data. Another goal of the Fisheries Observer Program is to monitor for fisheries gear interactions between commercial gear and federally protected species such as sturgeon, sharks, marine mammals, and sea turtles. Conditions under which these interactions occur, and the possible causes and solutions for them are being provided by the Fisheries Observer Program.

The Harbor Porpoise Take Reduction Team used observer data to identify the gear that is directly involved in interactions with harbor porpoise. They were able to pass regulations requiring fishermen to use the appropriate net twine and mesh sizes that had lower incidents of mortality for harbor porpoise. This would not have been possible without the observer data. Currently the Virginia institute of Marine Science (VIMS), the Virginia Marine Resources Commission (VMRC) and commercial fishermen from the State of Virginia are working with NMFS to reduce the incidental take of loggerhead sea turtles in the Chesapeake Bay. The observer data is being used to identify the conditions under which these takes occur and what gear is responsible.

HBCUs' Untapped Potential

Ms. Cathy Fore spoke about the need for HBCUs and MSIs to become more business aware, to market their technological facilities and capabilities. HBCUs must actively create their own entrepreneurial opportunities. Institutions of higher learning must become better business managers.

Sustainable Alliances

An excellent model of a sustainable alliance is the Science and Engineering Alliance (SEA) which was started by Lawrence Livermore National Laboratory, Prairie View A&M, Alabama A&M, JSU and Southern University in 1990. This alliance creates a virtual university of 33,000 students who benefit from the combined resources. SEA Partners work together with other private and public institutions to enhance and promote the capabilities of HBCUs. Dr. Robert Shepard

suggests that other groups form their own four to five member alliances, soliciting partners who balance strengths and weaknesses.

Partnering with Africa

The panelists expressed a strong need for a clearer process by which universities in Africa, and other developing countries, have the opportunity to work with U.S. universities and governmental laboratories. Some universities already do participate in the "twinning" program in which a university in Africa is paired with a university in the U.S. But this has not been put forth as a priority, and as such it has little financial support from U.S. AID. And the process of developing partnerships is not easy, as there is no central clearinghouse. Right now, much of this work is done on an individual basis, in which a few African students are provided with grants. The benefits to both countries and all the involved universities are great, and this is certainly an under tapped resource.

Dr. Brad Brown suggested that people interested in partnering with African universities should try to make direct contact with individual researchers either in a research laboratory such as NIOMR (Nigerian Institute of Oceanography and Marine Research) or an academic institution such as the University of Ghana, Legon. The Internet makes this possible.

Becoming Part of the Policymaking Decision

It is crucial to become part of the decision making process. By the time information reaches the Commerce Business Daily and the Federal Register notes, it is too late to influence the outcome. President Bush's decision to put $1.4 billion over the next four years into HBCUs came through personal, direct lobbying by African-American leaders. HBCUs, as well as NOAA, need to develop and maintain strong contacts in the government to influence policy strategy and decisions.

Need for Better Communication

Dr. Gary Matlock of NOS asked: What can we do to better give people communications about programs like the National Fisheries Observer Program? What can we do to get more awareness of the kind of activities available? Dr. Roy Pemberton replied that this is a difficult problem. There is the problem of not having a central list serve, so information can reach the right people all the time. Currently, information goes up on bulletin boards at the science departments of colleges, but clearly this is not as effective as it needs to be. We do want to get more people involved, and we need to have more effective ways of reaching our target audience.

X. LOOKING AHEAD

Working Groups were asked to address key issues raised at the Conference, to assess realistic implementation of strategies, to determine the investments and commitments needed for implementation, and to distribute responsibilities among academia, the public and private sectors, in order to maximize success.

From the Working Groups were developed a list of concerns and recommendations which are presented in the next section.

Members of academia and NOAA Line Office personnel co-facilitated the working groups:

National Marine Fisheries Service (NMFS) Working Group: Dr. Bradford Brown, NMFS, and Dr. Matthew Gilligan, Savannah State University;

Office of Oceanic and Atmospheric Research (OAR) Working Group: Ms. Ann Georgilas, OAR, and Dr. Livingston Marshall, Morgan State University;

National Weather Service (NWS) Working Group: Mr. Jose Garcia, NWS, and Dr. Paul Croft, Jackson State University;

National Environmental Satellite, Data, and Information Service (NESDIS) Working Group: Mr. Benjamin Watkins, NESDIS, and Dr. Abdul Mohamed, Jackson State University; and

Office of Finance and Administration (OFA) Working Group: Mr. Robert Stockman, OFA, and Dr. Mark Hardy, Jackson State University.

Concerns and Recommendations

Before listing the concerns and recommendations, it is deeply important to note that all the Working Groups acknowledged the tremendous effort NOAA has made in establishing programs, partnerships, and initiatives to increase and sustain diversity in the oceanic and atmospheric sciences. This said, it is clear from the concerns and recommendations that NOAA has not yet done an adequate job of making this information available.

Concerns

The concerns are listed in order of magnitude.

- **THE NEED FOR CLEARER COMMUNICATION**

  The need for greater and clearer communication kept coming up throughout the Conference. One panelist expressed his dismay that with all the programs NOAA had available to students, very few of the students present at the Conference knew about them. Greater communication was called for to publicize the activities of NOAA and its Line Offices so that the larger public knows what these agencies do. It was also called for in creating more effective partnerships between MSIs, private industry, and the government. Finally, more

communication is needed at the legislative level, to convince Congress that these programs deserve to be funded. This concern, the need for greater communication, was expressed more frequently than any other in the Conference. It remains a real obstacle for increasing and improving diversity, as this is the third Conference and the call for greater communication has been made at each one. There have been improvements—a central NOAA web page for diversity and an increased feeling among students that their mentors were communicating well—but there is much work to be done.

- **THE NEED FOR MORE MSI INITIATIVE**
  MSIs and HBCUs need to take a greater initiative in establishing partnerships, understanding business arrangements, and developing science majors. MSIs need to objectively assess their strengths and weaknesses, market their advantages, and seek partnerships that will produce mutual benefits.

- **THE NEED FOR PARTNERING SUPPORT**
  Many participants talked about the difficulties of establishing partnerships. The most frustrating partnership experiences were those that had been developed through a single contact person. If that contact person left, the entire project fell apart. Several Conference participants advocated advisory councils for partnerships so that the long-term interests of the collaborative work would be promoted, regardless of individual commitment, and incorporated within the structure of the host partner.

- **THE NEED FOR FACULTY SUPPORT**
  Many faculty expressed frustration at being overworked, trying to put together partnerships, write proposals, do significant research, write articles, and teach class. Faculty enthusiasm for and participation in increasing and sustaining diversity must be supported. As much as is feasible, faculties could be provided opportunities by university administrations such as short-term leaves of absences to participate in faculty exchange; faculty's mentoring of disadvantaged students and involvement in outreach programs should count towards tenure; and faculty members should have support in writing grant proposals.

- **THE NEED FOR MONEY**
  "Money is nice," said one participant. And more money is nicer. With the federal budget facing more severe cutbacks than ever, several participants talked about the practical side of getting money. They advocated that the search for money be personal. Faces, real people from NOAA, from the HBCUs, from partnering industries must lobby Congress in person. In addition, most Congressional members are unaware of the deep commitments NOAA has made to education and diversity. Congressional members must see the practical workings of NOAA and must understand that the research NOAA does is enhanced by this attention to education and diversity.

- **THE NEED FOR STUDENT SUPPORT**
  This area has seen improvement since the first Expanding Opportunities Conference. Participants spoke more of retention with an eye to very practical concerns. For instance, internships are valuable to students, but little accommodation is made for housing or for travel

costs to and/or from the internship location. Without a secure way of finding affordable, short term, housing, many students must turn down opportunities. Likewise, minority students often have needs that are not acknowledged or addressed by program directors.

- **THE NEED FOR OUTREACH**
  Outreach needs to happen at all levels – community, pre-school to post-graduate, internationally, and among scientific disciplines. Outreach that emphasizes collaboration, communication, and cultural awareness forms the basis for ethical work—work that supports not just the diversity of people, but their well being as well, work that increases knowledge while respecting land and culture.

Recommendations

FOR BOTH NOAA AND MSIs

Work to ensure the new NOAA-MSI Partnership succeeds.

FOR NOAA

- Create a centralized list-serve to disseminate information about opportunities by email. This should be connected to the central NOAA web site, so students can sign onto the list-serve by clicking a button.

- Review the information it currently sends out by flier, making sure it is visually appealing.

- Send information to Biology Departments for consideration by biology students even if the university has no Department of Marine Sciences.

- Designate a key person or persons from each Line Office to be the contact person for MSIs.

- Identify a way to contact MSIs to announce important information. Each Line Office should have a contact person at each MSI, and a list-serve for these contact people to advertise appropriate programs.

- Send NOAA representatives to MSIs on a regular basis to establish personal contact.

- Release some of the OAR (Office of Oceanic and Atmospheric Research) funding directly to MSIs so that they can partner with JIs.

- Develop a clear and visible public presence to increase awareness as to what NOAA and its Line Offices do.

- Hold some meetings of funding agencies at MSIs so experts can give talks at the school following the meeting.

- Get students interested in the sciences at an early age by conducting extensive outreach to Minority Schools, K-12, Middle and High Schools.

- Include teachers at all levels in outreach programs, to increase their knowledge.

FOR MSIs

- Establish, if at all possible, a Marine Biology or/and Coastal Management Program.

- Increase networking and partnering with other MSIs.

- Become savvy about understanding the business side of creating and maintaining partnerships.

- Ask, where appropriate, their Business Schools to guide them in writing effective proposals.

- Tap public involvement by creating alliances with the public, private, federal, state, local and academic sectors.

- Identify key contact people in NOAA.

- Monitor projects for grant proposals from SG and NURP.

- Create a central data bank of minority students in the sciences, current and graduates. This data bank can be used by students to seek housing for internships, to find out information about life in new areas, and to learn about post-graduate experiences.

- Establish adult education courses in the sciences as a way of increasing public support for new programs.

APPENDICES

APPENDIX A - AGENDA

Expanding Opportunities in Oceanic and Atmospheric Sciences

Building Sustainable Alliances

April 1-3,2001
Jackson State University
Jackson, MS

SUNDAY
April 1, 2001

1:00 pm	**Registration**	**Quality Inn Hotel & Suites**
6:00 pm-8:00 pm	**Pre-Conference Reception** Remarks by The Honorable Bennie G. Thompson, United States House of Representatives	**Presidential Hall**

MONDAY
April 2, 2001
JSU Liberal Art Building

7:45 am-8:15 am	**Registration**	**Lobby**
	PLENARY SESSION	**Room 266 (Overflow, Room 146)**
8:15 am-8:45 am	**Opening & Dedication** Dr. Ambrose Jearld, Jr, Chief Research Planning and Coordination Staff, National Marine Fisheries Service/NOAA; Conference Chair	
	Greetings and Welcome Dr. Ronald Mason, Jr., President, Jackson State University The Honorable Harvey Johnson, Jr., Mayor of Jackson, Mississippi The Honorable Thad Cochran, United States Senate Rear Admiral Evelyn Fields, Office of Marine and Aviation Operations, NOAA	
8:45 am -9:15 am	**Charge to the Conference** Rear Admiral Evelyn Fields, Office of Marine and Aviation Operations, NOAA Dr. N. Joyce Payne, Director, Office for the Advancement of Public Black Colleges, National Association of State Universities and Land-Grant Colleges (NASULGC)	

9:15 am - 10:30 am **Perspectives from NOAA's Leadership - Progress and Impediments: Building Sustainable Alliances**

Moderators: Dr. Denise Stephenson-Hawk, Chairman, The Stephenson Group and Member, NOAA Science Advisory Board
Dr. William White, Associate Dean, School of Science and Technology, Jackson State University

Panelists: Mr. John Oliver, Deputy Assistant Administrator, NOAA National Marine Fisheries Service
Ms. Louisa Koch, Deputy Assistant Administrator, NOAA Office of Oceanic and Atmospheric Research
Capt. Ted Lillestolen, Deputy Assistant Administrator, NOAA National Ocean Service
Ms. Mary Glackin, Deputy Assistant Administrator, NOAA National Environmental Satellite, Data, and Information Svc.
Dr. Edward Johnson, Director of Strategic Planning and Policy, NOAA National Weather Service

10:30 am-11:00 am **COFFEE BREAK**

11:00 am-12:30 pm **FIRST CONCURRENT WORKSHOPS**
Models that Work and Lesson Learned

Academia **Room 146**
Panel A - Achieving Educational and Occupational Goals

Moderators: Dr. Edward Thomas, Auburn University
Ms. Nikola Garber, National Sea Grant College Program, NOAA

Panelists: Dr. William Bonner, University Center for Atmospheric Research
Dr. Bradford Brown, NMFS/NOAA
Dr. Gleyn Bledsoe, land Grant and Outreach, Northwest Indian College
Dr. Marin Robinson, Northern Arizona University
Ms. Letise T.. Houser, Brown University
Dr. Mark Hardy, Jackson State University

Private Sector **Room 262**
Panel A - Building Mutually Beneficial Partnerships

Moderators: Ms. Pamela Neal, Sarkeys Energy Center, Oklahoma University
Mr. Robert Stockman, Office of Finance & Administration, NOAA

Panelists: Ms. Jennifer Carfagno, Weather Channel
Ms. Cathy Fore, Oak Ridge MEITP, Department of Energy
Ms. Delois Cutter, Tal-Cut Inc.
Dr. Edward Johnson, NWS/NOAA
Mr. Edwin Mitchell, J-Tek, Inc.
Ms. DeJonnette Grantham-King, Advance Environmental Consultants, Inc.

Public Sector **Room 263**

Panel A - Increasing Access to Public Resources

Moderators: Mr. Benjamin Watkins, NESDIS/NOAA
Ms. Rita Presley, Jackson State University

Panelists: Dr. Jewell Prendeville, National Science Foundation
Dr. Robert Menzer, National Center for Environmental Research, EPA
Ms. Jacqueline Rousseau, USEC/NOAA
Mr. James Harrington, NASA
Mr. Anthony Overton, University of Maryland Eastern Shore
Ms. Jan Kucklick, NOS/NOAA
Dr. Teferi Tsegaye, Alabama A&M University
Ms. Julie Marcy, U.S. Army Corps of Engineers

Student **Room 266**

Panel A - Creating Paths to Success in Marine and Atmospheric Sciences

Moderators: Mr. Jose Garcia, NWS/NOAA
Dr. Dionne Hoskins, Savannah State University

Panelists: Dr. Michael Fogarty, NMFS/NOAA
Mr. Ricardo Lopez, California State University
Dr. Pace Wilber, NOS/NOAA
Ms. Andrea Sealy, Pennsylvania State University
Dr. Randal Mandock, Clark Atlanta University
Mr. M. Brandon Jones, Delaware University

12:30 pm-2:00 pm **LUNCH** - Jacob L. Reddix Campus Union, General Purpose Room

Moderator: Dr. Roy DeBerry, Vice President for External Affairs, Jackson State University

Keynote: Ms. DeLois A. Cutter, President, Tal-Cut Company

2:00 pm **Opening of Business, Technology, and Career Trade Fair**
(Remains open through Tuesday)
Lee E. Williams Athletics & Assembly Center

2:30 pm-4:00 pm **SECOND CONCURRENT WORKSHOPS** **Room 146**

Models that Work' and Lessons Learned

Academia

Panel B - Investing in Building Capacity

Moderators: Dr. Larry Robinson, Florida A&M
Ms. Margaret McBride, Chesapeake Bay Program, NOAA

Panelists: Dr. Joseph Okoh, University of Maryland Eastern Shore
Dr. Abdul Mohamed, Jackson State University
Dr. Michael Sissenwine, NMFS/NOAA, Northeast Fisheries Science Center
Mr. Kurt Shinkle, National Geodetic Survey/NOAA
Dr. Arthur Allen, University of Maryland Eastern Shore
Dr. Robert Stewart, Texas A&M

Private Sector **Room 262**
Panel B - Converging Business and Academic Practices

Moderators: Dr. Mildred Ofosu, Delaware State University
Dr. Fred Thurberg, NMFS/NOAA

Panelists: Dr. Barry Costa-Pierce, Mississippi/Alabama Sea Grant
Mr. Clinton Twilley, Concurrent Technologies Corp.
Mr. Eddie Hanebut, Digital Quest, Inc.
Mr. George B. Brooks, Jr., University of Arizona
Dr. Richard Gragg, Florida A&M
Mr. Kelton Clark, Morgan State University

Public Sector **Room 263**
Panel B - Sustaining Linkages for Social and Economic Development

Moderators: Dr. James Arrington, South Carolina State University
Mr. William Parker, NWS/NOAA

Panelists: Mr. Ken Davidson, NESDIS/NOAA
Ms. Michele McCoy, EASC/NOAA
Dr. Barbara Ousby, Mississippi Department of Economic and Community Development
Dr. Mack Felton, Dillard University
Dr. Darryll Keith, EPA
Mr. Jamison Hawkins, NWS/NOAA

Student **Room 266**
Panel B - Becoming a Professional in Marine and Atmospheric Sciences

Moderators: Dr. Brian Bingham, Western Washington University
Mr. Alonzo Hamilton, NMFS/NOAA

Panelists: Ms. Pamela Lestenkoff, University of Alaska
Ms. Noelani Puniwai, Washington State University
Ms. Shawn Arellano, Woods Hole Oceanographic Institution
Mr. Ashton Robinson-Cook, Jackson State University
Ms. Wanda Jones, University of Florida-Gainesville
Mr. Anthony Overton, University of Maryland Eastern Shore
Ms. Essie Coleman-Duffie, Southeast Fisheries Science Center, NOAA
Mr. Lawrence C. Tynes, Sr. 1 Eastern Administrative Support Center, NOAA

4:15 pm-5:30 pm **POSTER PRESENTATIONS**
Student, Faculty, Public, and Private Sector Posters
(Will remain on exhibit until 1 :00 pm on Tuesday)
Lee Williams Athletics & Assembly Center

Conveners of student participants:
Dr. Paulinus Chigbu, Jackson State University
Dr. Paul Croft, Jackson State University

Convener of NOAA participants:
Dr. Sheila Stiles, NMFS/NOAA

6:00 pm-8:00 pm **CONFERENCE BANQUET**
Jacob L. Reddix Campus Union, General Purpose Room

Moderator: Dr. Willie Brown, Vice President for Technology, Jackson State University
Introducer: Dr. Joyce Payne, Director, Office for the Advancement of Public Black Colleges, NASULGC
Keynote: Dr. Ronald Mason, Jr., President Jackson State University

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Tuesday
April 3, 2001
JSU Liberal Arts Building

7:45 am-8:30 am **Registration and Continental Breakfast** **Lobby**

8:30 am-10:00 am **PLENARY SESSION**
Untapped Resources and Opportunities for Building Sustainable Alliances **Room 266 (overflow Room 146)**
Moderator: Dr. Livingston Marshall, Associate Professor Morgan State University
Keynote: Dr. Margaret Leinen, Assistant Director for GeoSciences, National Science Foundation
Panelists: Ms. Cathy Fore, Manager MEITP, Department of Energy
Mr. Justin Ahanhanzo, Consultant, UNESCO/IOC
Dr. Russell Schneider, Chief Science Support, Storm Prediction Center, NOAA
Mr. Eddie Hanebut, President, Digital Quest, Inc.
Dr. Robert Shepard, Science and Engineering Alliance
Ms. Senayt Asseta, Program Coordinator, American Association for the Advancement of Science
Mr. Roy Pemberton, Graduate Student, Virginia Institute of Marine Science

10:00 am - 10:30 am **COFFEE BREAK**

10:30 am - 12:00 pm **WORKING GROlJPS**
Looking Ahead clnd Innovations

National Marine Fisheries Service **Room 266**
Facilitators: Dr. Bradford Brown, NOAA
Dr. Matthew Gilligan, Savannah State University

Office of Oceanic and Atmospheric Research **Room 262**
Facilitators: Ms. Ann Georgilas, NOAA
Dr. Livingston Marshall, Morgan State University

	National Weather Service	**Room 263**
Facilitators:	Mr. Jose Garcia, NOAA Dr. Paul Croft, Jackson State University	
	National Ocean Service	**Room 146**
Facilitators:	Ms. Jocelyn Martin, NOAA Dr. George Burbanck, Hampton University	
	National Environmental Satellite, Data, and Information Service	**Room 254**
Facilitators:	Mr. Benjamin Watkins, NOAA Dr. Abdul Mohamed, Jackson State University	
	Office of Finance and Administration	**Room 264**
Facilitators:	Dr. Robert Stockman, NOAA Dr. Mark Hardy, Jackson State University	

12:00 pm -1:30 pm **LUNCH**
Jacob L. Reddix Campus Union, General Purpose Room

Moderator: Dr. Felix Okojie, Vice President for Research and Strategic Initiatives, Jackson State University

Keynote: Dr. Darrell Jay Grimes, Dean, Institute of Marine Sciences
The University of Southern Mississippi

Best Posters Awards Special Recognitions

2:00 pm -4:00 pm **PLENARY SESSION** **Room 266 (overflow Room 146)**

Closing

Moderators: Ms. Carmella Davis Watkins, National Environmental Satellite, Data, and Information Service, NOAA
Dr. Emorcia Hill, Abt Associates, Inc.

Concluding Remarks
Dr. Ambrose Jearld, Jr., NMFS/NOAA, Conference Chair

4:00 pm TEA **To be announced**

National Oceanic and Atmospheric Administration
Jackson State University

Expanding Opportunities in Oceanic and Atmospheric Sciences:
"Building Sustainable Alliances" Conference Luncheon

April 2, 2001
Jacob L. Reddix Campus Union
General Purpose Room
12:30 p.m.

PROGRAM

Dr. Roy DeBerry
Vice President for External Affairs
Moderator

Musical Interlude ..... *Mr. Joe Ringold*
Instructor of Music, Assistant Band Director

Greetings ..... *Dr. Mark G. Hardy*
Interim Associate Vice President for Academic Affairs

Grace ..... *Mr. Obra Hackett*
Director, Career Counseling & Placement

Luncheon

Musical Selection ..... *Mr. Joe Ringold*

Introduction of Speaker ..... *Dr. Roy DeBerry*

Keynote Speaker ..... *Ms. DeLois A. Cutter*
President, Tal-Cut Company

Musical Selection ..... *Mr. Joe Ringold*

Closing Remarks ..... *Dr. Abdul K. Mohamed*
Dean, School of Science & Technology

National Oceanic and Atmospheric Administration
Jackson State University

Expanding Opportunities in Oceanic and Atmospheric Sciences:
"Building Sustainable Alliances" Conference Banquet

April 2, 2001
Jacob L. Reddix Campus Union
General Purpose Room
6:00 p.m.

PROGRAM

Dr. Willie Brown
Vice President for Information Technology
Moderator

Musical Interlude . . . . . Mr. Terry Miller
Senior Education Music Major

Greetings . . . . . Dr. Glenda Glover
Dean, School of Business

Grace . . . . . Mr. Clyde Christopher
Adjunct Professor, Department of Computer Science

Dinner

Musical Selection . . . . . Mr. Terry Miller

Introduction of Speaker . . . . . Dr. Joyce Payne
Director, Office for the Advancement
of Public Black Colleges, NASULGC

Keynote Speaker . . . . . Dr. Ronald Mason, Jr.
President, Jackson State University

Musical Selection . . . . . Mr. Terry Miller

Closing Remarks . . . . . Mr. John Oliver
Deputy Assistant Administrator
National Marine Fisheries Service

National Oceanic and Atmospheric Administration
Jackson State University

Expanding Opportunities in Oceanic and Atmospheric Sciences:
"Building Sustainable Alliances" Conference Luncheon

April 3, 2001
Jacob L. Reddix Campus Union
General Purpose Room
12:30 p.m.

PROGRAM

Dr. Felix A. Okojie
Vice President for Research and Strategic Initiatives
Moderator

Musical Interlude ..... Ms. Jeanette Powell
Senior Music Piano Major

Greetings ..... Dr. Evelyn Leggette
Dean, University College

Grace ..... Dr. George Washington
Adjunct Professor, Department of Biology

Luncheon

Musical Selection ..... Ms. Jeanette Powell

Introduction of Speaker ..... Dr. Felix A. Okojie
Vice President for Research and Strategic Initiatives

Keynote Speaker ..... Dr. Darrell Jay Grimes
Dean, Institute of Marine Sciences
The University of Southern Mississippi

Closing Remarks ..... Dr. Ambrose Jearld, Jr.
Chief, Research Planning and Coordination
NOAA/NMFS/NEFSC

APPENDIX C

STUDENT ABSTRACTS FOR POSTER PRESENTATIONS

OCEANIC/MARINE AND FISHERIES SCIENCES

(1)

OCCURRENCE OF SOME FISHES IN VARIOUS HABITATS IN THE VICINITY OF MISSISSIPPI SOUND. Sonya D. Barner[1], Sara E. LeCroy[2] and Chet F. Rakocinski[2].
[1]*Department of Biology, Jackson State University, Jackson, MS 39217;*[2] *University of Southern Mississippi, Institute of Marine Science, Gulf Coast Research Laboratory, 703 East Beach Drive, Ocean Springs, MS 39566;*

To generate museum records and document biodiversity in Mississippi coastal waters, fishes were collected from various habitats in Mississippi Sound and nearby Gulf of Mexico waters, ranging from Fort Bayou inshore waters to open waters near Horn and Chandaleur Islands. Samples were collected with seines and an otter trawl. Fishes were sorted, identified, catalogued and deposited in the fish museum at Gulf Coast Research Laboratory (GCRL). The GCRL Museum database was searched to provide additional information on the five most abundant species from each habitat in order to compare fish habitat preferences for the most common species collected. Forty species of fish were identified. The following families had the highest number of species: Carangidae (5), Fundulidae (5), Sciaenidae (5), Engraulidae (3) and Sparidae (3), followed by the Clupeidae (2), Gobiidae (2), Mugilidae (2), Synodontidae (2) and Syngnathidae (2). Of the seven species collected at the Fort Bayou station, *Menidia beryllina*, *Anchoa mitchilli*, and *Lucania parva* were the most abundant accounting for about 76% of the total catch. In the offshore areas of Barrier islands, eleven species were collected with *Anchoa hepsetus, A. mitchilli* and *Saurida brasiliensis* being the most abundant. Two different distribution patterns were evident based on our collections. Pelagic forage species such as *Anchoa mitchilli* and *Menidia beryllina* were widespread, showed no apparent habitat association and were euryhaline, occurring widely throughout the area. The second pattern was shown by species that were associated with one or two habitat types. These included *Sauridia brasiliensis*, *Eutremeus teres*, and *Stenotomus caprinus*, which were collected only at the open water stations, *Gobiosoma bosc*, from low salinity mud bottoms, *Trachinotus carolinus* and *Menticirrhus americanus* from nearshore sand bottoms, and all three species of *Fundulus*, *Oligoplites saurus* and *Eucinostomus argenteus* from high salinity grassbeds.

(2)

PREDICTION OF SHRIMP BIOMASS FLUCTUATIONS AND CATCH RATES USING A BIOMASS DYNAMIC MODEL: A PRELIMINARY STUDY. Atanasio Brito[1], David Die[2,4], Richard Gragg[1], Elijah Johnson[1], Jennifer Cherrier[1], Larry Robinson[1] and Brad Brown[3]. *[1]Environmental Sciences Institute, Florida A&M University, Tallahassee Florida and the [2]Center for Unified Fisheries Education and Research, [3]NOAA Southeast Fisheries Center and the [4]University of Miami, Rosenstiel School of Marine and Atmospheric Sciences, Miami, Florida*

The Mozambique Sofala Bank (16°20'-21°00') shrimp fishery was over fished and the fishing effort was 30% greater than the effort that would produce the maximum sustainable yield for the year 2000. Recent introductions of powerful shrimping vessels, night time fishing and the constant upgrading of navigation systems such as Global Positioning System and Echo Sounder by commercial fleets have counteracted the management practices of seasonal closures, total allowable catches and limited entries. This work uses a biomass dynamic model to predict monthly biomass fluctuations of penaeid shrimp in Sofala Bank. The model can give managers a predictive capability in estimating monthly biomass flutuactions for the purpose of maintaining a sustainable shrimp fishery. A 9-year series (1991 to 1999) of a commercial fleet shrimping catch and effort statistics, for *Farfantepenaeus indicus* and *Metapenaeus monoceros,* were input into the biomass dynamic model. A reasonably good correlation between the estimated catch per unit of effort and the observed monthly catch per unit of effort for both species was observed in the model. The estimated catch per unit of effort, for *F. indicus,* following the all year recruitment pattern yielded an r-value of 0.7363. The harvestable biomass, from 1991-1999, of *F. indicus,* oscillated on a monthly basis between 34 and 415 tons. The catchability coefficient for the fleet is estimated to be 0.000085. While the annual growth biomass oscillated between 387 and 1083 tons. The estimated catch per unit of effort, for *M. monoceros,* fits the observed at an r-value equal to 0.5379 for a seven-month recruitment pattern. The model predicts that the harvestable biomass of *M. monoceros* oscillated between 83 and 783 tons. The catchability coefficient for this species was estimated to be 0.000026. The annual growth biomass oscillated between 593 and 1262 tons. This preliminary work has provided the key elements necessary for a definitive study. Future work will be more comprehensive, using data from all Sofala Bank shrimping fleets and the six shrimp species caught in the past 15 years.

(3)

FISHERY TROPHIC LINKAGES IN THE CHESAPEAKE BAY ECOSYSTEM. R.H. Graves[1], L.S. Marshall[2], and J.R. Keough[3]. *[1]Morgan State University and USGS Patuxent Wildlife Research Center, Baltimore and Laurel, MD; [2]School of Computer, Mathematics, and Natural Sciences, Baltimore, MD; and [3]USGS Patuxent Wildlife Research Center, Laurel, MD.*

Annually, landings from the Chesapeake Bay ecosystem account for roughly 250,000 – 350,000 metric tonnes of total catch from U.S. fisheries. Collectively, over 50 species of finfish, crustaceans, and bivalves are caught in the Bay. The complexity of the bay ecosystem, along with effects that stem from the steadily increasing human population of its watershed, challenges fishery management. Modern fishery management calls for multi-species models and

approaches. Unlike single-species approaches, multi-species approaches treat stocks as part of an ecosystem, taking into account natural mortality, growth effects, and dynamics of the entire food web. In order to develop these approaches, a good understanding of trophic linkages under varying conditions is needed. This study serves to identify trophic linkages through the use of a combination of stomach content and C, N, and S stable isotope analysis. Samples represent important finfish, bivalve, and crab populations in oligohaline and mesohaline regions of the Bay. We seek to identify the trophic roles and connections of and among species and age classes spatially, temporally, and under varying water quality conditions.

(4)

A PRELIMINARY STUDY OF SUBSTRATE PREFERENCE BY HATCHERY PRODUCED JUVENILE RED SNAPPER (*LUTJANUS CAMPECHANUS*). Jomeka Johnson[1], Chigbu, P.[1] & Ogle, J.[2] [1]*Department of Biology, Jackson State University, Jackson, MS 39217;* [2]*Institute of Marine Sciences, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566.*

Substrate characteristics influence the distribution of benthic organisms, including fishes. Red snapper larvae settle out to the bottom of the Gulf of Mexico following a planktonic larval existence. A previous laboratory study using circular tanks suggested that 0+ red snapper collected from the wild preferred shell to sand substrate, perhaps because shells provide refuge to juvenile snapper from predation. However, hatchery-produced fish may differ from wild conspecifics in their behavior, for example, in habitat selection. This can increase the vulnerability of hatchery-produced fish or wild conspecifics to predation, and thus can potentially contribute to the failure of fish stock enhancement projects. We examined substrate preference by hatchery-produced 0+ red snapper using two raceways and two circular tanks. Each container was divided into two equal areas, the floor was covered with sand in one area and clam shells in the other half. Groups of four (n=6) fish < 92.0 mm in size were introduced into the experimental chambers and visually observed at various times from morning to night. On the average, more fish (75%) were observed in the areas of the tanks with sandy substrate than in the areas with shell (25%). Only in one case was there no apparent difference in substrate preference, as about 50% fish were on sand and 50% on shell. These results are inconsistent with a published study that suggested the wild caught juvenile red snapper preferred shell to sandy substrate. Further studies are planned to confirm this observation, to compare substrate selection by hatchery-produced and wild caught snapper, and to assess ontogenetic changes in substrate preference.

(5)
MARINE MAMMAL PROGRAMS AND ACTIVITIES AT THE SOUTHEAST FISHERIES SCIENCE CENTER, PANAMA CITY LABORATORY, FLORIDA. Wanda Jones, *University of Florida and National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory*

The National Oceanic and Atmospheric Administration (NOAA) Fisheries, is mandated by the Marine Mammal Protection Act of 1972 and Amendments of 1994 to manage and conserve certain marine mammal species including all cetaceans, seals and sea lions. In the southeast region, the Southeast Fisheries Science Center (SEFSC) Protected Resources and Biodiversity Branch (PRBD) houses the Marine Mammal Investigation Group that participates in the Marine Mammal Stock Assessment and Marine Mammal Health and Stranding Response Program(s). In compliance with the act mandates, stranding programs, biomonitoring programs, and population surveys have been developed and implemented in the southeast region. The SEFSC programs oversee NMFS research conducted on marine mammal communities in three ecosystems: the Gulf of Mexico Shelf, the South Atlantic Shelf, and the US Caribbean Shelf. A number of cetacean (whale and dolphin) species, pinniped (seals) species, and sirenian (manatees) species inhabit these areas seasonally and year-round. Research conducted by the SEFSC is utilized by NMFS' Office of Protected Resources and Conservation and Recovery Programs in the management and enforcement branches to create, implement, mitigate, and enforce regulations supporting the Marine Mammal Protection Act of 1972.

Several SEFSC field laboratories within the southeast region conduct research and activities in keeping with the goals and mission of the Marine Mammal Programs. The Panama City Laboratory, Panama City Beach, Florida, in cooperation with the University of Florida, conducts marine mammal programs under the PRBD including stock assessment, mortality estimation, health assessment, life history, and behavioral research. Recently, from 1997-2000, Jones (in prep) conducted field research on bottlenose dolphins in Panama City and the surrounding areas. The work focused on stock assessment and the general behavioral ecology of pods and individual dolphins. Information collected included abundance estimates, residency status, habitat use, movement patterns, group associations, and the development of activity budgets for the various pods in northwest Florida marine and estuarine waters. In addition, a photoidentification catalog was created and continues to be updated for dolphins inhabiting the waters surrounding Panama City and neighboring cities, Destin and Port St. Joe. This catalog is a valuable asset in the identification of resident and transient dolphins, for behavioral studies, and for stock assessment goals. It is also useful in determining identification of individuals in unusual mortality events and those examined during the normal course of data collection for the Marine Mammal Health and Stranding Response Program (MMHSRP). Research and activities conducted for the MMHSRP include collaboration with the Southeast Region Stranding Network for marine mammal rescue, rehabilitation, health assessment, and necropsy for sample collection for the Biomonitoring Program including life history, genetic, morphometric, pathology, virology, and feeding ecology research.

(6)

ABSENCE OF *MONOPYLEPHORUS RUBRONIVEUS* IN FISH FEEDING STUDIES. Tiffany Lee, *Savannah State University, Savannah, GA; David Gillett, University of Charleston, Charleston, SC.*

Tidal creeks serve as nursery and refuge habitats for many economically and ecologically important species of fish and crustaceans. During at least one stage of their lives, most of these fish and crustaceans feed upon the benthos living in the creeks. The tubificid oligochaete *Monopylephorus rubroniveus* is the numerically dominant macrobenthic organism found intertidally in southeastern tidal creeks. Oddly enough, *Monopylephorus* and similar organisms are rarely found during fish gut-content studies. We have performed a series of experiments in which we fed both oligochaetes and hard-bodied amphipods to a common estuarine fish, *Fundulus heteroclitus* and measured the state of digestion of each after 2, 15, 30, or 60 minutes in the gut. To evaluate the presence of food, items in the gut were assigned a score, 0- empty, 1- tissue (identified under a compound microscope) and 2- whole, based on the degree of digestion. Amphipods were easily identified to species at all four sampling times. After 2 minutes the oligochaete was still easily identified. At 15, 30, and 60 minutes the oligochaete was only recognizable as setae, if there were any remains left at all. It is our feeling that most fish diets, which are based upon typical gut-content analysis methods, underestimate the importance of oligochaetes and other soft-bodied organisms while overestimating the importance of hard-bodied organisms due to their quick digestion time in the gut of the fish.

(7)

ARCVIEW GIS UTILIZATION IN IDENTIFICATION AND QUANTIFICATION OF SHORE TYPE AND LAND USE IN AN URBANIZED SUBESTUARY OF THE CHESAPEAKE BAY. Patrice Longshaw, *Marine and Environmental Science Undergraduate, Hampton University*

The technological advancements that have been made in mapping during the last few years allow for many statistical and database functions to be integrated into one program. One such program is the ArcView GIS program, distributed by Environmental SR Imaging. The Hampton River, a tributary of the James River adjacent to Hampton Roads, at the mouth of the Chesapeake Bay in Virginia, is an ideal location to utilize the capabilities of ArcView GIS to analyze land use and shoreline types. ArcView allows overlaying of digitized maps from various sources such as the City of Hampton. and USGS. Each of these layers, once applied to a basemap, can be shown, or hidden, as appropriate for the particular area being analyzed. This project is in progress, and will provide many opportunities for student research in the future. This will be an ongoing study to better quantify and assess effects of shore types and land usage on the Hampton River ecosystem.

(8)

INVESTIGATIONS OF THE HEALTH OF THE STRIPED BASS IN THE CHESAPEAKE BAY: MYCOBACTERIA INFECTIONS IN STRIPED BASS. Anthony S. Overton[1], Eric B. May[1], and F.J. Margraf[2]. *[1]University of Maryland Eastern Shore, Maryland Cooperative Fish and Wildlife Research Unit 1120 Trigg Hall Princess Anne, Maryland 21853. [2]Alaska Cooperative Fish and Wildlife Research Unit 210 Irving I Building P.O. Box 757020 University of Alaska Fairbanks Fairbanks, AK*

Several species of bacteria have been isolated from striped bass in the Chesapeake Bay. *Mycobacteria sp.* is of particular interest to scientists because if its association with large nodules (granulomas) or ulcers throughout many of their tissues. The resulting disease may be characterized by emaciation, inflammation of the skin, open lesions, and ulceration. We determined the extent of Mycobacteria infection in striped bass and provide evidence of decreased overall condition of fish affected by these bacteria. Almost 50% of the fish showed some sign of an external sore. Granulomas appeared in at least one organ in 53% of the fish in our samples regardless of the presence or absence of external sores. The Gran scores from the spleen and heady kidney were significantly higher than either the heart and liver and appeared to be most closely associated with the presence of external The condition factor was significantly higher for striped bass without sores (0.96) than those with sores (0.82). Condition factors involving all fish clearly shows a trend, with NGNS at 0.99, GNS at 0.92 and GS at 0.81.Slopes of the regression loge weight (g) and loge length (mm) for striped bass with sores was significantly higher than those fish without sores. However the weight at length were more variable (lower r2) in striped bass with sores than those fish without sores.

(9)

THE HABITAT UTILIZATION OF JUVENILE HAWKSBILL SEA TURTLES *(ERETMOCHELYS IMBRICATA*) AT BUCK ISLAND REEF NATIONAL MONUMENT ST. CROIX U.S.VIRGIN ISLANDS. Roy A. Pemberton Jr. and John A. Musick, *College of William & Mary, Virginia Institute of Marine Science, Fisheries Science Lab., Gloucester Pt, VA 23062*

Juvenile hawksbill, *Eretmochelys imbricata*, and green, *Chelonia mydas*, sea turtles are found in waters of Buck Island Reef National Monument, St. Croix U.S. Virgin Islands. Sea turtle surveys were conducted at Buck Island in the summer of 1998 and winter of 1999. Green turtles were found in the southern area of the monument in blocks A through J and block R. These blocks were either adjacent to or near areas of large sea grass beds, which are the predominant foraging areas for green sea turtles. The majority of juvenile hawksbills sighted were along the north side of the monument in blocks J through N. There was a significant difference in the mean number of juvenile hawksbills sighted in blocks with low zoanthid (*Zoanthus sociatus*) cover and those with high zoanthid cover. More juvenile hawksbills were sighted in blocks with high zoanthid cover. Their habitat utilization around Buck Island reflects their foraging focus on zoanthids.

Radio and sonic telemetry was used to elucidate site philopatry of juvenile hawksbills at Buck Island. The hawksbills exhibited strong site philopatry for the North side of Buck Island.

Each turtle monitored had a relatively small home range (≤ 2 km^2) which it occupied for at least several months. Turtles moved less than 1.09 km over a period of several months. Their ranges appeared to not be limited by the park boundaries but possibly by the distribution of zoanthids in the habitat. Judging from tag recapture studies these animals may be resident in the habitat for periods of at least several years. Strong site philopatry was maintained by one juvenile hawksbill despite the passage of Hurricane Lenny in November of 1999.

(10)
THE ECOLOGICAL IMPORTANCE OF CRINOIDS ON HECETA BANK, OREGON.
Puniwai, Noelani and Tissot, Brian N. *Washington State University at Vancouver, 14204 NE Salmon Creek Ave. Vancouver, WA 98686.*

Heceta Bank is a commercially important offshore rocky bank with depths of 80-400m. Surveys of Heceta Bank were completed yearly between 1988 and 1990 using the submersible Delta. Transects provided data on physical habitat, and fish and invertebrate diversity and abundance. These transects were revisited this past summer and will be visited again next year as part of a 2 year study. The use of the submersible Delta, as well as the remote operating vehicle ROPOS provided the opportunity to sample a greater variety of habitats on the bank.
The crinoid *Florometra serratissima* is a common invertebrate associated with hard substrate throughout the bank. The goal of this study is to compare the abundance and distribution of past studies to current studies 10 years later. The patterns that emerge from this study can be used to understand the importance of crinoids to the deep-sea benthic community of the Northeast Pacific Ocean and the role these invertebrates, and other benthic organisms, may play in the life cycle of economically important groundfish.

(11)
EFFECTS OF SALINITY ON FOOD CONVERSION AND GROWTH OF JUVENILE RED SNAPPER *(LUTJANUS CAMPECHANUS)*.
[1]Pamela Riley-Daniels, [1]Himabindu Remata, Chigbu, P.[1], Ogle, J[2]., & Lotz, J.[2]. [1]*Department of Biology, Jackson State University, Jackson, MS 39217;* [2]*Institute of Marine Sciences, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566.*

Salinity is an important factor affecting growth and distribution of marine organisms. In a recent study, "high value habitat" for juvenile red snapper was defined in the northwestern Gulf of Mexico, as areas with temperature of 24 – 26^{0}C, dissolved oxygen level $\geq$ 5 mg/L and salinity of about 35‰. Nevertheless, limited information is available on the response of red snapper to different levels of physico-chemical parameters. Defining salinity level for optimal growth of juvenile snapper is invaluable for its culture. It is also useful for predicting the response of snapper to changes in salinity in its natural environment. Juvenile red snapper produced at the University of Southern Mississippi-Gulf Coast Research Laboratory (USM-GCRL) were transported to JSU marine science laboratory and acclimated to laboratory conditions for one week. Fish were then randomly assigned to 10 gallon aquarium tanks containing 25ppt water. The salinity in the tanks was then gradually adjusted to15ppt, 25ppt or 35ppt over a week period, after which the fish were anaesthetized, measured and weighed.

There were three or two fish per tank and four replicates for each salinity treatment. Fish were fed pre-counted, weighed pelleted food, *ad libitum*, twice daily. After 28 days the fish were measured and weighed. There were no significant differences in the mean relative growth (P = 0.457) and food conversion ratio (P = 0.106) among salinity treatments. Preliminary studies suggest that juvenile red snapper can survive for several days at lower (~7 ppt) and higher (~45 ppt) salinities.

(12)

PREY PREFERENCE AND FUNCTIONAL RESPONSE OF ADULT BLUE CRABS *CALLINECTES SAPIDUS* TOWARDS TWO PREY SPECIES. Ariel Settles[1], Anson Hines[2], Livingston Marshall[1] . *[1]Morgan State University, 1700 Coldspring Lane, Baltimore, Maryland 21251, [2]Smithsonian Environmental Research Center, 647 Contees Wharf Road, Edgewater, Maryland USA*

Blue crabs are large epi-benthic predators that forage in diverse habitats along the Gulf and Atlantic coasts of the United States. Our previous research showed that predation by blue crabs regulates multiple prey abundance and distribution, but this work focused on density-dependent interactions with one prey species at a time to infer regulation of benthic community structure. In this study, we considered prey preference and functional responses of large (140 mm) blue crabs to varying combinations of two prey species simultaneously, juvenile blue crabs 30-70mm and Baltic clams *Macoma balthica* 20-30 mm, in large lab tanks. Preliminary results indicate that adult crabs preferred clams to juvenile crabs, and addition of a second prey species altered the predator's functional responses to the prey species from type II to type III for juvenile crabs, and from type III to type II for clams. These changes could have major implications for stability of prey populations, since type II responses destabilize while type III stabilize prey populations.

(13)

PATHOLOGIC CHANGES OBSERVED IN PYGMY SPERM WHALES (*KOGIA BREVICEPS*) STRANDED ALONG THE FLORIDA COAST 1992-2000. Fred Williams III [1,2] and Ruth Ewing [1]. *[1] National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Miami Laboratory and [2] Tuskegee University, College of Veterinary Medicine, Nursing, and Allied Health.*

Necropsy and histologic evaluations were performed in 20 pygmy sperm whales (*Kogia breviceps*) that had been stranded along the Florida coastline. The animals were attended to by the US Southeastern Marine Mammal Stranding Network volunteers as they responded to stranding notices. Their personnel performed the necropsies and collected the tissue samples evaluated in this study. The gross lesions included findings consistent with the cardiomyopathy reported in the species. The microscopic lesions primarily include cardiomyopathies characterized by cardiac atrophy and cardiomyocyte degeneration. These changes were observed with no sex bias, and were commonly accompanied by non-specific changes indicative of cardiovascular collapse or shock. No definitive cause for the lesions was identified. The histiological reports of those cases were reviewed and are presented in a summarized format.

This collection of data may be used to further understand the mechanisms behind why these animals leave leave alone.

ENVIRONMENTAL SCIENCES

(14)

CUMULATIVE IMPACT OF PHOTOOXIDATION AND COMETABOLISM ON THE DEGRADATION OF PETROLEUM HYDROCARBONS BY INDIGENOUS NEARSHORE BACTERIA. [1]Milton Clarke, [1]Xiaoling Ding, [1]Richard Gragg, [1]Jennifer Cherrier and [2]Jeff Chanton, *[1]Environmental Sciences Institute, Florida A&M University, [2]Department of Oceanography, Florida State University*

Photooxidation and co-metabolism have been shown to enhance the biodegradation of refractory organic compounds. Petroleum consists of a complex mixture of hydrocarbons, some of which are biologically refractory. A series of 90 day incubations, with bacteria from a nearshore oil-contaminated (NC) site and a nearshore pristine (NP) site were carried out to evaluate the cumulative impact of photooxidation and cometabolism on the biodegradation of petroleum hydrocarbons (PHCs). Crude oil was photooxidized by exposure to natural sunlight for 16 h. A parallel series of incubations were carried out using unphotooxidized oil as the experimental control. Ground pinfish powder, a labile substrate, was used as the co-metabolite. Bacterial respired CO_2 taken at various time points was used as an indicator for the degree of oil degradation. Our results showed that in NC incubations, the CO_2 concentrations were 5000, 6900, and 11600 ppm for unphotooxidized oil, pinfish, and pinfish plus oil, respectively. Correspondingly, those observed in the NP incubations were 1,500, 14500 and 17800 ppm, respectively. The biodegradation of photooxidized oil was completely inhibited, at both sites, even under the presence of labile pinfish (CO_2 concentrations were about 500 ppm, which was the same as the background). These findings indicate that bacteria at NC site more efficiently degrade unphotooxidized oil than bacteria at the NP site. Additionally bacteria at the NP site can more efficiently degrade labile substrate than bacteria at the NC site. The time required for reaching the steady-state of CO_2 respiration for oil amended with pinfish (a few days) was much shorter than that of oil alone (about 40 days) at both of these sites. Photoinduced inhibition of CO_2 respiration may be due to the fact that after photomodification, some PHCs are more toxic than their parent compounds. Our gas chromatographic analysis of photooxidized oil also showed that more PHCs dissolved in water, especially smaller fractions, compared to unphotooxidized oil, suggesting that bacteria were exposed to higher PHC concentration in photooxidized oil incubations. Further experiments will investigate the relationship between the extent of PHC photooxidation and PHC photoinduced inhibition or enhancement of bacterial CO_2 respiration.

(15)

CHELATE-ASSISTED PHYTOEXTRACTION OF LEAD FROM CONTAMINATED SOILS USING WHEAT (*TRITICUM AESTIVUM* L.) B. Crudup, R. Warren, M.F.T. Begonia, and G.B. Begonia, *Jackson State University, Jackson, MS 39217*

Preliminary studies indicated that wheat (*Triticum aestivum* L.) can tolerate and accumulate significant amounts of lead (Pb) in its shoots when grown in Pb-amended sand. To further evaluate the potential of wheat for phytoextraction, a study was conducted to determine whether the timing of ethylenediaminetetraacetic acid (EDTA) application and acetic acid amendment can further enhance the shoot uptake of Pb. Two seeds were planted in each 150 ml super cell containing top soil and peat (2:1, v:v) amended with various levels of Pb and EDTA. Results revealed that wheat plants can tolerate toxic Pb concentrations as evidenced by the non-significant differences in shoot and root biomass among treatments. An exception to this general observation was the root inhibition of plants grown in 2000 ppm Pb that was amended with EDTA and acetic acid one week before harvest. Generally, root and shoot Pb uptake increased with increasing concentrations of soil-applied Pb. When no EDTA was added to the growth medium, the majority of the Pb was retained in the roots. However, when EDTA was applied one week before harvest, there was an enhanced Pb translocation to the shoots. Application of acetic acid in conjunction with EDTA led to a tremendous increase in shoot Pb uptake.

(16)

EFFECTS OF CHELATES ON THE BIOACCUMULATION OF LEAD FROM A CONTAMINATED SOIL USING COFFEEWEED (*SESBANIA EXALTATA* RAF.) E. Dillon, O. Okuyiga-Ezem, T. Williams, M.F.T. Begonia, and G.B. Begonia, Jackson State University, Jackson, MS 39217

This study was conducted at the Jackson State University greenhouse to evaluate whether the addition of a synthetic chelate, ethylenediaminetetraacetic acid (EDTA), can further enhance the effectiveness of coffeeweed (*Sesbania exaltata* Raf.) as a phytoextraction species. Coffeeweed seeds were grown in various concentrations of lead (Pb) and EDTA mixed with a growing medium composed of sieved soil, peat, and sand (4:2:1, v:v:v). After six weeks of growth, the plants were harvested and their Pb contents were extracted using a modified nitric acid-hydrogen peroxide digestion technique. Lead concentrations were quantified by atomic absorption spectrophotometry. Results showed that coffeeweed can tolerate soil Pb levels up to 2000 ppm and that EDTA can significantly enhance the uptake of Pb by both the roots and the shoots. The results further demonstrated that pre-planting application of EDTA caused a greater Pb uptake by the plant compared to the untreated control and plants that were amended with EDTA one week before harvest.

(17)

CYTOTOXIC EFFECTS OF PENTACHLOROPHENOL IN PRIMARY HEPATOCYTE CULTURES OBTAINED FROM CHANNEL CATFISH (*ICTALURUS PUNCTATUS*).

Waneene C. Dorsey, Paul B. Tchounwou, and Ali B. Ishaque, *Environmental Toxicology Research Laboratory, NIH-Center for Environmental Health School of Science and Technology, Jackson State University, 1400 Lynch Street, Box 18540, Jackson, MS 39217, USA*

Organochlorine residues are ubiquitous in the environment and have been found worldwide in soil, water, and air samples. Of particular interest are species of organochlorine compounds found in pesticides, because of their efficient biocidal activity against insects and microorganisms. An example of such pesticides is Pentachlorophenol (PCP), an organochlorine compound that has been used worldwide for many industrial and domestic applications. In this research, we investigated the acute toxicity of PCP to fish hepatocytes. The cytotoxicity of PCP was determined *in vitro*, using cultured primary hepatocytes from male channel catfish. The viability of cells, exposed for 2 days to PCP, was assessed by the flurorescein diacetate (FDA) method, using a Fluoroscan microplate reader. Study results indicated a linear relationship between cell survival and PCP toxicity. Upon 48 hrs of exposure, the NOAEL, LOAEL, LC_{50} of PCP were 62.5 $\pm$ 10.3, 125.0 $\pm$ 15.2, and 2000.0 $\pm$ 9.6 ppm, respectively. Based on these preliminary results, further studies are underway to assess the estrogenic potency of PCP, as well as its ability to transcriptionally induce stress genes in liver cells.

(18)

CELLULAR RESPONSE (CYTOTOXICITY AND P53 EXPRESSION) TO ARSENIC AND ATRAZINE BY HEPG2 CELL LINES.

Reshuna Y. Durden, Paul B. Tchounwou, Barbara A. Wilson, and Ali B. Ishaque, *Environmental Toxicology Research Laboratory, NIH-Center for Environmental Health School of Science and Technology, Jackson State University, 1400 Lynch Street, Box 18540, Jackson, MS 39217, USA*

Atrazine and Arsenic-containing compounds are among the leading chemicals that are used in America for agricultural purposes. Atrazine is a man-made herbicide used for the control of broadleaf and grassy weeds. It is persistent in the environment and contaminates ground waters and surface waters that are sources for human consumption and recreation. Lifetime exposure to Atrazine, at levels above 0.003 mg/L, has the potential of causing cancer. Arsenic is a carcinogen not only for skin, but also for internal organs such as the lung and bladder. Health effects associated with arsenic exposure include diabetes, cardiovascular disease, hearing loss, and neurological and neurobehavioral effects. The maximum contaminant level for arsenic in drinking water is 50 ug/L. The goals of this project were: (1) to determine the toxicity of arsenic trioxide and atrazine using the lactate dehydrogenase (LDH) assay, and (2) to determine the cellular response mechanism of Arsenic and Atrazine in human hepatic carcinoma cell (HepG2) lines. To conduct this experiment, HepG2 cells were seeded at $1x10^6$ cells/mL and exposed to the chemicals for 48 hours. LDH analysis was used to determine the lethal concentration at which 50-percent of the cell population (LC_{50}) dies. Total protein concentration was determined using the Bradford Assay, and Western Blot analysis evaluated p53 cellular protein expression. The results indicated that Atrazine alone was nontoxic to HepG2 cells in the concentration range

tested. The LC_{50} value for arsenic trioxide was shown to be 12 ppm. The tumor suppressor gene product p53, which is a critical mediator of the cellular response to DNA damage, was expressed after treatment of HepG2 cells with 12ppm of Arsenic.

(19)

THE INFLUENCE OF NITROGENOUS COMPOUNDS ON GROWTH AND SEXUALITY OF THREE MICROALGAL SPECIES. Eric J. Fisher[1], I. O. Farah, M. G. Hardy and H. S. Yang, *Jackson State University, Jackson, MS 39217*

Total growth, sexuality and utilization of various nitrogenous compounds by microalgae in 21-day batch culture media (Lewin's FW1 medium at 25°C within an illuminated growth chamber) were studied using microbiological, spectrophotometrical, microscopical and statistical techniques. Microalgae exhibit luxuriant growth in eutrophic ponds and lakes by metabolizing abundant nitrogen and phosphorous found in these areas. These abundant nutrients facilitate primary productivity and are reassembled in algal cells to become part of their biomass. Nitrogen is one of the most important inorganic/organic nutrients utilized by microorganisms. This microalgal ability may, however, produce an excellent source of quality nitrogen for various uses. Our objectives are (1) to determine if microalgae will grow and transform poor quality nitrogen into quality biomass by their response to different nitrogenous sources in the growth medium and (2) to determine if primary products accumulate in microalgae exposed to various concentrations of nitrogen and the influence on algal sexuality. Three microalgae; *Chlorella pyrenoidosa, Chlamydomonas reihardtii* and *Chlorococcum echinozygotum* were inoculated in media containing twenty different nitrogenous compounds (including various amino acids) at 1, 10, 100, 1,000 and 10,000 ppm. Results showed statistically significant differences ($p<0.01$) among treatments. For the above algal species, mean and SD for total growth ranges were respectively as follows: 0.099±0.001 - 1.07±0.1, 0.071±0.03 - 1.13±0.07, 0.12±0.016 - 1.642±0.02 in OD units/ml. Mean sexuality (cell %/ml) ranges were respectively as follows: 10.8±7.75 – 69.6±3.10, 8.0±2.43 – 81.20±2.71, 3.33±0.11 – 67.00±2.00. All three species showed significant growth at higher concentrations (>1,000 ppm). Urea, asparagine, citrulline and uric acid showed the highest accumulation of organic material in algal cells. An inversely proportional relationship was found between zygotic cell counts and growth. Therefore, it was concluded that the concentrations to be used for the best primary productivity and sexuality is at least 1,000 ppm. This study points to the potential of using microalgae to transform low quality and cheap nitrogen into biomass, a condition that could be exploited to improve plant cell culture productivity under aquatic conditions.

(20)

AXENIC LINES OF *SPARTINA ALTERNIFLORA* FROM SURFACE STERILIZED SEEDS. Alisa G. Harkins[1], Trenis D. Palmer[1], Marc E. Frisher[2] and Chandra I. Franklin[1]. *[1]Marine Environmental Science and Biotechnology Research Center, Savannah State University, P.O. Box 20228, Savannah, GA 31410. [2]Skidaway Institute of Oceanography, 10 Ocean Science Circle Savannah, GA 31411*

The smooth cordgrass (*Spartina alterniflora*) is a dominant plant species in saltmarshes of southeastern United States, and it can account for up to 90% of biomass production. In anthropogenically impacted saltmarshes, interactions between *S. alterniflora* and sediment microbial communities appear to influence the uptake, transformation, and ultimate removal of contaminants including hydrocarbons, heavy metals and xenobiotics. Axenic (microbe-free) lines of *S. alterniflora* are needed for conducting experiments to assess the individual roles of *S. alterniflora* and microbes. Under natural conditions, it is not feasible to conduct such experiments, because they cannot be physically separated. In this report, the methodology to produce axenic lines of *S. alterniflora* from seeds surface-sterilized using chlorine fumes is described. Due to the microbe-rich habitat of *S. alterniflora*, its seed surface appears to be heavily infested with fungal and bacterial population. Surface sterilization of seeds using conventional methods did not yield satisfactory results. Therefore, an alternate method using chlorine fumes generated by mixing commercial bleach (Clorox) and glacial acetic acid was used. Seeds were exposed to chlorine fumes for 10-90 min (in 5-10 min increments) and subsequently germinated on sterile nutrient medium (100 seeds/treatment). Ten days later, data on number of seeds showing microbial growth (contamination) were collected. Seeds exposed for 10-30 min showed 5-10% contamination. Seeds exposed for 35 min and above showed no contamination. As expected, prolonged exposure to chlorine fumes reduced seed viability. Ten minute exposure reduced seed viability by 13%, whereas 90 min exposure resulted in 60% reduction of seed viability. At 35 min, 29% reduction of seed viability was observed. Results from these studies indicate that 35 min exposure to chlorine fumes is optimal for surface sterilizing *S. alterniflora* seeds. Viable surface-sterilized seeds germinated into normal plants with well-established root and shoot systems with no signs of microbial growth in the nutrient medium.

(21)

BIOCONCENTRATABLE POLYCYCLIC AROMATIC HYDROCARBONS & QUINONE PHOTOPRODUCTS IN EVERGLADES CANALS C-11 AND C-111. Haynes, S.[1,2]; Gragg, R.D.[1]; Orazio, C.E.[2]; Lebo, J.A. [2]; R. [2]; Frederic Essien[1], Larry Robinson[1], and Maurice Eddington[3]. *Florida A & M University, [1]Environmental Sciences Institute, and the [3]Department of Chemistry, Tallahassee, Florida; [2]USGS, Columbia Environmental Research Center, Columbia, Missouri USA*

Urban runoff is a major source of polycyclic aromatic hydrocarbon (PAH) contamination in the Everglades. Solar ultraviolet radiation is a component of the Everglades temperate climate that has the potential to photo-modify some PAHs. Growing evidence suggests that the real hazards of PAHs to aquatic life may be due to the toxic effects of photooxidized PAH

photoproducts formed by PAH absorption of ultra-violet radiation in sunlight. PAHs are difficult to measure by conventional means of sampling and a means of sampling and measuring ultra-trace levels of PAH photoproducts in the aquatic environment has not been reported. In this investigation samples were collected from 2 sites in the Everglades: Canals C-11/S-9 and C-111/S-177. Bioavailable PAHs and quinone photoproducts in the water column were sequestered using a semipermeable membrane device (SPMD). These devices mimic the bioconcentration process of lipophilic compounds by aquatic organisms. After a 28-day sampling period, the SPMDs were retrieved, dialyzed and analyzed by GC-FID and HPLC/UV. A new method for measuring quinone photoproducts was developed without any post-dialysis cleanup by direct HPLC/UV analysis. The GC and HPLC methods, in conjunction with SPMD sampling, enable PAHs in the Everglades to be measured at levels as low as 10ng/ mL. The limit of quantitation for the photoproducts is estimated to be in the μg/mL range by this method. Naphthalene, fluoranthene, and chrysene were detected in SPMDs at both sites. No quinone photoproducts were detected. In addition to the PAH related compounds, the SPMD samples were also screened for organochlorine pesticides (OCP). The highest concentration levels of OCP detected from both sites were trans-chlordane and cis-chlordane with concentrations ranging between 11.5-12.2 and 8.9-9.8 ng/mL, respectively. Endosulfan was highest in canal C-111/S-177 with a concentration of 348 ng/mL. Other pesticides detected in SPMD included DDT, DDE and dieldrin.

(22)

PHYTOREMEDIATION OF LEAD-CONTAMINATED SOILS USING TALL FESCUE (*FESTUCA ARUNDINACEA* L.). M. Ighoavodha, A. Butler, M.F.T. Begonia, and G.B. Begonia, Jackson State University, Jackson, MS 39217

Tall fescue (*Festuca arundinacea* cv. 'Spirit') had been found to tolerate and accumulate substantial amounts of lead (Pb) in its shoots when grown in Pb amended sand. To further evaluate the suitability of tall fescue for phytoextraction, a study was conducted to determine whether the timing of ethylenediaminetetraacetic acid (EDTA) application and acetic acid amendment can further enhance the shoot uptake of Pb. Seeds were planted in 1.9 L plastic pots containing top soil, peat, and sand (4:2:1, v:v:v) amended with various levels of Pb and EDTA. Generally, root and shoot growth of tall fescue were not significantly affected at the two lower Pb levels, but were inhibited at the two higher Pb treatments with preplanting EDTA amendments. EDTA significantly increased shoot Pb uptake. However, there was no difference in Pb uptake whether EDTA was applied before planting or a week before harvest. Addition of acetic acid to the growing medium one week before harvest, further enhanced shoot and root Pb uptake only in plants grown at 1000 ppm Pb.

(23)

A STUDY OF THE EFFECT OF ULTRA VIOLET LIGHT ON RESIDENTS IN MISSISSIPPI. Amalee Jayasinghe and Pao-Chiang Yuan, *Department of Technology, School of Science and Technology, Jackson State University, Jackson, MS 39217*.

The depletion of the ozone layer has increased the amount of harmful ultra violet rays reaching the earth. This results in damage to human health, plants and the ecosystem. Studies have shown that UV radiation causes skin cancer known as melanoma, suppresses the immune system and causes premature wrinkling. The object of this study was to determine whether UV radiation had any effect in the number of cases of skin cancer reported in Mississippi. Health statistics were obtained from the Department of Health along with measurements of UV radiation using ultra violet sunsor scales. Based on data obtained, we can conclude that UV radiation does cause an increase in skin cancer. This study will prove helpful in educating residents about the risks and ways to prevent skin cancers.

(24)

TRANSIENT EXPRESSION OF THE REPORTER GENE BETA GLUCURONIDASE IN *SPARTINA ALTERNIFLORA* EXPLANTS. Whitney H. Palefsky, Alisa G. Harkins and Chandra I. Franklin. *Marine Environmental Science and Biotechnology Research Center, Savannah State University, P.O. Box 20228, Savannah, GA 31410.*

The smooth cordgrass (*Spartina alterniflora*) is a dominant plant species in saltmarshes of southeastern United States, and it can account for up to 90% of biomass production. In anthropogenically impacted saltmarshes, interactions between *S. alterniflora* and sediment microbial communities appear to influence the uptake, transformation, and ultimate removal of contaminants including hydrocarbons, heavy metals and xenobiotics. A gene transfer system is being developed in an effort to utilize transgenic technology to produce genetically engineered *S. alterniflora* that can be used as a biosensor for heavy metal contamination in saltmarshes. Published protocols for genetic transformation or regeneration of *S. alterniflora* are not currently available. Therefore, studies in this laboratory focus on developing a gene transfer system and a compatible tissue culture system for regenerating transgenic *S. alterniflora*. As *Agrobacterium* mediated DNA transfer is not practical with grasses, particle bombardment mediated DNA delivery is being used. In this report, results from studies to optimize DNA delivery to fleshy young shoot explants of *S. alterniflora* are presented. The efficiency of DNA delivery was assessed based on transient expression of the reporter gene beta-glucuronidase (*gus*) as measured by the number of *gus* expressing units [(GEU) - blue spots resulting from the GUS histochemical assay]. Particle bombardment parameters such as helium pressure, vacuum level in the particle delivery chamber, particle travel distance, and the plasmid concentration were optimized for efficient DNA delivery. Obviously, increasing the plasmid concentration resulted in higher GEUs, whereas physical parameters controlling the velocity of particles greatly influenced the DNA delivery even at higher plasmid concentrations. Results from this study indicate that 1550 psi helium pressure, 28 inches of Hg chamber vacuum, 85 mm of particle travel distance and a plasmid concentration $\geq$1µg/delivery are optimal for DNA transfer to *S. alterniflora* explants.

(25)

TEMPORAL PATTERNS IN THE ABUNDANCE OF FISHES IN THE NEARSHORE AREAS OF THE ROSS BARNETT RESERVOIR. [1]Raymond Portis, [1]Crockett, R., [1]Chigbu, P., [2]Holman, T. & [2]Bull, L. [1]*Department of Biology, Jackson State University, Jackson, MS 39217;* [2]*Institute of Marine Sciences, Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39566.*

Information on spatio-temporal patterns in the abundance of prey and predators is important for assessing the extent of their spatial overlap and therefore the degree of predation pressure exerted on the prey. We conducted day time electroshocking in the Ross Barnett reservoir to assess spatial and temporal patterns in the abundance and size structure of fishes in the nearshore areas. Electroshocking was carried out, approximately bimonthly, from July 1999 to July 2000 in four areas of the reservoir. In each area we made three consecutive fifteen minute collections. All fish were placed on ice for later processing in the lab., or preserved immediately after collection in 10% formalin. In the lab. the fishes were identified, counted, measured and weighed. Eighteen (18) species of fish were captured. Threadfin shad (*Dorosoma petenense*) and gizzard shad (*Dorosoma cepedianum*),), important prey of largemouth bass (*Micropterus salmoides*) were the most abundant. Other abundant fishes were silversides and bluegill sunfish (*Lepomis macrochirus*). Abundances of threadfin and gizzard shad, and that of their major predator, largemouth bass increased in the nearshore areas of the reservoir from summer to fall.

(26)

EFFECTS OF CADMIUM ON THE BIOLUMINESCENCE OF VIBRIO FISCHERI, AND THE GROWTH AND OXYGEN UPTAKE OF A HETEROGENEOUS POPULATION OF MICROORGANISMS. Lamar Reed and Paul B. Tchounwou, *Environmental Toxicology Research Laboratory, NIH Center for Environmental Health, School of Science and Technology, Jackson State University, 1400 J.R. Lynch St., P.O.Box 18540, Jackson, MS.*

Bacterial In vitro assays such as the Microtox Assay have become an attractive alternative to traditional and costly fish and invertebrate methods for toxicological screening. In this research, we tested the toxic effects of cadmium against a marine bacterium (*Vibrio fischeri*), and a heterogeneous population of bacterium derived from the Pearl River in Jackson, Mississippi. Using the level of bioluminescence (*Vibrio fisheri*), and the kinetic of dissolved oxygen uptake and growth (mixed bacterial population) as measures of toxicity, cadmium concentrations effecting 50% reduction in these parameters (EC_{50}) were determined as toxic end-points. The activity quotients were also computed to determine the degrees of toxicity. Bacterial bioluminescence was assessed using the Microtox Assay. Optical density (measure of growth) and oxygen uptake were measured over an extended period of time (20 hours). EC_{50} values of 0.79+0.12, 4.50+0.04 and 5.00+0.42 mg/L were recorded for bioluminescence, growth and oxygen uptake, respectively. As expected, these results indicated that *V.fischeri* was about one order of magnitude (8.3 times) more sensitive to cadmium toxicity than the mixed

population of Pearl River microorganisms. Reductions in bioluminescence, growth, and oxygen uptake were directly correlated to cadmium concentration, with toxic levels ranging from slightly toxic in lower concentrations, to extremely toxic in higher ones. Upon 20 hours of exposure, a strong correlation (r^2=0.98) was found between the times required to produce 50% reduction in dissolved oxygen concentrations (T50s), and the concentrations of cadmium, indicating a time-response relationship with respect to cadmium toxicity.

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CYTOTOXICITY OF ARSENIC TRIOXIDE AND MSMA TO HUMAN LIVER CARCINOMA CELLS: COMPARATIVE STUDY OF TWO BIOASSAYS. Tanya Robinson, Paul B. Tchounwou, Barbara A. Wilson, Ali B. Ishaque, *Environmental Toxicology Research Laboratory, NIH- Center for Environmental Health School of Science and Technology, Jackson State University, 1400 Lynch Street, Box 18540, Jackson, MS 39217, USA*

Arsenic is the 20th most abundant element. It is released to the environment as a result of natural phenomena. Several adverse health effects have been associated with the exposure of Arsenic and its toxicity depends on the chemical species involved. Cytotoxicity is the study of effect of acute (high) concentration of chemicals on living cells. Diphenyltetrazolium Bromide (MTT) and Fluorescein Diacetate (FDA) assays are among the most widely used methods to test the cytotoxicity of various environmental compounds. The objectives of this research were to find the concentration of Arsenic needed to kill 50% (LC_{50}) of HepG2 cells (cytotoxicity), to compare MTT and FDA methods used in evaluating cytotoxicity of Arsenic, and to compare the toxicity of Arsenic Trioxide (inorganic form) and MSMA (organic form). HepG2 cells were grown with DMEM medium in a CO_2 incubator until maximum growth, after which cells were washed and trypsinized. Next, fresh medium was added and centrifuged at 3,000 rpm for 10 minutes.180-ul of cells at a density of 300,000 cells/mL were seeded into each well of two 96-well tissue culture plates. Next, 20ul of serial dilution of Arsenic (0.2,0.4,0.8,1.6,3.1,6.3,12.5,25,50 and 100ppm) and MSMA (2, 4, 8, 16, 31, 63, 125, 250, 500 and 1000ppm) were added columnwise. The FDA assay was conducted by washing the plates once and adding 100ul of 10ppm Flourescein Diacetate solution columnwise to each well and placing the plates in the CO_2 incubator for 30-60 minutes before reading the fluorescence with the Spectrofluorometer. The MTT assay was conducted by adding 50ul of the 5,000ppm MTT solution to each well columnwise and placing the plates in a CO_2 incubator for 30 minutes. The medium was carefully removed and 200ul of DMSO was added to each well. The plates were incubated for 10 minutes in a CO_2 incubator and optical density was read at 405nm. The results showed there were no significant differences between the FDA and MTT assays based on theLC_{50} values obtained from both assays. It is concluded that Arsenic Trioxide (inorganic) is more toxic than MSMA (organic Arsenic). The two methods gave comparable results and the difference in LC_{50} between the two bioassays for Arsenic was not significant.

(28)

CYTOTOXICITY AND PROLIFERATION STUDIES WITH SODIUM ARSENITE IN SKIN DERMAL FIBROBLASTS, THP-1, AND JURKAT CELLS. Dwayne J. Sutton[1], Paul B. Tchounwou[1], and Hari H.P. Cohly[2]. *[1]Molecular Toxicology Research Laboratory, NIH-Center for Environmental Health, School of Science and Technology, Jackson State University, 1400 Lynch Street, Box 18540, Jackson; MS 39217; [2]Department of Plastic Surgery, University of Mississippi Medical Center, Jackson, MS 39216*

Ingestion of arsenic affects primarily the skin by causing keratotic lesions that may lead to cancer. Contamination of well water with arsenic leached from underground sediments leads to the formation of these pre-cancerous skin lesions due to arsenic ingestion. It has been proposed that the mechanism underlying the unique properties of arsenic involves changes in mitogenic signaling. Based on the hypothesis that arsenic exposure results in the modulation of both positive and negative regulators of cell proliferation, this study examined the acute cytotoxicity and proliferation of dermal fibroblasts, monocytes (THP-1) and T cells (Jurkat) in the presence of different concentrations of arsenic. Cytotoxicity was assessed by incubating THP-1 and JKT cells in RPMI 1640 and dermal fibroblasts in Iscove's DMEM with 10% fetal bovine serum, 1% streptomycin and penicillin for 96 hrs in 96-well microtiter plates, at 37^{o}C in a 5% CO_2 incubator. Cell proliferation in 96-well plates was determined in cultured cells exposed for 24, 48, and 72 hours, using the MTT assay. The concentrations of sodium arsenite effecting 50% reduction in cell viability were found to range from 25 ppm to 50 ppm for all the cell-lines tested. The peak proliferation for Jurkat cells was 6 ppm and that for THP-1 and dermal fibroblasts was 1.5 ppm. These results show that arsenic affects proliferation at different concentrations for different cells.

(29)

PHYSICO-CHEMICAL AND BACTERIOLOGICAL ASSESSMENT OF THE WATER QUALITY IN THE ROSS BARNETT RESERVOIR IN CENTRAL MISSISSIPPI. Paul B. Tchounwou, and Mike Warren. *Environmental Toxicology Research Laboratory, NIH-Center for Environmental Health, School of Science and Technology, Jackson State University, 1400 Lynch Street, Box 18540, Jackson, Mississippi 30217, USA.*

Ross Barnett Reservoir (RBR) serves as a source of water supply for the city of Jackson, Mississippi. It also constitutes an important site for recreational activities for many Mississippi counties' residents. A broad spectrum of illnesses have been associated with water-contact activities such as bathing, and swimming in recreational waters. In this research, we assessed the bacteriological quality of water in the RBR, and compared the bacteria levels to recommended criteria for public health protection. From 06/12/99 to 10/02/99, weekly water samples were collected from two different sites in the reservoir, and tested for a number of bacteriological parameters including: heterotrophic plate counts (HPC), total coliforms (TC), fecal coliforms (FC), and fecal streptococci (FS). Collected samples were also tested for basic physical and chemical characteristics of water. Study results indicated that the mean concentrations of bacteria at the two sampling sites were $5.6x10^6 \pm 1.5x10^6$, $4.5x10^4 \pm 5.3x10^4$, $5.0x10^2 \pm 1.6x10^2$, and $9.1x10^1 \pm 7.3x10^1$ colony forming units per 100 mL of water for HPC, TC, FC, and FS,

respectively. The values of physical and chemical parameters were at acceptable levels. However, bacterial densities often exceeded federal/state guidelines by several orders of magnitude, raising considerable public health concerns.

(30)
INFLUENCE OF PLANT GROWTH REGULATOR LEVELS AND NITROGEN CONTENT ON CALLUS INDUCTION FROM *SPARTINA ALTERNIFLORA* EXPLANTS. Laurie M. Thomas, Donna E. McDowell, Kashandra L. Jackson, Archie R. Hayes, Whitney H. Palefsky and Chandra I. Franklin. *Marine Environmental Science and Biotechnology Research Center, Savannah State University, P.O. Box 20228, Savannah, GA 31410.*

In saltmarshes of southeastern United States, smooth cordgrass (*Spartina alterniflora)* is a dominant plant species, and it can account for up to 90% of biomass production. Transgenic technology is being developed to genetically engineer *S. alterniflora* for use as a biosensor for heavy metal contamination in saltmarshes. An efficient tissue culture/regeneration system is needed for developing the transgenic technology. Callus induction is the initial response of explants cultured *in vitro*. In this report, results from studies to optimize plant growth regulator levels as well as nitrogen source and content of the tissue culture medium for callus induction are presented. Fleshy young shoot explants of *S. alterniflora* were cultured on medium containing various levels of a cytokinin [6-benzylaminopurine (BAP)] and an auxin [2,4-Dichlorophenoxy acetic acid (2,4-D)]. Similar explants were also cultured on medium containing organic or inorganic nitrogen source. Fleshy young shoots cultured on medium containing high levels of BAP (>5 μM) and 2,4-D (>20 μM) showed typical callus induction patterns. High levels of inorganic nitrogen content (20 mM ammonium 39.4 mM nitrate ions) in the culture medium caused necrosis and rapid death of explants, whereas explants cultured on medium containing low levels of inorganic nitrogen (7 mM ammonium and 28 mM nitrate ions) or an organic nitrogen source showed sustained growth. Results from these experiments indicate that organic nitrogen or low levels of inorganic nitrogen and high levels of a cytokinin and an auxin promote callus induction from young shoot explants of *S. alterniflora*.

(31)
PM-2.5 MONITORING IN FLAGSTAFF DURING THE PRESCRIBED BURN AND RESIDENTIAL WOOD BURNING SEASONS. Amanda Thompson and Marin Robinson, *Northern Arizona University, Flagstaff, Arizona*.

In 1997, the EPA passed a law to regulate fine particulate matter (PM-2.5), in addition to coarse particulate (PM-10), targeting particles with aerodynamic diameters ≤ 2.5 μm. These regulations were promulgated due to concerns that fine particles can become lodged in the lungs and thereby contribute to pulmonary disease. In addition to health concerns, PM-2.5 contributes to visibility impairment and climate change, since small particles scatter visible light and increase albedo in cloud-free portions of the atmosphere. Major sources of PM-2.5 include fuel combustion, agricultural burning, and forest fires (natural or prescribed). Concomitant with the new PM-2.5 standards has been an expressed desire by Federal, tribal, and State land managers

to use prescribed fire as a method for restoring wildland ecosystems. The fire-suppression policy of the 20th century (1910-1990) has left national forests in an unhealthy state, characterized by dense undergrowth and heavy fuel loads, increasing the likelihood of catastrophic wildfire. The potential benefits of prescribed fire are great, yet the smoke generated by such fires may put public health and welfare at risk. Thus the need to speciate chemical components of wood smoke, and identify those components with greatest toxicity, is an issue of primary importance.

To address this concern, we initiated a pilot project to collect PM-2.5 from wood smoke in Flagstaff, AZ. Flagstaff is located in the Coconino National Forest, the largest continuous ponderosa pine forest in the United States. Ongoing and proposed ecological restoration initiatives for this forest include the combined use of mechanical thinning, pile burns, and broadcast burns. Four portable air monitors (AirMetrics) were located at selected sites in Flagstaff to collect 24-hour samples of PM-2.5 during the prescribed burn season (Summer-Fall 2000) and residential wood burning season (February-March 2001). Monitors were operated as saturation samplers, to determine if the EPA 24-hour standard (65 $\mu g/m^3$) had been exceeded. Monitoring results and plans for future PM-2.5 speciation studies during prescribed burns of the Coconino National Forest will be reported.

(32)
EFFECTS OF SALINITY ON DEVELOPMENT OF *HYLA REGILLA* EMBRYOS. Ezra Yohannes, *Shaw University, Raleigh, NC and Vandergon, Davis, Brewster, Plank, Martin and Kats, Natural Sciences Division, Pepperdine University, Malibu, CA.*

Chemical contamination in fresh water streams and lakes may have detrimental affects on amphibian species. The affect of salinity (0-7 ppt) on embryonic development, growth and survival in the Pacific tree frog *Hyla regilla* was examined. *Hyla regilla* embryos exposed to < 4 ppt showed normal developmental rates and survivability, whereas embryos exposed to 5 ppt salt concentration showed decreased survival, slower development and abnormal growth. Embryos exposed to 6 or 7 ppt showed slow growth, abnormalities and did not survive to hatching.

ATMOSPHERIC SCIENCES

(33)
A STUDY OF TORNADO FORMATION AND ASSOCIATED TOPOGRAPHY IN ARKANSAS. Ashton Robinson Cook, *Jackson State University, Jackson, Mississippi 39217*

A study was performed on severe thunderstorm activity and tornado formation in Arkansas in relation to topography. On March 1, 1997, January 21, 1999, and February 24, 2001 mid latitude cyclones affected Arkansas by spawning tornado outbreaks. Some areas were affected multiple times by these outbreaks as tornadoes hit these areas. The study indicated that topographical difference plays a helpful role in the formation and development of tornadoes which increases the frequency of tornadoes occurring within the areas of topographical differences in Arkansas. More specifically, tornadoes can be focused in these areas where the

traits of the landscape change from Ozarks and Ouachita Mountains to the north and west to the flat lands and delta regions of the south and east. The study also illustrates that there is a correlation between this "tornado alley" and the frequency and strength by which these tornadoes exhibit as they propagate through these areas.

(34)
FAST-RESPONSE ENVIRONMENTAL TEMPERATURE SENSOR CALIBRATIONS.
Quentin Cowans, Thomas Smith, and Randal L. N. Mandock, *Morehouse College, Earth System Science Program, Clark Atlanta University, 223 James P. Brawley Dr., SW., Mail Stop 241, Atlanta, GA 30314*.

A number of methods have been devised over the years to measure the fluxes of sensible and latent heat near the air/land interface. Indirect methods include profile, Bowen-ratio, Priestley-Taylor, Penman-Monteith, bulk-transfer, gradient, structure function, and others. The direct method of surface flux measurement is referred to as eddy correlation, where fluxes are determined as covariances of the perturbations of meteorological variables. In the eddy correlation method, vertical kinematic sensible heat flux is simply <w'T'>, and vertical kinematic latent heat flux is <w'q'>, where w' represents the vertical component of the perturbation wind vector, T' is the perturbation dry bulb temperature, q' is the perturbation specific humidity, and <> represents an averaging operation. The Earth System Science Program at Clark Atlanta University (CAU) has begun to calibrate fast-response wind, temperature and humidity sensors for later deployment in eddy correlation measurements of evaporation, momentum, buoyancy, and sensible heat flux. Initial test data for calibration spectra, averages, and flux measurements are reported. These measurements were made on the roof of the Research Center for Science and Technology at CAU.

(35)
DETERMINATION OF THE OPTICAL EFFECTS OF ATMOSPHERIC AEROSOLS USING SUN PHOTOMETERS. Adwoa K. Gyekye, *Clark Atlanta University, Department of Physics*

The Clark Atlanta University (CAU) Earth System Science program operates an Atmospheric Optics Observatory on the roof of the Research Center for Science and Technology. This observing facility provides a platform for instruments used to monitor the amount of solar energy reaching Earth's surface throughout the day. An Ascension Technology RSP (Rotating Shadowband Pyranometer) measures the global, direct, and diffuse radiation at the surface for visible wavelengths. In addition, a NOAA automated weather station operated at the observing site provides meteorological data on atmospheric pressure, temperature, humidity, wind speed, and wind direction. The ultimate goal of this project is to be able to model the effects of atmospheric haze (aerosol particles) and water vapor variations on the total amount of energy from the sun that reaches the surface. To improve our ability to interpret data obtained by the RSP and the meteorological instruments, CAU is developing a simple, inexpensive atmospheric haze sensor that uses an LED (light-emitting diode) as a narrow-band detector. Six different LED wavelengths are available, and data from such a device operated throughout the

day at multiple wavelengths can be used to determine the fraction of incident solar energy that has been lost due to the total amount of haze and water vapor in the atmosphere. Sun photometers have been built and operated for each of the different LED wavelengths. The sun photometer measurements are analyzed by plotting the natural logarithm of the solar radiances measured with the photometer versus the secant of the zenith angle of the sun at the time of each observation (Langley plots). The optical thickness of the atmosphere is obtained by measuring the slope of the plotted line. Results obtained with the CAU sun photometers will be presented.

(36)
SODAR OBSERVATIONS OF THE ATLANTA URBAN BOUNDARY LAYER.
Ilomechina, Sochi and Randal L. N. Mandock, *Clark Atlanta University, Earth System Science Program, 223 James P. Brawley Dr., SW. Mail Stop 241, Atlanta, GA 30314*

An Aerovironment 300C monostatic sodar was installed on the roof of the Research Center for Science and Technology at Clark Atlanta University in summer 2000. The sodar is located about one mile west of downtown Atlanta, 22 meters above ground level, in a medium height and density urban environment.

The sodar is currently operating in the facsimile mode, but existing software is under revision to enable it to produce Doppler vertical wind speed and variance measurements early in 2001. Facsimile records showing meteorological phenomona such as fog and low cloud layers, frontal passage, rise and descent of the convective boundary layer, and nocturnal structure at the top of the boundary layer will be described and compared with meteorological data from our rooftop weather station.

(37)
INTER-COMPARISON OF REBS Q^{3}7.1, PDS7.1, & THRDS7.1 RADIOMETERS'S PERFORMANCE CHARACTERISTICS. Dwayne C. Joseph & J. Quentin Cowans, *Clark Atlanta University, 223 James P. Brawley Drive, Atlanta, GA 30314*

Radiometers are instruments used for detecting and measuring the intensity of radiant energy. With the use of net radiometer, total hemispherical radiometer, and a pyranometer these instruments will assist in studying the radiative balance within the atmospheric boundary layer in Atlanta. Furthermore, this research will take into account the role clouds and surface albedo partake in comprising the radiative balance.

(38)
AN INTERCOMPARISON OF TWO ULTRASONIC ANEMOMETERS. Pierson, Bryant R. and Randal L. Mandock, *Clark Atlanta University, 304 Lakeside Village Dr., Atlanta, GA 30317*

A low cost R.M. Young Ultrasonic anemometer was intercompared with a more expensive Solent Research Ultrasonic anemometer. Mean and standard deviations, comparability, and bias of wind speed, wind direction, the vertical wind component, and the speed of sound were calculated. Also presented in this research are response characteristics of the sensors, computed accuracy, momentum and buoyancy flux, and virtual temperature.

(39)
GAS TRAPPING IN VAPOR DEPOSITED WATER-ICE FILMS (90-145 K). Brian Raymond and Marin Robinson, *Northern Arizona University, Flagstaff, Arizona*

Water-ice is abundant throughout the solar system and can influence both atmospheric chemistry and composition. One way in which ice influences composition is by trapping and transporting gases, such as with comets. As comets form, the amount of gas trapped depends, in part, on the phase of the condensing ice (amorphous or crystalline). As a comet approaches the Sun, amorphous ice crystallizes, releasing some of the trapped volatiles. Eventually the comet sublimes, releasing the rest. The purpose of this study was to investigate this process with CO_2, CH_4, CO, and N_2. In a high vacuum chamber, a thin film (375 nm) of amorphous (90-110 K) or crystalline (110-145 K) ice was co-deposited with a selected gas (10:1 gas: water) on a pre-cooled Al substrate. The film was annealed (1K/min) through the phase change (147-153 K) and sublimation of the ice film (162-183 K). The phase change was monitored using grazing-angle Fourier Transform Infrared-Reflection Absorption Spectroscopy, while the gas release was detected using integrated flux to a mass spectrometer. Results show that all four gases were trapped by ice. CO_2, and to some extent CH_4, were released during the phase change and sublimation; N_2 and CO were released only during sublimation. Amorphous ice trapped more CO_2 than crystalline ice, but roughly equal amounts of N_2, CH_4 and CO

(40)
DIAGNOSING AND PREDICTING EXTREME PRECIPITATION EVENTS IN SOUTHEAST BRAZIL. Aisha C. Reed and Brant Liebmann. *NOAA Climate Diagnostic Center*

Extreme daily precipitation events that occurred in Sao Paulo, Brazil from 1979-1995 during the austral summer are examined to document the atmospheric conditions associated with their occurrences. In this study, events are studied in which 14% and 30% events of the average seasonal total rainfall fell in one day at, at least one station. Mean composites and anomalies are obtained for the 500-millibar heights, to make synoptic patterns, and outgoing longwave radiation (OLR), to observe convection, for the day of and days preceding and following the event. There is a stationary trough on the days preceding and the day of the event, and the OLR

indicates that convection is in the area at least one day before the event and begins to dissipate the day after an event.

(41)
RAINFALL ESTIMATES OVER WEST AND CENTRAL AFRICA FROM TRMM PR, TRMM MERGED, CMAP, GPCP AND SSM/I: A COMPARISON OF THE INTERANNUAL VARIABILITY FOR 1998 AND 1999. Andrea Sealy and Gregory Jenkins. *Department of Meteorology, Pennsylvania State University, 503 Walker Building, University Park, PA 16802*.

The accurate measurement of tropical rainfall is essential to understanding interannual variability, climate change, the hydrologic cycle and its link to the general circulation. There are numerous methods for estimating tropical precipitation including rainguages, the Special Sensor Microwave Imager (SSM/I) satellite, Outgoing Longwave Radiation (OLR) measurements and, more recently, the Tropical Rainfall Measuring Mission (TRMM) satellite which carries as one of its precipitation measuring instruments the first space-borne precipitation radar (TRMM PR). These data sources differ in their rainfall estimates over the tropics due to differences in horizontal resolution as well as spatial and temporal sampling. In this study I have compared the interannual variations in rainfall estimates for 1998 and 1999 during the West and Central Africa wet seasons from TRMM PR, TRMM Merged, CPC Merged Analysis of Precipitation (CMAP), Global Precipitation Climatology Project (GPCP) and SSM/I data. Previous results for West Africa have shown that the TRMM PR and TRMM Merged rainfall estimates differ in the intensity and occurrence of maximum rainfall during June-August 1998. The results from this study point to differences in the amount of rainfall estimated by the different datasets and the occurrence of maximum rainfall during the rainy season. The results also indicate differences in inter-annual variability of the rainfall estimates from the five datasets.

(42)
A STUDY OF PREDICTIVE MODELS FOR FORECASTING TROPICAL CYCLONE AND HURRICANE ACTIVITY OVER THE GULF OF MEXICO. Jamese Dacia Sims and R. Suseela Reddy. *Department of Physics, Atmospheric and General Sciences, Jackson State University, Jackson, MS*

Predictive models including a) a regression model and b) Hurricane Predictive Index (HPI) have been developed for predicting the origin and evolution of tropical cyclones and hurricanes over the Gulf of Mexico. These models describe the air-sea interactions and associated tropical cyclone and hurricane activity using NOAA GOES satellite data and data from buoys in the Gulf of Mexico. These models were tested for 1999 (August 18-25) Hurricane Bret, that was formed and developed in the Gulf of Mexico. The models simulated and predicted the air sea interactions and associated tropical cyclone/hurricane activity.

(43)

CHARACTERIZATION OF FORTY-TWO YEARS OF RAINFALL DATA FOR EARLY COUNTY, GA. Monesa Watts[1] and Donald Perkey[2], [1]*Jackson State University, Jackson, MS;* [2]*Global Hydrology and Climate Center, Huntsville, AL.*

Knowledge of water supply and demand associated with rural and agricultural communities may be greatly beneficial with regard to periods described by water deficit. One of the most important parameters associated with water deficit is the amount of rainfall. The purpose of this study was to determine the frequency of occurence and intervals between rainfall amounts along with calculating the mean and standard deviation for Blakely, GA located in Early County. Daily precipitation totals along with the climatology for the region were obtained from the Southeast Regional Climate Center through the University of Georgia's Website. Excel was used to evaluate all collected data and to estimate the mean rainfall amount; the frequency of precipitation amounts were found to be greatest in March and decrease throughout the following months with a slight increase in July over the forty-two year period. Regarding intervals between daily rainfall, there were greater occurrences of consecutive days without rainfall than consecutive days with rainfall. Data Analysis of spectral distribution of precipitation, frequency of precipitation events, and intervals between precipitation days led to a characterization of precipitation for Early County, GA.

(44)

SOME ASPECTS OF AIR-SEA INTERACTIONS AND ASSOCIATED TROPICAL CYCLONES OVER THE GULF OF MEXICO USING SATELLITE AND BUOY DATA. Ashley Zachary and R. Reedy, *Dept. of Physics, Atmospheric Sciences and General Science, Jackson State University, MS 39217*

Under the NASA FAR program, a study has been undertaken for investigating some aspects of air-sea interactions and associated tropical cyclones over the Gulf of Mexico using satellite data. In the present study, we investigated the air-sea interactions for Hurricane Gordon and the related hurricane activity for the year 2000. NOAA satellite GOES imagery and buoy data from NDBC for sea surface temperature and other meteorological variables were used in the to calculate heat, momentum, and moisture fluxes during the formation and development of hurricanes. The study suggested that a) sea surface temperature was maximum (29°), b) a 3-5 day oscillation in the heat flux was noticed before the 3 days of the hurricane formation, and c) a strong correlation was noticed between heat fluxes and the sea level pressure.

ABSTRACTS FROM RESEARCHERS AND RESEARCH ORGANIZATIONS

OCEANIC/MARINE AND FISHERIES SCIENCES

(45)
ATLANTIC COD AND HADDOCK EGGS ON GEORGES BANK, 1995 TO 1997; INTERANNUAL VARIATION IN DISTRIBUTION, ABUNDANCE AND MORTALITY RATES. Peter Berrien and John Sibunka, *NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center, James J. Howard Marine Sciences Laboratory, Highlands, NJ 07732*

GLOBEC Broadscale Surveys on Georges Bank were implemented to assess bank-wide features on a monthly basis during the first half of the calendar year. These surveys provide information on distribution and abundance and on biological rates such as mortality/survival and growth of planktonic life stages of target species. This bank-wide approach provides some of the 'big picture' examination of potential factors in the determination of recruitment rates, as compared to the more focused approach of 'process studies'. Analysis of egg collections of the two targeted fish species, Atlantic cod and haddock, provides the starting point in a 'life table' assessment. It is assumed that egg production rate parameters can be linked with those of larvae, and with the adult stocks that produced them. Additionally, because eggs are passive constituents of the plankton their fate can be strongly influenced by circulation patterns on the Bank.

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A TRIBAL TRAINING AND DEMONSTRATION PROJECT ON SHELLFISH AQUACULTURE: A NORTHWEST INDIAN COLLEGE AND WASHINGTON STATE UNIVERSITY COLLABORATION. Gleyn E. Bledsoe, *Northwest Indian College, 2522 Kwina Rd., Bellingham, WA 98226*

The Northwest Indian College (NWIC), in collaboration with Washington State University (WSU), established a Tribal Shellfish Extension Training and Demonstration Facility at the campus of NWIC. The facility is used to train conventional NWIC students and Native American's who desire to establish their own shellfish farms or to work in shellfish aquaculture. It is administered as part of the NWIC/WSU Cooperative Extension Program serving the tribal and non-native communities within the states of Washington, Oregon, and Alaska. The facility also provides Washington State University with a marine aquaculture facility that is available to their Cooperative Extension and academic programs. Previously, WSU did not have such a facility.

An integral part of the project was the development of a shellfish demonstration area in which students can physically construct and experience several methods of shellfish aquaculture. Another function of the demonstration area is to conduct research into new methods of husbandry that improve shellfish growth, permit shellfish grow out in bottoms that are not otherwise suitable for such, and to reduce adverse impact to the environment. An example of this was the construction and maintenance of a modified post and longline system to grow Pacific Oysters (*Crassostrea gigas*) in an area plagued by severe wind/tidal damage that previously prevented successful grow out. In

addition, the area was the site of a sensitive eelgrass bed. The successful results of the project and information pertaining to the facility in general are presented.

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A PRELIMINARY ANALYSIS OF GROWTH DATA OF JUVENILE LOGGERHEAD (*CARETTA CARETTA*) SEA TURTLES FROM NORTH CAROLINA, U.S.A. Joanne Braun-McNeill[1], Sheryan P. Epperly[2], Larisa Avens[3], and Samuel Sadove[4]. *[1]NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Beaufort, North Carolina 28516; [2]NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, Florida 33149; [3]NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Beaufort, North Carolina 28516; [4]Long Island University, Southampton College, Southampton, New York 11968.*

Determining the age at which sea turtles mature is vital to understanding sea turtle demography, thereby facilitating conservation management practices. However, as sea turtles cannot be aged based on external characteristics, it is only possible to estimate the age at maturity using indirect methods such as measuring the growth rates of wild, recaptured turtles. Previous studies have documented a higher rate of growth for wild, juvenile loggerhead (Caretta caretta) sea turtles in the southern Bahamas and Florida than in Virginia. The National Marine Fisheries Service sea turtle program in Beaufort, North Carolina has been conducting mark-recapture studies in Core and Pamlico Sounds, North Carolina since 1988, and has tagged a total of 978 loggerhead (*Caretta caretta*) sea turtles, most of which were incidentally captured in commercial pound nets. Data from the New York State Marine Turtle Project were also included in the analysis. Straight-line measurements of carapace length (notch-tip) taken for each turtle ranged from 41.4-103.0cm. External Inconel Style 681 tags applied to both rear flippers and internal passive integrated transponder (PIT) tags injected into the left front flipper enabled identification of recaptured turtles. Growth rates (Carapace length initial - Carapace length at recapture / Years at large) were assigned to a 10cm size class based on the mean of the initial and recapture length and averaged. Multiple t-tests were used to calculate differences in mean growth rates among the recaptured loggerheads from the different regions of the western Atlantic. To date, 29 loggerheads have been recaptured after being at large for 11 months or more, allowing for measurable growth. Similar to Virginia, North Carolina and New York had slower growth rates compared to Florida and the Bahamas although these differences were not always significant. Differences in growth rate have been attributed to the seasonal availability of food as well as the costs associated with seasonal migrations. Growth rates may also vary depending upon the genetic composition of the respective populations. This may have important ramifications for the management of the declining northern nesting population of loggerhead sea turtles.

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LARVAL HATCH FECUNDITY FOR A STOCK OF FRESHWATER PRAWNS RAISED IN ARIZONA. George B. Brooks, Jr., *Adjunct Assistant Professor, Wildlife and Fisheries Resources, University of Arizona, Tucson, AZ*

Successful prawn hatchery management requires a knowledge of the number of brood stock required to produce a defined number of postlarvae. In *Macrobrachium rosenbergii*, Larval Hatch Fecundity (LHF) is defined as the number of larvae released from the egg mass following incubation. In the literature there are two reported values for average LHF, 1,000 larvae per gram of female prawn weight and approximately 400 larvae per gram of female prawn weight. The research detailed in this paper explores the LHF for a stock of *M. rosenbergii* commonly available in the United States. The results suggest a LHF value close to 400 for this particular stock of prawns. This particular LHF value could be the result of a number of factors including environmental, genetic differences and differences in rearing technique.

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AQUACULTURE AS A TOOL TO TEACH SCIENCE IN THE GILA RIVER INDIAN COMMUNITY. George B. Brooks, Jr. and Joyce Baldwin, *Department of Land and Water Resources, Gila River Indian Community, P.O. Box C, Sacaton, Arizona 85247*

An environmental/science education program designed to provide a fundamental understanding of biological and environmental science for K-12 students has been initiated in the Gila River Indian Community (GRIC) near Phoenix Arizona. As part of this program, aquaculture was used as a method for teaching the scientific method, cell biology, mathematics, development and ecology. This 9 school program was designed to prepare O'otham (Pima) and Pee Posh (Maricopa) students for careers in natural resource management or as preparation to enter college. The program included gaining experience in tilapia egg incubation and tilapia growth studies.

The breakthrough for the concept occurred in 1997 when students from Estrella school on the Community, took a 4th place with a tilapia culture project at the International Science fair. In 1999, students from Vechij Himdag MashchamakuD (New Pathways to Learning) alternative high and middle school on the Gila River Indian Community, competed in the 46th annual Central Arizona Regional Science and Engineering Fair and took home three awards. Most recently a pilot scale commercial fish farm at the GRIC Juvenile Detention an Rehabilitation facility has been added to the program.

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AN OVERVIEW OF THE TRIP INTERVIEW PROGRAM. Pamela Brown-Eyo, *NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, Florida 33149.*

NOAA- Fisheries, Southeast Fisheries Science Center maintains several fisheries statistical data collection programs. These programs collect information that is used to manage the marine fish stocks of the South Atlantic Ocean. One of those commercial fisheries databases

is the Trip Interview Program (TIP). The TIP program provides details such as size frequency for species landed. TIP sampling is conducted throughout the southeast states and Puerto Rico and the US Virgin Island. In each area a TIP Scientist monitors the local marine fishing activity. The Scientist interviews the fishermen and collects fish measurements and biological samples on individual fish from the fishing trip. These interviews provide specific information, such as, area fished, hours fished, species landed, the pounds landed, the length of the fish or the width of the crabs, the species sex and the otoliths for age determination. This data is used to evaluate the growth and health of the fish populations. Since 1985, the TIP program has interviewed 49,891commercial fishing trips, collected data on 543 species of marine fish and shellfish, measured the length of 2,993,933 individual species, and removed 98,380 otoliths for aging studies. The TIP program continues to provide detailed data for the management of the Nation's marine resources.

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PRELIMINARY INVESTIGATIONS OF CRAB PREDATION ON BAY SCALLOPS.

Joseph Choromanski and Sheila Stiles. *NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center, Milford Laboratory, Milford, CT 06460*

In the course of bay scallop aquaculture research conducted at the National Marine Fisheries Service Laboratory in Milford, CT, excess scallops were donated to Connecticut municipal shellfish commissions for free-planting in area waters. The practice of free-planting or tossing seed scallops (10 - 40 mm) directly into the water has come under scrutiny because of the observable decreasing return in the number of adults (>60 mm) caught by recreational fisherman in the towns that have such policies. Field studies of bay scallops have suggested a variety of causes for population fluctuations including habitat loss, genetic inbreeding depression, and predation. It is generally known that crab predation can be a major factor in survival and growth of bay scallops for reseeding or stock enhancement efforts, especially in sites devoid of eel grass which can serve as a refuge for small scallops.

To evaluate crab predation on scallops, an experimental study was conducted with green crabs (*Carcinus maenas*) in the laboratory. Six treatment aquaria with 10^0 C flowing seawater were established with a single crab and 10 scallops. A seventh aquarium, with 10 scallops and no crab to check for non-predator related mortality, was used as a control. Four separate trials were run with scallops in each of the following size classes: 10, 20, 30 and 40 mm shell height. Trials were duplicated with a second set of crabs and scallops. Observations were made at 1, 6, 20, and 48 hours for each study. Results indicated that larger-sized scallops had higher survival rates, indicating some degree of refuge from predation by green crabs. In addition, damage to scallop shells was manifested in a characteristic appearance which could be used in identifying mortality by crab predation in the field.

A smaller scale project involved a comparison of bay scallop predation by Asian shore crabs (*Hemigrapsus sanguineus*) versus similar-sized green crabs. Six containers were set up for each crab species with fifteen scallops and one crab per container. The shell height of scallops ranged from 6-8 mm and the carapace width of crabs ranged from 18.0 to 25.3 mm. Observations were made after 48 hours when the experiment was terminated. The most notable difference was the number of scallops eaten by the male and female crabs. Generally, male

crabs ate all of the scallops in their containers, while the female crabs ate very few to none. This difference could be attributed to the larger size of the claw of the male crabs. There was a slight difference in the number of scallops eaten by the green crabs versus Asian shore crabs. These observations can be used for planning purposes when attempting to enhance or replenish scallop populations.

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POPULATION ENHANCEMENT EFFORTS FOR THE BAY SCALLOP, *ARGOPECTEN IRRADIANS,* IN THE NIANTIC RIVER ESTUARY, CONNECTICUT, USA. Ronald Goldberg[1], Jose Pereira[1], Paul Clark[1], Bernard Faber[2], David Porter[2], Lorenz Rinek[2], Barbara Kanter[2], Eric Kanter[2] and Walter Lord[2]. [1]*NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center, Milford Laboratory, Milford, CT 06460*; [2]*Waterford East-Lyme Shellfish Commission, 5 Rope Ferry Road, Waterford CT 06385*

The Niantic River supports presently a small population of bay scallops, *Argopecten irradians*, that is harvested recreationally. Numbers of bay scallops have fluctuated greatly with a peak level estimated as high as 20 million animals in the 1940s (Marshall, 1960). Three potential enhancement strategies were evaluated: 1) collection of natural spatfall, 2) direct re-seeding, and 3) over-wintering of hatchery-reared stock for creation of spawner sanctuaries. Assessment of natural spatfall in 1997 indicated that peak spawning occurred in late July and that spat were dispersed widely, however, too few spat were available for enhancement activities. In direct re-seeding experiments, time of planting and the inferred predation intensity were major factors affecting survival, while planting density had no significant effect. The Waterford East- Lyme Shellfish Commission (WELSCO) held 26,000 bay scallops in suspension culture during the 1998 – 1999 winter, of which, 60 - 80 % survived and spawned during the summer of 1999 within mobile spawner sanctuaries (cages suspended on long-lines). This effort is being repeated during 1999 – 2000. An annual recreational harvest survey has been initiated to assess enhancement activities. The pro-active approach of WELSCO in using aquacultural methods for enhancement of bay scallop populations is appropriate when natural recruitment is poor and habitat and environmental conditions are not limiting.

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A CONTRIBUTION TO THE EARLY LIFE HISTORY OF DEEP-SEA SMELTS (FAMILY: BATHYLAGIDAE) IN THE GULF OF MEXICO. Alonzo N. Hamilton, Jr. and Joanne Lyczkowski-Shultz, *NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula Facility, 3209 Frederic St., P.O. Drawer 1207, Pascagoula, MS 39568-1207*

Five species in a single genus of deep-sea smelts occur in the central western Atlantic and among these the larvae of only three species have been described; *Bathylagus bericoides, B. longirostris*, and *B. compsus* , Southeast Area Monitoring and Assessment Program (SEAMAP) ichthyoplankton collections are taken in the deep ocean habitat of these fishes within the Gulf of Mexico only during April to June with infrequent observations during winter months. Under current SEAMAP protocols bathylagid larvae are initially identified to the family level y

scientists at the Polish Sorting and Identification Center in Szczecin, Poland. A recent synthesis of existing literature on the Bathylagidae uncovered numerous questions concerning their nomenclature, species validity and larval identification. Reexamination of archived bathylagid larvae from Gulfwide collections has allowed us to describe the distribution of the larvae of these fishes and to investigate their occurrence relative to oceanographic conditions and features in the deep Gulf.

(54)
CONTINUING THE LEGACY OF MARINE EDUCATION AND RESEARCH PARTNERSHIP: THE SAVANNAH STATE UNIVERSITY/ NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION COOPERATIVE MARINE EDUCATION AND RESEARCH PROGRAM: (SSU/NOAA CMER). Dionne L. Hoskins, *NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Savannah State University, Savannah, Georgia 31404*

The Cooperative Marine Education and Research (CMER) Program was established on February 6, 1995 when a Memorandum of Understanding was signed between Savannah State University (SSU) and the National Oceanographic and Atmospheric Administration (NOAA). The relationship between NOAA and SSU is a long-standing one. NOAA has provided substantial guidance and support to Savannah State University for almost 30 years, beginning in the early 1970's when the university first began offering marine science courses and in 1979 when SSU formalized a Bachelor of Science degree in Marine Biology. NOAA has continued to provide vessels, dive training, student support and capacity-building assistance to Savannah State University while Savannah State University has offered research, education products, and information to NOAA through formal grants, contracts, and Memoranda of Understanding since 1981. The relationship between NOAA and SSU has now been expanded to provide for even more active cooperation in the advancement, organization, and operation or marine research, education, in-service training, and demonstration programs. In its first year, the CMER program has supported several coordinated research and education programs funded by Sea Grant and the Department of Education. These include internship opportunities that expose students to marine aquaculture and workshops in statistical analysis, research presentation and website design, and marine-related geographical information system (GIS) applications.

(55)
NOAA'S CENTER FOR COASTAL FISHERIES AND HABITAT RESEARCH: A JOINT NOAA FISHERIES AND NATIONAL OCEAN SERVICE FACILITY. Donald E. Hoss, *101 Pivers Island Road; Beaufort, NC 28516*

Founded in 1899, the laboratory has served under various government agencies since opening. Currently there are 75 +employees, plus port samplers, post-doctorate researchers, graduate and undergraduate students who staff the laboratory. Research topics are broad in scope and support NOAA's goals to build sustainable fisheries, sustain healthy coasts, and recover protected species.

Organizational structure of the Center consists of one research branch with 9 teams conducting research on environmental and fishery questions. Applied Spatial Ecology and Habitat Characterization, Coastal Ecosystem Research and Restoration, Fisheries Oceanography and Ecology, Plankton Ecology and Physiology, and South Florida Fish Ecology and Contaminants teams address environmental issues related to ecology of living marine resources in various habitats. Research projects involve ecological processes in salt marshes and seagrass beds and the fish and shellfish that utilize them in locations ranging from Virginia to south Florida to Louisiana, Texas, and California coasts. State of the art ecological, chemical, biochemical, and satellite imagery methodologies are used in the course of these studies. Fisheries focused investigations are conducted by the Fish Biology, Population Dynamics and Cetacean and Sea Turtle teams. The research is oriented toward understanding environmental and fishery factors that control the abundances of important fishery species, sea turtles, and marine mammals. The reef fish community of the SE U.S. continental shelf and menhaden resources of the Atlantic and Gulf of Mexico receive major attention by these teams. Population model development and evaluations of stock dynamics for fishery management in coastal fisheries as well as highly migratory species are conducted. Sea turtle studies focus on biology and dynamics of loggerhead, green, and Kemp's ridley in the NC coastal waters. Cetacean studies deal with all coastal marine mammals and with a concentration on the coastal bottlenosed dolphin stocks. The Information Technology and Spatial Analysis team provides statistical assistance, satellite imagery, and spatial data that are used by other research groups within the Laboratory, and they make the satellite data available to academic institutions and the private sector.

Researchers for these teams provide scientific and management advice to Fishery Management Councils along the Atlantic and Gulf coasts and to habitat managers in NOAA and other Federal and state agencies. Frequently staff are called upon to provide scientific information in instances where there has been environmental damage, and scientific advice is needed on the impacts as well as potential approaches to mitigate for impact and restore habitats to improve both damaged habitats and fisheries.

(56)

OVERVIEW OF FOOD WEB DYNAMICS IN THE NORTHWEST ATLANTIC: DETECTING CHANGES IN KEY PROCESSES AND PARAMETERS IN A MULTI-SPECIES CONTEXT. Jason S. Link, Frank P. Almeida, Cheryl G. Milliken, and Lance P. Garrison. *Food Web Dynamics Program, NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543*

The fish component of the northwest Atlantic continental shelf ecosystem has undergone well-documented changes over the past three decades. Particularly, gadids, flatfish, and other demersals are less abundant whereas smaller pelagics and elasmobranchs are more abundant than historical levels. In addition to abundance, we monitor several diet parameters including percent diet composition, percent prey frequency, total stomach contents, predator size, and prey size to estimate and assess major processes and rates for key fish in this ecosystem. Some of the major processes and rates we examine from these parameters are 1) trophic links and interaction strengths for multi-species models, 2) food web statistics, 3) M vs. F, 4) the partitioning of

energy, biomass, and yield, 5) recruitment bottlenecks, 6) essential fish habitat, and 7) consumption, predation, competition and production rates. Our time series extends for 25 years, contains more than 100 predators and 1200 prey items, ranges from Cape Hatteras to Nova Scotia, covers over 83,700 square nautical miles, and spans the period and locale of intense perturbation on the fish community of this ecosystem. Changes in these key processes and rates are not trivial to detect at these spatial and temporal scales, but if observed, as they have been in this ecosystem, allow quantification of the effects of over-exploitation and more importantly provide an assessment of the potential for recovery of economically important fish stocks. This example demonstrates the value and utility of maintaining long-term, broad-scale monitoring efforts.

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IS *SIROLPIDIUM ZOOPHTHORUM* THE ANIMAL EATER ITS NAME SUGGESTS? NEW EVIDENCE OF PARASITISM. Christopher Martin, *NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center, Milford Laboratory, Milford, CT 06460*

A phycomycetous fungus has been observed repeatedly in larvae of the bay scallop, *Argopecten irradians,* at the Milford Laboratory. This microorganism has been tentatively identified as *Sirolpidium zoophthorum* Vishniac, first observed at this laboratory by V.L. Loosanoff almost fifty years ago. The morphology and development of the fungus have been previously described. While apparently enzootic in scallop cultures at our laboratory, *S. zoophthorum* has not been tied directly to mass mortalities of this species. Loosanoff regarded it as parasitic in the bay scallop and in the larvae and juveniles of other bivalves. However, his evidence was largely circumstantial, i.e., conspicuous presence of "infected" larvae in cultures suffering high mortality.

Using pure cultures of *S. zoophthorum,* freshly isolated from affected scallop larvae, it has been possible to demonstrate that this fungus is one likely cause of observed mortality. Exposure of 72-hour scallop larvae to suspensions of recently emerged zoospores resulted in approximately 70% mortality in 4 days. Fungal thalli were detected in up to 88% of dead larvae. Untreated controls remained unaffected. *S. zoophthorum* was successfully reisolated from parasitized larvae, thus satisfying Koch's Postulates.

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EFFECT OF HARMFUL ALGAE ON MARINE RESOURCES IN THE GULF OF MEXICO. Steve L. Morton, Kate Schaffer, Tina Mikulski, Steven Eaker, Mark Busman, Brad Mitchell, Nikki Wiggens and Peter Moeller. *Marine Biotoxin Program, National Ocean Service/NOAA, Center for Coastal Environmental Health and Biomolecular Research, 219 Ft. Johnson Rd., Charleston, SC 29412*.

A number of species of microalgae commonly observed from the Gulf of Mexico produce bioactive compounds that have profound effects on marine resources. These biotoxins lead to mortality events of marine resources and human diseases after consumption of contaminated shellfish or finfish. The 1995 and 1996 manatee mortality events and the 1999 dolphin mortality event will be used as examples of biotoxins leading to loss of marine

resources. Human diseases caused by toxic algae known to be found along the Gulf Coast include Neurotoxic Shellfish Poisoning (NSP) and Ciguatera Fish Poisoning (CFP). The cause of the mortality events and human intoxications will be discussed. Current research conducted by the Marine Biotoxin Program on new potential toxic algal species will also be presented.

(59)
LABORATORY CULTURE OF LARVAL TAUTOG: RECENT UPDATES AND CHANGES. Dean M. Perry, David A. Nelson and Robin S. Katersky, *NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center, Milford Laboratory, Milford, CT 06460*

Adult field-captured tautog, *Tautoga onitis,* were spawned in the laboratory. Larvae were cultured according to standard laboratory procedures developed at the Milford laboratory using a recirculating system containing six 1140 L conical rearing tanks. During the summer of 2000, the following changes were made to our protocol which increased larval survival. These changes included increasing live feed density in the rearing system, extending the duration of rotifer feeding, and decreasing the initial larval stocking density. Larvae were fed an axverage of 9×10^6 rotifers per day, which is double the amount fed in previous years. They were also fed rotifers for a 25d period compared to 14d in prior years. With this increased larval survival we are currently monitoring growth rates of these juveniles under laboratory conditions. From December 14, 2000 to February 2, 2001, total length (mm) and biomass were measured and recorded biweekly. Specific growth rate was 0.30 mm d^{-1} and biomass increased at an average of 0.04 g d^{-1}.

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AN ANALYSIS OF SIMILARITY COEFFICIENTS AND TAXONOMIC CLUSTERING METHODS FOR IDENTIFICATION OF BACTERIAL FISH PATHOGENS. Steven C. Pitchford and Richard A. Robohm, *NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center, Milford, Connecticut 06460*

Reliable classification of bacterial pathogens often poses a problem for those investigating the cause of fish disease. In the absence of sufficient DNA probes for fish pathogens, the most reliable identification method is numerical taxonomy based on bacterial phenotypic traits. A number of mathematical formulas exist for first producing similarity coefficients and then clustering organisms for construction of taxonomic trees. A systematic comparison of these approaches has not been published for cross family classification of bacteria.

We report here an evaluation of programs for similarity coefficients and clustering techniques that are available in the NTSYS-PC software package from Exeter Software (Setauket, NY). We tested 96 permutations of pairs of similarity coefficients and clustering techniques for their ability to produce correct taxonomic trees from representative bacteria (primarily fish pathogens) from six taxonomic families. Reliability was determined by looking for correct phylogenetic groupings after the programs were applied to a database of phenotypic characteristics for 28 known pathogenic species that we compiled from the literature and 30 that we isolated and identified through a consensus of five taxonomic schemes. A minimum of 40

and a maximum of 86 traits were compared between organisms depending upon the available data. A set of 10 semi-quantitative measures were established to evaluate the resulting taxonomic trees.

The most accurate permutation proved to be Kulczynski no. 2 (K2) association coefficient in combination with the Complete Linkage method. Use of this combination in conjunction with a sufficient database will help in classifying bacteria when family and genus are unknown.

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DISTRIBUTION OF BDELLOVIBRIO-LIKE BACTERIA IN ALASKA'S EASTERN BERING SEA (EBS) SHELF. DeLois M. Powell[1], Henry N. Williams, Ruby Singh and Andy Sneider[2], J. Frank Morado and Lisa Appesland[3]. [1]*Department of Natural and Physical Sciences, Shaw University, Raleigh, NC;* [2]*University of Maryland at Baltimore;* [3]*NOAA, National Marine Fisheries Service, Alaska Fisheries Science Center/RACE, Seattle, WA*

Scientists around the world are currently involved in ongoing studies to investigate the ecology of a unique predator in the marine environment, the endoparasitic bacterium, *Bdellovibrio* and to note its interaction with other organisms in the marine ecosystem. Previous studies about the distribution of *Bdellovibrio* in Alaskan waters did not exist. This project intended to determine if *Bdellovibrio* or Bdellovibrio-like bacteria occur in these waters and to add isolates to the collection that is currently being characterized and compared from other parts of the world. A Nissin bottle dropped from the deck of the NOAA trawl Fishing Vessel (F/V), Aldebaran collected subsurface water (from approximately 1-meter depth) of the Eastern Bering Sea (EBS) during July 1-23, 1999. Water, mud and fish and shellfish gut samples were collected with the intent to survey the diverse habitats of the EBS and to focus on near- and offshore areas in the Bristol Bay. A total of 30 samples were enriched for detection of Bdellovibrio-like bacteria (addition of *Vibrio parahemolytica*) and analyzed in the NOAA laboratory, using a modified agar overlay technique. Seven of 19 samples tested were positive for Bdellovibrio-like bacteria. Thirty-six mud-gut samples were collected from EBS and 5 mud-gut samples were collected from Larrabee State Park. Of 15 samples assayed, one proved positive for Bdellovibrio-like bacteria. Two additional mud samples collected at H184 and H195 (haul designation number) were positive for Bdellovibrio-like bacteria. A modification of the membrane filter technique used to analyze water for fecal coliforms was employed to survey water samples for the presence of possible hosts. Preliminary colonial characterization of bacterial isolates indicated a diverse population of potential host organisms.

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THE TRAP POND PROGRAM: A SERVICE LEARNING PARTNERSHIP BETWEEN COLLEGES AND PARKS. Michael A. Reiter[1] and Jenna Luckenbaugh[2]. [1]*Department of Agriculture and Natural Resources, 1200 N. DuPont Hwy., Dover, DE 19901-2277;* [2]*Trap Pond State Park, RD2, Box 331, Laurel, DE 19956*

The Trap Pond Program (TPP) is a service-based teaching and research relationship between the Department of Agriculture and Natural Resources of Delaware State University and

Trap Pond State Park, DE. The park provides expertise and opens its lands for research and teaching programs in freshwater, wetland, terrestrial, and coastal ecology/environmental sciences, as well as interdisciplinary resource management, and in return the department works on topics relating to the management needs of the park. The university gains an extensive field site containing a wide variety of aquatic and terrestrial communities and a working relationship with the state's resource personnel. Students gain the ability to work on issues of present-day concern and access to the expertise that exists in the state's resource management agencies. At the same time, the TPP benefits the park directly and the State of Delaware indirectly by providing inexpensive manpower to study freshwater, terrestrial, and coastal questions impacting the park and its mission. The program also benefits the park and the state by encouraging students to develop an interest in the sciences while providing future employees and citizens trained in local environmental issues. The TPP is intended to be a model program for other state parks and institutions of higher learning (particularly small colleges and regional universities) both within Delaware and beyond.

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SELECTION STUDIES ON GROWTH AND SURVIVAL OF BAY SCALLOPS (*ARGOPECTEN IRRADIANS*) FROM LONG ISLAND SOUND. Sheila Stiles, Joseph Choromanski, and Christopher Cooper. *USDOC, NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center, Milford, CT 06460*

Selection studies are underway to investigate genetic responses for improving growth and survival of bay scallops (*Argopecten irradians*) from Long Island Sound through breeding. Previous findings from early responses to selection for growth indicated variation among several lines, with some modest gains. Several reasons were given for the range in early responses, including stage and age of scallops at the time of selection, the selection differential, inbreeding, density and other culture factors.

Subsequent measurements on the growth and survival of scallops from the same lines at a later time in development demonstrated some, but less variability in the responses among the lines. Responses in the progeny are best measured at the same stage or age as when the parents were selected. Measurements also provided more definitive information that density-dependence was a critical factor in evaluating responses. Preliminary results from breeding the F_1 generation suggest that interaction with survival may be a more important factor in selecting scallop populations than selecting for growth alone. For example, mortality was observed among the smallest and the largest scallops of some lines, thus the mean size of the survivors in the groups or sublines was similar. This could be connected with genotype-related mortality which was suggested from genetic population analyses employing allozymes. Progeny of the next generation currently in early phases of growth should further elucidate responses to selection.

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POPULATION CHARACTERISTICS OF THE U.S. SOUTH ATLANTIC RED PORGY STOCK. Douglas S. Vaughan, *NOAA-CCFHR, National Marine Fisheries Service, 101 Pivers Island Road, Beaufort, NC 28516*

The age structure and status of the U.S. south Atlantic stock of red porgy is examined, using recorded and estimated landings and size frequencies of fish from commercial, recreational, and headboat fisheries from 1972-1997. Estimates of annual, age-specific population numbers and fishing mortality rates (F) were obtained by application of a calibrated virtual population analyses (VPA), using fishery-independent data from MARMAP hook-and-line and trap gears in the calibration procedure. Fishing mortality rates (F) increased from 0.05 in 1974 to 1.34 in 1997 for fully recruited ages (assumed 4+ throughout for comparative purposes) with M = 0.28, while spawning potential ratios declined from 90% to 32% based on mature female biomass and from 89% to 17% based on total mature (male and female) biomass. Recruits to age 1 declined from a peak of 7.6 million age-1 red porgy in 1973 to 12,000 age-1 red porgy in 1997; while total spawning stock (mature) biomass declined from a peak of 11,700 t in 1978 to 323 t in 1997. Long-term and severely declining recruitment to age 1, headboat CPUE, and MARMAP Survey CPUE raise concerns about overfishing. Generally static SPR has been at or below the South Atlantic Fishery Management Council's criteria for overfishing (SPR = 30%) since 1981. Keeping in mind the difference between thresholds and targets, it would appear that reducing F to a level at or below that equivalent to 40% static SPR is necessary for rebuilding the U.S. south Atlantic red porgy stock.

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GROWTH AND SURVIVAL OF BAY SCALLOPS, *ARGOPECTEN IRRADIANS IRRADIANS,* FED *TETRASELMIS CHUI* BY TWO METHODS. James C. Widman Jr. and David Veilleux, *NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center, Milford Laboratory, Milford, CT 06460*

Tetraselmis chui was grown using two different methods, carboy vs GRAMPS (Greenhouse Algal Mass Production System) and fed to bay scallops, *Argopecten irradians irradians* - growth and survival were monitored. Algae grown by the traditional Milford carboy method utilize artificial light and artificial seawater with the addition of various nutrients, trace elements and vitamins. GRAMPS-grown algae utilize sunlight and natural seawater from Milford CT harbor, which is UV treated and then enriched with a commercially available F/2 media. Current results indicate a slight growth advantage when using algae grown in the carboys. Increases in mean shell height ranged from 2.6 -3.1 mm for scallops fed with GRAMPS-grown algae, while scallops fed carboy-grown algae increased 3.6 - 4.1 mm. Most surprising was the decrease in survival when scallops were fed *Tetraselmis* grown using the GRAMPS method. Survival of scallops on the GRAMPS-grown *Tetraselmis* averaged 64%, and scallops fed carboy *Tetraselmis* averaged 89%. Additional research is needed to determine the cause of the growth and survival discrepancies observed between the two growing methods.

(66)
PUTTING OUR TECHNOLOGY TO WORK ON THE (FISH AND SHELLFISH) FARM.
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As part of our technology-transfer activities, we have organized an annual training session titled, "Growing Microalgal Feeds for Marine Aquaculture -- The Milford Workshop." Microalgae are cultured as feeds for molluscan shellfish (scallops, clams, and oysters) and as part of the live-food chain for marine finfish. Practical knowledge and skills required to culture microalgae successfully are diverse, ranging from microbiology to ecology, chemistry, engineering, physics, and hard-knocks lessons. The purpose of this annual Workshop is to organize and condense the diverse, practical information and skills needed to culture microalgae in a hatchery setting into a three-day crash-course integrating both lecture and hands-on laboratory sessions. The Workshop is offered at no cost, as part of the Milford Laboratory's ongoing efforts to support development of US aquaculture, with first preference given to commercial growers and extension personnel. Enrollment is limited to 16. The 2000 class included participants from commercial shellfish farms, state extension programs, academic research laboratories, and Native American Tribal groups on both Atlantic and Pacific coasts of the US.

(67)
ENHANCING COASTAL MANAGEMENT THROUGH GEOSPATIAL ANALYSES.
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Working with partners from academia, non-governmental organizations, and state/local governments, the NOAA Coastal Services Center fosters the application of geographic information systems (GIS) and remote sensing in coastal management. Our remote sensing activities work with data streams from satellite, airborne, and *in-situ* sources to identify new or under-utilized remote sensing activities, such as LIDAR and acoustic sensors, that could assist coastal managers. GIS activities cover a broad range and include "rescuing" geospatial data from non-digital formats and customizing GIS applications to more effectively integrate remote sensing and other data to aid decisions in the coastal and marine environment. Distributing tools for developing metadata, providing training in development of metadata, and hosting applications that allow simultaneous searching of multiple geospatial archives fosters access to geospatial data and technologies. Through fellowships, internships, cooperative agreements, and traditional classroom settings, the Center also provides hand-on training in the use of these technologies and their practical application to coastal management issues.

ENVIRONMENTAL SCIENCES

(68)

EFFECTIVE MOLECULAR MECHANISMS TO IDENTIFY MICROORGANISMS RESISTANT TO TOXIC METALS IN THE ENVIRONMENT. Raul Cuero, John Williams, Nnana Mogongwa, Felicia King, Alonso Sadberry, and Ashley Chatham. *Prairie View A&M University, PO BOX 685, Prairie View, Texas 77446*

Although many metals including Zn^{+2}, Cu^{+2}, Fe^{+2} and others, are essential to microbial metabolism, all are potentially toxic. However, microorganisms such as bacteria and fungi can develop mechanisms to accumulate these metals, thus making the microorganisms and/or their metabolic products ideal for metal recovery and/or environmental protection. Metals affect microbial metabolisms, enzymatic activity, membrane transport, and nucleic acid synthesis. Therefore, the aim of the present investigation, was to use fungal molecular structures and products such as RNA molecule and enzyme chitosanase, respectively, in relation to microbial growth, under different concentrations of toxic metals, thus identifying strains resistant to toxic metals that can be used for further decontamination of these toxic metals in the environment. Different fungal isolates and a bacteria strain were tested during the study. However, *Aspergillus flavus*, and *Fusarium graminearum*, were mainly used in every experiment. The fungal isolates were sequentially grown in agar media, then inoculated in sterile soil media containing sterile ground corn, and finally transferred to broth media. All the media contained 0-5 ppm concentrations of toxic metal ,including Zn^{+2}, Cu^{+2}, Fe^{+2} . Some cultures were amended with the natural polysaccharide chitosan to induce chitosanase production. The toxic metal-amended fungal cultures were incubated in replicates at room temperature. Agar and broth media were incubated for 3-6 days, while soil cultures were incubated 3-12 months. Soil cultures were always used as the primary inoculum for the sequential inoculation of the agar and broth media. Soil and liquid cultures were subjected to analysis for fungal growth; only liquid cultures were used for RNA yield (Cuero et al., 2000), while chitosanase production was assessed in chitosan-amended agar, for which a qualitative assay is reported based on an arbitrary scale (- = little enzyme production; ++ = medium enzyme production; +++ = abundant enzyme production; and ++++ = very abundant enzyme production) (Cuero, 1996). The results show that both copper and zinc either in single or combined treatment stimulated fungal growth 10 times (up to 0.45 gr. biomass) in liquid cultures. Similarly, fungal populations increased 4-12 times in soils treated with the metal ions (up to $1x10^6$ CFU) as compared to non-treated fungal cultures, after 3 months. Stimulation of fungal growth corresponded with an increase in RNA yield and concentration, depending upon the fungal species. Growth and RNA production by *A. flavus* were stimulated more by zinc, while *F. graminearum* was stimulated more by copper. RNA and growth of the bacteria Bacillus spp., were markedly increased by zinc. Chitosanase production was also higher in fungal cultures amended with chitosan and toxic metals. The present results show an effective molecular approach to use RNA and/or enzymes to identify microorganisms with potential for removal of toxic metals from the environment.

(69)

PETROLEUM HYDROCARBONS IN SEDIMENTS AND RIBBED MUSSELS FROM RESTORED, UNRESTORED, AND REFERENCE MARSHES IN THE ARTHUR KILL, NEW YORK / NEW JERSEY, USA. Ashok D. Deshpande, Bruce W. Dockum, and Amy M. Tesolin, *NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center. James J. Howard Marine Sciences Laboratory at Sandy Hook, 74 Magruder Road, Highlands, New Jersey 07732*

An underwater pipeline ruptured during January 1990, discharging about 567,000 gallons of No. 2 fuel oil into the Arthur Kill. The City of New York Parks and Recreation Department restored 2.6 hectares of the impacted marsh with *Spartina alterniflora*. We collected sediment and ribbed mussel samples from restored, unrestored, and reference sites over two collection periods to assess the functional effectiveness of the restoration efforts with respect to total petroleum hydrocarbons (TPHs). TPHs in sediments varied within and between sites, and within sections of the individual cores, with generally higher concentrations found in the deeper sections. TPHs in surface sediments ranged from less than the method detection limit (MDL, 181 mg/g wet weight) to 490 mg/g wet weight for a restored site, less than MDL to 7890 mg/g wet weight for an unrestored site, and less than MDL for a reference site. TPHs in ribbed mussels also varied within and between sites, with a range of less than MDL (54 mg/g wet weight) to 540 mg/g wet weight. There was no correlation between TPHs in mussels and TPHs in sediments. Another spill of about 50,000 gallons of No. 2 fuel oil occurred at one of the reference sites shortly after the last collection period. We collected additional samples of sediment and ribbed mussels at this site to study the petroleum hydrocarbon patterns before and after the spill. Hydrocarbon fingerprints, double ratio plots, and principal component analyses were used to examine if sediments and ribbed mussels were contaminated with the spilled oil.

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HIGH PERFORMANCE UV (HPUV) INACTIVATION OF *E. COLI*. Kurt A. Garrett, Cheryl M. Davis and De Lois M. Powell, *Department of Natural and Physical Sciences, Shaw University, Raleigh, NC*

The use of ultraviolet light for inactivation of microorganisms is well documented in the literature. Ultraviolet light used for inactivation is sometimes called germicidal UV or UV254 (the specific wavelength known to have the most lethal effect on bacteria, fungi and viruses). While this band of invisible light is part of the sun's spectral energy, artificial sources of germicidal UV come from manufacturers such as Sylvannia and General Electric. The greatest users of germicidal UV lamps are wastewater treatment facilities seeking alternative methods of disinfection that reduce the need for chlorine and chlorine derivatives. The disinfection mechanism generally points to the disruption of the microorganism's DNA. In turn, the disruption of microbial DNA prevents replication and can cause 'death'. Early UV light inactivation research was set back when conventional ultraviolet lamps performed below expectations. This failure was traced to lamp design. While researchers sought intense high-energy germicidal UV light, manufacturers designed low-energy UV lamps, primarily used for wastewater disinfection. In research typical inactivation times, using conventional germicidal

UV lamps, range from 20 minutes to several days for virus and similar times for bacteria. Recently, we tested a new lamp system, High Performance Ultraviolet Light (HPUV; CSMO, Inc.) and found it to reduce 10^6 colonies of herpes simplex virus (HSV) in three seconds. We are proposing use of the HPUV for inactivation of *E. coli*. Our studies will measure inactivation initiation, inactivation optimum and hyper-inactivation. HPUV is expected to result in quicker inactivation times for *E. coli* than conventional UV lamps. This data will allow us to construct a response curve for *E. coli* when using HPUV inactivation. Future research will use these data to determine inactivation conditions that preserve important protein triggers of the cellular immune response.

(71)
RESTORATION AND ASSESSMENT OF URBAN SALT MARSH HABITAT DAMAGED BY A SEVERE OIL SPILL. David Packer[1], Joe Vitaliano[1], & Carl Alderson[2]. [1]*NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center, James J. Howard Marine Sciences Laboratory, Highlands, NJ 07732;* [2]*Salt Marsh Restoration Team, Natural Resources Group, New York City Parks, 200 Nevada Ave., Staten Island, NY 10306*

Few scientific studies have focused on *restored* salt marshes (restored because of a severe environmental impact) as opposed to *created* or *constructed* marshes (created in response to mitigation). In 1990, a 576,000 gallon oil spill seriously damaged marshes of the Arthur Kill, the strait separating Staten Island, NY from NJ. The Salt Marsh Restoration Team of NYC Parks implemented a multi-year restoration and monitoring project to restore marshes directly impacted by the 1990 spill. To date, restoration activities included the successful reintroduction of over 9 acres of Arthur Kill-propagated salt marsh cordgrass, *Spartina alterniflora*. SMRT has been monitoring several parameters in oiled marshes that were replanted and oiled marshes left for natural recovery, including *Spartina* biomass/density, ribbed mussel (*Geukensia demissa*) density, fish abundance/diversity, frequency/duration of feeding of wading birds, and sediment total petroleum hydrocarbons (TPH) in replanted and unplanted sites. In 1996 the National Marine Fisheries Service?s James J. Howard Marine Sciences Laboratory extended the study by characterizing and assessing the structure and function of replanted, unplanted, and reference marshes. Studies included sediment chemistry, contaminant analyses, macrobenthic surveys, and stomach content analyses of mummichogs (*Fundulus heteroclitus*). Results are presented from the two investigations. A quantitative assessment of these marshes may allows us to evaluate our ability to restore this habitat?s functional attributes, and identify indicators of habitat and living resource health and recovery within a heavily urbanized and degraded estuary.

(72)
THE EVOLUTION OF MTBE AS A POLLUTANT. Pao-Chiang Yuan, Doris McPherson and Youguo Xu, *Hazardous Materials Management Program, Department of Technology, School of Science and Technology, Jackson State University, Jackson, Mississippi*

We have learned a lot of lessons from the past. The famous materials we've used in the past are asbestos, PCB (polychlorinated biphenyl) transformer oils, freon, and lead in paint and

also in gasoline. They were wonderful useful materials that served their purposes for us until we found they have harmful health problems. Most of them cause chronic diseases and irreversible harm. Some materials have been used for thousands of years, such as asbestos, until two to three decades ago, when we stopped using it in this country, it is still being used by other countries. For most of these toxic materials, their substitutes have been found and they have been totally exclude from the United States market. MTBE is used as a fuel additive mixed into gasoline starting from about a decade ago, due to the Clean Air Act Amendment (CAAA) that required improvement in the air quality in some parts of the country, until scientist found MTBE in our water and ground water supply. This is a case of our efforts to control air pollution now threatening water quality. MTBE is a possible human carcinogen according to the US EPA (United States Environmental Protection Agency).

ATMOSPHERIC SCIENCES

(73)
HPVCI - DISTANCE LEARNING. Paul Croft, Rafael Mahecha, R. Suseela Reddy, and Pat Fitzpatrick. *Meteorology Department, Jackson State University, Jackson, MS*

As a part of the High Performance Visualization Center Initiative (HPVCI) at Jackson State University, the JSU Meteorology Program (JSU MP) is developing a Distance Learning Initiative involving mesoscale modeling and products (MM5 and COAMPS) for college and professional users. Through computer visualizations of mesoscale model data and results, and their presentation and use in the classroom, both students and professionals will have the opportunity to learn and examine the nature of numerical weather prediction models. Visualization products will be available to the broader atmospheric and minority communities for education and training, particularly in an electronic classroom. Assisted directly by several undergraduates, three websites, including a developmental site (http://www.angelfire.com/ms2/hpvci/index.html), the JSU Meteorology Program's homepage (http://weather.jsums.edu), and a research platform site http://betsy.jsums.edu/~hafner/oper5.html) are in development to address the needs of users. Ultimately all three sites will be linked and/or merged. Numerical model guidance and their output will be used to create class materials. Both models (MM5 and COAMPS), run in real-time, and will be used to explain the reasons for weather modeling, the need to do so, and the methodological approaches used. A study through beta testing is planned. Various target audiences will be selected to consider general and specific skills and knowledge that different users may, or may not have, to define their goals when visiting the websites. Users with various academic backgrounds, and levels of meteorological skills will be introduced to the sites, asked questions about it (e.g., how easy is it to navigate the site? Is labeling clear?), and asked for comments. Before final release, the sites should have a layout, information, products, and labels that are clear and easy to use (without losing technical quality) for all audiences. Suggested improvements to the sites include further explanation of products, less crowded maps, and "make-your-own" overlays. Upon completion the Jackson State University Meteorology Program's HPVCI websites will serve as a clearinghouse for model output and products.

(74)
A NEW U.S. CLIMATE ATLAS. Marc S. Plantico[1], Lynn A. Goss[1], Liz Love-Brotak[1], Gregory Hammer[1], Christopher Daly[2], George Taylor[3]. [1]*National Climatic Data Center, Scientific Services Division, Asheville, NC 28801;* [2]*Spatial Climate Analysis Service, Oregon State University, Corvallis, OR 97333;* [3]*Oregon Climate Service, Oregon State University, Corvallis, OR 97333*

The National Climatic Data Center (NCDC) has developed a new, electronic Climate Atlas of the United States which is available on CD-ROM. The purpose of this Atlas is to depict the climate of the United States in terms of the distribution and variation of major climatic elements. The Climate Atlas is intended to meet the needs for climatic information from commercial, industrial, agricultural, research, and educational institutions, as well as from the general public. The new atlas replaces the previous Climatic Atlas of the United States which was published in 1968. Data used for the old publication were from the period 1931-1960 and the nearly 200 maps were hand contoured. The new atlas used innovative technology and easy to use Geographic Information Systems (GIS) to objectively generate many of the maps. The analytical model, PRISM (Parameter-elevation Regressions on Independent Slopes Model) which was developed at the Oregon Climate Service (OCS) at Oregon State University, was used to generate nearly 350 different map products. An additional 350 maps were generated at NCDC. Most atlas products are derived from the 1961-1990 period of record. This poster illustrates some of the map products that are contained in the new atlas.

(75)
SOME ASPECTS OF AIR-SEA INTERACTIONS, HURRICANE PREDICTIVE MODELS AND VARIABILITY OF TROPICAL CYCLONES. R. Suseela Reddy[1] and Richard L. Miller[2]. [1]*Jackson State University, Jackson, MS;* [2]*Earth System Science, NASA Stennis Space Center*

Under the NASA research grants, we present the work established on (a) the air-sea interactions and associated tropical cyclones during their formation and evolution over the Gulf of Mexico, (b) the development of predictive models for hurricane activity, and (c) the variability of tropical cyclones over the North Atlantic. The studies suggested that, (a) a 3-5 day oscillation was noticed in the heat and momentum fluxes during the formation and evolution of hurricane activity, (b) Hurricane Predictive Index (HPI) was used for hurricane prediction, and (c) a long-term ~ 50-year oscillation was noticed in the tropical cyclone activity over the North Atlantic Ocean.

(76)
MESOSCALE CIRCULATION OVER THE COMPLEX PHYSIOGRAPHY IN LOUISIANA-MISSISSIPPI (LA-MS) COASTAL REGION. R. Suseela Reddy, Paul Croft and Pat Fitzpatrick, *Jackson State University, Jackson, MS*

Mesoscale air flow in coastal regions is determined by land-sea temperature contrast (land-sea breeze) and by the shape of a coastline. In addition to topography, shape of coastline

has an effect on mesoscale wind flow, and thus, on various meteorological variables including cloudiness and air pollution. We present in this study an understanding of the mesoscale circulation in LA-MS coastal region and in particular the combined effect of the lake and shape of the coastline. The Penn State/NCAR Mesoscale Model (MM5 version 3.1) was used with several options including multiple nesting and several convective and boundary layer parameterizations, as a modeling tool to investigate mesoscale wind flow patterns in the study area. Two cases of mesoscale circulation during the summer of 1999 were selected for numerical simulations (24 July and 17 August). The study suggested that the MM5 model is suitable for numerical studies of sea-breeze circulations and it is capable to simulate diurnal variations of wind patterns and convective cloudiness. Results will be presented and discussed.

(77)
TECHNOLOGICAL ADVANCES AT THE LOWER MISSISSIPPI RIVER FORECAST CENTER -USING GIS TECHNOLOGY. Keith Stellman , Amanda Roberts, and Dave Reed. *NOAA, National Weather Service, Lower Mississippi River Forecast Center, 62300 Airport Road, Slidell, LA 70460*

The National Weather Service (NWS) is responsible for supporting the nation's welfare and economy by issuing river and flood forecasts and warnings. To do this, the NWS has 13 River Forecast Centers (RFC) in the United States. The Lower Mississippi River Forecast Center (LMRFC), located in Slidell, LA, is responsible for issuing routine river and flood forecasts at over 170 locations daily and over 30 locations when rivers are expected to exceed flood stage at these locations. The NWS uses hydrologic computer models on state-of-the-art technology to prepare these forecasts.

The LMRFC collects, processes, and analyses a large amount of data. To keep its users informed, the LMRFC prepares a significant number of products using ArcView. These products are used internally at LMRFC and within the NWS and may be posted to the LMRFC webpage. Products prepared using ArcView include: precipitation estimates from the NWS WSR-88D Radar for time periods ranging from hourly to yearly; contoured observed precipitation for time periods ranging from daily to yearly; monthly normal precipitation maps and departure from normal; forecasted precipitation in 6-hour increments for 24 hours in the future including gridded model output; and maps displaying the status of river forecast locations to name a few. We will demonstrate this technology and how it is integrated into LMRFC products and services.

(78)
REGIONAL CLIMATE MODELING IN THE SOUTHEASTERN UNITED STATES. Loren D. White, *Jackson State University, Jackson, MS*

Besides their application to long-term large-scale issues such as global warming, numerical "climate models" are increasingly being developed to study and predict anomalous conditions on seasonal and interannual timescales. A complex regional climate model developed at Florida State University (the FSU Nested Regional Spectral Model) has been used at Jackson State University to examine issues of climate predictability and forcing over the Southeastern

U.S. Most emphasis has been on the interrelationship between surface forcing from the ocean (e.g. El Nino) and from the land surface (e.g. soil moisture). Sensitivity of model results to specifics of the domain choice was also investigated in one set of winter season experiments. A unique approach to "ensemble" model forecasts has been explored by variation in the details of the initial soil moisture and temperature conditions. This technique provides a useful means of determining the degree to which model forecast uncertainties over specific regions may be attributable to uncertainties in the initial conditions of the land surface. Finally, experiments which vary the number of vegetation types modeled within the domain will be discussed. Especially at high horizontal resolutions, the question of how many vegetation types "need" to be recognized by a climate model is currently unknown and can most likely be resolved by many numerical experiments of this type.

APPENDIX D

TRADE FAIR

Below is a list of private and government organizations that participated in the trade fair. The goal of the organizations was to recruit students for internships, as well as potential graduates/ professionals for full-time employment. Students networked to establish relationships with universities and companies to pursue potential research/training opportunities.

1 U. S. Environmental Protection Agency
2 Lockheed Martin
4 Mississippi-Alabama Sea Grant Consortium
5 U. S. Navy Office Programs
6 American Association for the Advancement of Science
7 National Data Buoy Center
8 JobDirect.com
13 NOAA Chesapeake Bay Office
14 U.S. Army Corps of Engineers - Vicksburg District
15 NOAA National Weather Service
16 National Imagery and Mapping Agency
17 National Marine Fisheries Service
18 Chevron Refinery
20 Biosphere Atmosphere Research & Training, BART
21 West Valley Nuclear Services Company
22 NOAA Grays Reef National Marine Sanctuary
23 Department of Commerce - NOAA
24 Immigration and Naturalization Service
25 MS Space Commerce Initiative
26 Science and Engineering Alliance
27 JSU Center for Business Development & Economic Research
28 Jackson State University
29 JSU Department of Urban and Regional Planning
30 Morgan State University/P2K
31 Mississippi Consortium for International Development (MCID)
32 U. S. Army Research Laboratory

APPENDIX E - LIST OF ATTENDEES

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