

## *Sharks* — Lack of Data Makes Management Difficult

by Trey Driggers

Forty of the approximately 390 species of sharks are caught in the targeted shark fishery and as bycatch in other fisheries along the southeastern coast of the United States. Very susceptible to overfishing because of their low fecundity (production of offspring), late onset of maturation, and slow growth, many shark populations are declining and stronger management initiatives are being proposed. Populations of some species—the basking shark (*Cetorhinus maximus*), white shark (*Carcharodon carcharias*), bigeye sand tiger (*Odontaspis noronhai*), sand tiger (*Odontaspis taurus*), and whale shark (*Rhincodon typus*)—have become so decimated that directed fishing is prohibited. A major problem in the management of these fishes is the lack of biological data. As a result, fishery managers are forced to make assumptions about the life histories of the majority of the species based upon what is known about those few species that have been studied to a greater extent.

As a Ph.D. student in the Marine Science Program at the University of South Carolina, I have been collecting blacknose sharks, *Carcharhinus acronotus*, from South Carolina coastal waters for the past year. The objective of this study is to investigate the reproductive strategies of the blacknose shark and gain information on growth rates, age at first maturity, fecundity, and longevity. An additional component of (see *Blacknose Sharks* p. 6)



Sharks caught by SC DNR in the course of other studies are measured, tagged, and released. Those too large to be handled, such as this sandbar shark, are tagged in the water. Tags request that anglers send information to DNR on where the shark was caught and its measured length.

### *Marine Information Processing*

#### **New Lab Will Provide 21<sup>st</sup> Century Research Tools for Undergraduates**

Marine Information Processing (MIP) is the application of the technologies of remote sensing, digital image processing, global positioning systems (GPS), geographic information systems (GIS), geostatistics, and telecommunications to marine science. When combined with traditional estuarine and oceanographic measurements, experiments, and scientific hypotheses, MIP provides powerful tools for examining, evaluating, and modeling distributions and processes in the marine environment. Although this technology has been an integral component of many research projects by faculty, MIP concepts in the existing Marine Science laboratory exercises either have been taught by “piggy-backing” these exercises on individual faculty research equipment or taught using navigation charts, maps, photographs, and slides of regional and global patterns of weather, currents, and distribution patterns of oceanographic variables.

That is about to change. Baruch Associates and Marine Science Program faculty members Drs. Björn Kjerfve, Stephen Stancyk, and Dwayne Porter received a competitive grant from the National Science Foundation to acquire the infrastructure necessary to

(see *21<sup>st</sup> Century Tools* p. 7)



Baruch Briefs January-May 1999  
A. B. Miller, editor

### *From the Director*

## **Momentum is increasing !**

So far, this has been a great year, and should lead us into the next millenium in grand style! Our plans for the extension for the Baruch Marine Field Laboratory are falling into place, as we have secured the last of the necessary funds and enter the design phase. Grant funding is up by 67% compared to last year at this time. We continue to cultivate collaborative research activities with our first Visiting Scientist Award and an increasing range of projects at the Field Laboratory. Our support of the education program at USC is also expanding. For example, this year we conducted our first teleconferenced marine science course between the Columbia campus and the Field Laboratory. Outreach programs have also expanded and include a new series of workshops on coastal issues for decision-maker and interested environmental groups. Our eyes are cast forward as we build on this momentum, but we are also reflecting upon our past, as this year celebrates the 30<sup>th</sup> anniversary of the Baruch Institute. We owe much of our success to many of you readers—and we look forward to continuing to work with you as we move toward an even brighter future!



*Madlyn J. Fuchs*



## **North Inlet-Winyah Bay NERR NEWS**

In line with the National Estuarine Research Reserve System's plan to add weather monitoring to the System-Wide Monitoring Program (NERR SWMP), our site, along with two others, is serving as a test site to evaluate the realistic time and effort demands required by the addition of this component to existing duties. Over the course of several months, North Inlet-Winyah Bay NERR staff worked with other Baruch Institute personnel to effect a smooth transition in handling site weather data, which has been collected by the Institute for many years. The NI-WB NERR assumed the responsibility for collecting and managing this data on January 1. Plans to improve the site weather station are already in the works. First quarter 1999 weather data are available through the NI-WB NERR in combination with the many years of weather data formerly collected under the Institute's Weather Research Program. The plans are to update future weather data monthly but shorter term weather data can be provided to suit individual needs.

This year about half of the 23 NERR sites around the country will be participating in a project funded by the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) to test the performance of a field-deployable chlorophyll-*a* probe developed by YSI. Sites will obtain chlorophyll-*a* measurements under a wide range of field conditions using this probe and compare them with measurements from matched samples processed using more traditional laboratory analyses. Largely as a result of the quality of system chlorophyll information the local site has produced with its ongoing Water Chemistry Monitoring Program, the NI-WB NERR has been selected to consolidate the national-level information being collected under this initiative and prepare the summary technical and scientific presentations.

Evan Chipouras, the NI-WB Research Coordinator, was appointed to the NERR System's three-member Research Coordinator Executive Committee for a three-year term. Later this year, he'll assume the Chair of that committee and begin representing the NERR research contingent interests from all 23 NERR sites at their national association meeting as well as at other NOAA-NERR meetings.

Funding for two new Graduate Research Fellowships were made available for research associated with the North Inlet-Winyah Bay National Estuarine Research Reserve (NI-WB NERR) site. The NI-WB Reserve received more than twice the applications

## ***Congratulations!***

We are pleased to recognize these outstanding Baruch Associates and students who have received awards for their research, teaching, or community service.

### **John R. Carpenter**

The Neil Miner Award, a lifetime contribution award, by the National Association of Geoscience Teachers

### **Timothy A. Mousseau**

University of South Carolina Mortar Board Excellence in Teaching

### **Sarah A. Woodin**

University of South Carolina Russell Award for Research, Science and Engineering; and University of South Carolina Distinguished Professor

### **Stephen E. Stancyk**

College of Science & Mathematics, Advisor of the Year

### **P.V. Sundareshwar**

American Society of Limnology and Oceanography Best Student Poster (with a \$500 prize)

## **Stormwater Management**

*(continued from p. 8)*

After a productive morning session, participants traveled to Murrells Inlet to observe and discuss stormwater challenges faced by this coastal community. They visited representative problem areas as well as community success stories, including the marsh-front property acquired by the Murrells Inlet 2007 group with the County's support. The property will be retained as open space and eventually will be tied to the creekside boardwalk.

These coastal issue workshops are very effective means for exchanging information among scientists, environmental planners, regulatory officials, and community leaders. The Reserve and OCRM are planning future workshops and welcome suggestions for topics.

## **Rittscof Baruch Institute Visiting Scientist**

Dr. Dan Rittschof, Associate Professor of Zoology and Director of Graduate Studies, Program in Ocean Sciences, Duke Marine Lab, was selected from among several applicants to receive the Baruch Institute Visiting Scientist Award. This new, competitive award, made possible by a gift from the USC Class of 1932, provides a \$5000 award for an established scientist to conduct research for at least one month in residence at the Baruch Marine Field Laboratory (BMFL).

Dr. Rittschof's foci of research are the functions, mechanisms, and evolution of chemical signaling and communication systems. In both laboratory and field studies of chemically stimulated behavior and chemical ecology with locally abundant organisms emphasis is placed upon basic and potentially practical studies.

He used this award to investigate chemical settlement cues in soft-bottomed environments. One of the most compelling questions regarding development and maintenance of invertebrate populations in specific soft-bottom environments is how dispersal stages locate and recognize suitable habitats. Dr. Rittschof hypothesizes that many organisms recognize specific and highly conservative indicators of settlement habitats, and he used in situ diffusional chemical release systems to test the hypothesis that two chemical signals fundamental to organically rich soft sediment habitats cue colonization by invertebrates.

This field program tested sulfide and organic enrichment (bacterial culture nutrient broth). Chemicals were released (via diffusion) from gelled soft substrates at ecologically relevant concentrations. End points for determination were active burrowing into the gels. Initial experiments were a paired control versus treatment design based upon successful preliminary experiments on colonization of soft substrates at the Juan de Fuca Ridge in 1995. Data gathered from short-term deployments (6-48 h) will be used by Dr. Rittschof to assess the role and effective concentrations of chemicals as the basis for further study.

## **Extension for the BMFL Enters the Design Phase**

The competition was keen, but in the end a Pawleys island firm, Tyche and Walker Architects, LLP was selected to design the extension to the BMFL. The approximately 3500 sq ft extension will be used for office, education, and laboratory space for the North Inlet-Winyah Bay National Estuarine Research Reserve headquarters.

The extension will house NERR Reserve staff offices; a learning center (class room, continuing education programs); a monitoring equipment laboratory (services, downloading data loggers, etc. and instruction and education related to equipment and monitoring); and a library with computer-equipped carrels for study and research.

The National Oceanic and Atmospheric Administration's Estuarine Research Division has provided 70% of the funds and USC has provided the required 30% matching funds.

The target date for occupation is before the end of this calendar year.

## NERR NEWS

(continued from p. 2)

received by any other site, attesting to the value of this location and the facilities of the Baruch Marine Field Lab for graduate students to conduct research projects.

On June 1, Rebecca Ellin and Rich Lehnert, both from USC, will be the newest NI-WB NERR Graduate Research Fellows. They will both be conducting one-year research projects and also be participating in the Reserve's ongoing monitoring programs. Ellin will be studying the role of oyster reefs in the source-sink dynamics and transmission of planktonic *Perkinsus marinus*, and Lehnert will be conducting a study of the fish community associated with subtidal oyster shell, with implications for estuarine assessment. These Fellows join four Fellows from previous competitions: Tony D'Andrea of the State University of New York and Stefka Nikolova of USC are working in the NI-WB Reserve, and P. V. Sudareshwar and Chris Nietch are working at the ACE Basin NERR and using the BMFL to process their samples.

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## REMEMBER . . .



**SEA TURTLES are nesting**

**Please keep lights out on the beaches !**

## How Planned Giving Can Work for You

*and* the Baruch Institute



Supporters and friends of the Baruch Institute give to the Baruch Institute for many reasons. Some wish to continue to help provide research opportunities for our students. Others may want to support our outstanding research faculty or a particular educational outreach program. Whatever the reason, donors to the Baruch Institute share a common goal—to strengthen the Baruch Institute as a preeminent source for providing information critical to the wise use and management of our coastal and marine resources.

As many of you know, the Baruch Institute is in the midst of a capital campaign to raise \$1.25 million in support of our research and education activities. The opportunities for support are numerous. One of these opportunities is a gift made possible through estate planning. A planned gift can make a significant impact for the Baruch Institute and provide a way to give a gift larger than one may thought possible.

What many people do not know is that *you don't have to be wealthy to benefit!* These gifts can provide significant advantages for the donor during life while still ensuring that the beneficiary's interests are protected. Some little-known facts about planned giving follow:

The donor retains the use of all assets.

Current income can be increased with charitable trusts.

Capital gains taxes on highly appreciated property can be avoided.

A charitable trust can be used as a retirement plan.

A gift annuity or charitable trust can be used as an educational fund  
for children or grandchildren.

Charitable trusts can be used to manage assets for dependents.

The donor can deduct 100% of premiums for charitable gifts of insurance.

Estate taxes are saved with charitable bequests and trusts.

Assets can be passed tax free to heirs through charitable trusts.

This is a great way for individuals to plan for the future, for themselves and for the Institute, and I would be happy to answer any questions or provide further information on planned giving.

A handwritten signature in black ink that reads 'Tom Schlichtman'.

*Tom Schlichtman can be reached by telephone at 803 777 3920,*

*by e-mail at [toms@biol.sc.edu](mailto:toms@biol.sc.edu),*

*and by postal mail at Baruch Institute, USC, Columbia, SC 29208.*

*They're winners!*

## 1999 SC-GA Regional NOSB Winners Place Third in National Competition

Wando High School, from Mt. Pleasant, SC, took top honors in the South Carolina-Georgia regional competition of the National Ocean Sciences Bowl (NOSB) on February 13. But they didn't stop there! They also performed well at the national competition April 10-12, placing third behind defending national champions Lexington High School (Massachusetts) and Mount Carmel High School (California).

The Wando team members, Justin Sellers, Jack DeSlippe, Jeremy Zimmerman, Shawn Malone, and Greg Kinkade, coached by Julie Cliff, beat out 11 teams from throughout South Carolina and Georgia to become the regional winner and advance to the national competition. The SC-GA competition, held at the University of South Carolina, was one of 18 regional contests. The teams that advanced to the finals in

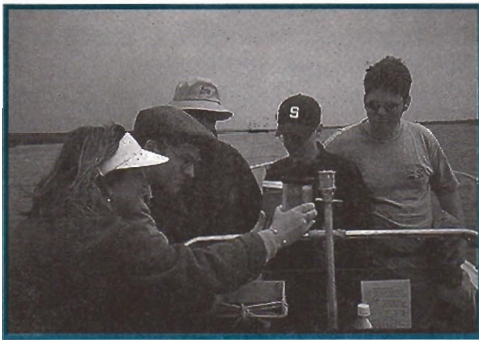
Washington, D.C., represented the best of the 1,200 students from 250 schools that competed regionally.

Both the regional and national competition tested knowledge of chemical, physical, biological, and geological oceanography, as well as historical and current events related to oceanography. The competition format was round-robin matches followed by double elimination rounds. In the national event, Wando was undefeated at the end of the round-robin matches and through the first two double elimination matches.

The Wando team also deserves recognition for having the "right" kind of competitive spirit. On the first night during dinner, the five team members seated themselves at five different tables in order to meet their competitors. They all stressed that the key to competing was to not get too uptight and to enjoy the competition. Obviously, they did.



**Wando team members (L to R): Shawn Malone, Greg Kinkade, Jack DeSlippe, Jeremy Zimmerman, and Justin Sellers, coached by Julie Cliff.**



**A two-day field trip April 5-6 to the Baruch Marine Field Lab gave the team an opportunity for some hands-on information gathering.**

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**Thank you!** The following organizations and individuals generously lent their support to the 1999 SC-GA Regional competition.

**Sponsors:** Belle W. Baruch Institute for Marine Biology & Coastal Research (USC), Bill Dukes, Consortium for Oceanographic Research and Education, Dixie Trophies, Georgia Marine Educators Association, Georgia Sea Grant Consortium, Georgia Wildlife Federation, Grays Reef National Marine Sanctuary, Greater Piedmont Chapter of the Explorers Club, Happy Bookseller, Jane Smith Turner Foundation, John Harris, NOAA Coastal Services Center, Simon & Schuster Publishers, Inc., South Carolina Department of Natural Resources, South Carolina Marine Educators Association, South Carolina Sea Grant Consortium, South Carolina Wildlife Federation, Spring Island Trust and the Lowcountry Institute, University of Georgia Marine Extension Service

**Supporters:** Belle W. Baruch Institute for Marine Biology & Coastal Research (USC), Charleston Math and Science Hub, Coastal Carolina University, College of Charleston, Gannett Television, Georgia Association of Marine Educators, Marine Science Program (USC), Midlands Math and Science Hub, NOAA Coastal Services Center, South Carolina Marine Resources Research Institute, South Carolina Sea Grant Consortium, University of South Carolina

**Volunteers:** Dennis Allen, Wendy Allen, Phil Astwood, Margaret Bergin, Sarah Boyce, Kurt Bretsch, Julian Burgos, David Cabrera, John Carpenter, Sara Christensen, Will Christensen, Jim Clark, Orinna Clark, Clint Cook, Melanie Culin, Carla Curran, Megan Dantzler, Nick Davidson, Margaret Davidson, Beth Day, Rick DeVoe, Teresa Donelan, Trey Driggers, Chris Ebert, Ed Ebert, Deirdre Edwards, Becky Ellin, Tali Engoltz, Bob Feller, Tara Fitzhenry, Madilyn Fletcher, Liz Galinis, Jim Gandy, Miguel Goni, Liz Gordon, Mary Jo Hartman, Traci Heincelman, Fred Holland, Dionne Hoskins, Arla Jessen, Bob Johnson, Wes Johnson, Paula Keener-Chavis, Megan Kelly, Elizabeth King, Robin Krest, Emily Lehr, Adam Leiterman, Barbara McCraith, Anne Miller, K. Morschauser, Steppen Murphy, Bryan Olson, Margaret Olson, Natasha Pratt, Kristine Priede, Stan Rachelson, Marcel Reichert, Amy Ringwood, Christie Robinson, Leslie Sautter, Mary Beth Sawyer, Tom Schlichtman, George Sedberry, Cecil Sharp, Becky Shuford, Bob Skinder, Virginia Smith, Jen Sparks, Steve Stancyk, Joe Staton, Gordon Stedman, Christie Stephans, Liz Strojny, Adena Teres, Sara Thieben, Jacob Tuttle, Paula van Schie, George Voulgaris, Jill Walker, Julianna Weir, Jennifer Weitzman, Lauren Whitler, Doug Williams, W. Williamson, Bonnie Willis, Wade Winterhalter, Robert Young, Richard Zinomar

# Blacknose Sharks (continued from p. 1)

Blacknose sharks range from North Carolina, USA, to Brazil and are of some, albeit minor, commercial and recreational importance. In the coastal waters of South Carolina they are relatively abundant from May through October. The maximum total length is approximately 160 cm (63 in). The world record blacknose shark, which was landed in Little River, SC, weighed 18.86 kg (41 lbs 9 oz).

additional component of this study is the investigation of the population structure of these sharks throughout their range.

Sampling for blacknose has been accomplished with the assistance of Glenn Ulrich and Doug Oakley of the SC Department of Natural Resources. I have joined their trips onboard the R/*Vanita* to locate and tag red drum, *Sciaenops ocellatus*. They are using longline gear (consisting of one mile of mainline and 120 gangions, equipped with 16/0 tuna circle hooks), which is fished for about an hour then retrieved, with a little hydraulic help, and the fish are removed from the hooks as each reaches the vessel. Sharks, which are considered bycatch, are measured (if possible), tagged, and released. (Tagging provides valuable information used to establish growth rates and elucidate movements of

the fish.) For my study, I have been able to sample their catch for blacknose sharks.

After a blacknose shark is captured, length and weight are recorded and the reproductive status and stomach contents are evaluated. After all pertinent measurements and information is collected, a section of vertebrae is removed from the shark, as well as tissue samples for genetic analysis. The vertebrae are used for age estimation, which in conjunction with other data will help establish growth rates, age at maturity, etc. These kinds of data are the basis for management of any fishery. Direct ageing relies on counting growth increments visible in hard parts such as spines, scales, bones, and otoliths (ear stones); however, since shark lack bones and otoliths, age determination of these

cartilaginous fishes relies on counting alternating translucent and opaque bands visible on vertebrae. One translucent and one opaque zone are together assumed to represent one full year of growth.

A preliminary analysis on the elemental composition of the vertebrae of these sharks has been completed. With the help of Dana Dunkelberger and Shaun Vose of the USC Electron Microscopy Center, we have determined that energy dispersive x-ray analysis will be of great assistance in verifying age estimates established in this study.

To date, samples from 64 blacknose sharks have been collected and analyzed. With assistance from other institutions, blacknose sharks will be collected this summer from the coastal waters of Georgia, Florida, and Brazil, and from the Gulf of Mexico. The resulting data will allow the determination to be made if blacknose sharks are one interbreeding population or if separate populations exist. Comparison of life-history information between blacknose sharks occupying different regions will also be made.

Age and growth studies focusing on sharks are difficult undertakings because the fishes are large, very mobile, difficult to collect, only present in a given area during certain seasons, and, quite frankly, do not appear to enjoy boating. This study will provide fisheries

## How old is that fish?

Fisheries biologists rely primarily on either length-frequency analysis or direct ageing to estimate the age of fishes.

Length-frequency analysis plots the number of fish caught versus their length. As normal distribution patterns become evident, the ages of the fish are assigned according to peaks in the distribution. This type of analysis is useful for separating the first few year classes; however, it is usually unreliable in separating older groups due to increased overlap in length distributions resulting from different growth rates.

Direct ageing is the most widely preferred method of age determination because age estimates are based on individual fish. This method of age determination relies on counting growth increments visible in hard parts such as spines, scales, bones, and otoliths.



The weight of each blacknose shark collected was recorded. Sampling was conducted from onboard the RV *Anita*, captained by Paul Tucker.



After measuring the shark's length, its reproductive status and stomach contents are assessed.

managers with the biological data on the blacknose shark they need to implement more effective management strategies.

Knowledge pertaining to the age and growth of each species within the fishery is of paramount importance to the proper management of sharks and the rational exploitation of the resource. Population dynamics analytical models, which serve as the foundation for management strategies, rely on accurate information on the age and growth rates of a stock or population of fish. These models provide critical information on recruitment, mortality rates, longevity, and reproductive potential, and, it is crucial that these models are based upon the best available biological data.

**An abbreviated list of sharks known to occur in the coastal waters of South Carolina**

Common Name	Scientific Name
Common thresher shark	<i>Alopias vulpinus</i>
Blacknose shark	<i>Carcharhinus acronotus</i>
Bignose shark	<i>Carcharhinus altimus</i>
Spinner shark	<i>Carcharhinus brevipinna</i>
Silky shark	<i>Carcharhinus falciformis</i>
Finetooth shark	<i>Carcharhinus isodon</i>
Bull shark	<i>Carcharhinus leucas</i>
Blacktip shark	<i>Carcharhinus limbatus</i>
Dusky shark	<i>Carcharhinus obscurus</i>
Sandbar shark	<i>Carcharhinus plumbeus</i>
White shark	<i>Carcharodon carcharias</i>
Tiger shark	<i>Galeocerdo cuvieri</i>
Nurse shark	<i>Ginglymostoma cirratum</i>
Smooth dogfish	<i>Mustelus canis</i>
Lemon shark	<i>Negaprion brevirostris</i>
Sand tiger shark	<i>Odontaspis taurus</i>
Atlantic sharpnose shark	<i>Rhizopionodon terraenovae</i>
Scalloped hammerhead	<i>Sphyrna lewini</i>
Great hammerhead	<i>Sphyrna mokarran</i>
Bonnethead shark	<i>Sphyrna tiburo</i>
Smooth hammerhead	<i>Sphyrna zygaena</i>
Spiny dogfish	<i>Squalus acanthias</i>

**In Memoriam**

**Jean Jackson Scully**

We were saddened to hear of the passing of a good, long-time friend to the Baruch Institute, Jean Taylor Jackson Scully. Mrs. Scully and her late husband, Leonard, who served as a Baruch Foundation Trustee for many years, provided valuable support to the programs of the Institute and the Baruch Foundation over the past three decades. In addition to securing support to improve the facilities of the Bellefield Nature Center, operated by the Belle W. Baruch Foundation, the Scullys were instrumental in the establishment of an endowment fund for the F. John Vernberg Scholarship Program, and provided support to enhance the Institute's Continuing Education Program. It is rare to find such passionate and generous individuals who devote their lives to charitable causes. We will surely miss the fiery, generous nature of Jean Jackson Scully.

**Reserve Education Activities for Summer**

Classes:

Coastal Ecology Classes for Children\*

The Fishes of North Inlet Estuary

How to Catch and Cook Crabs and Shrimps\*

Marsh-side Chats with Marine Scientists:

Little known Fishes and Shrimps from North Inlet Estuary

Oysters: Ecosystem Engineers

Classes require registration.

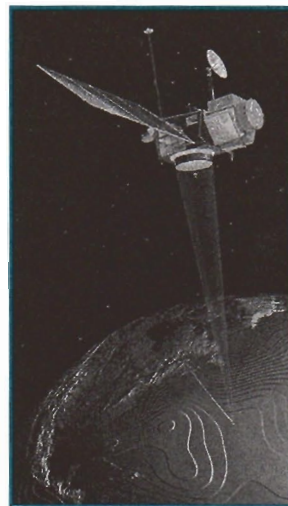
\* There is a charge for these classes.

For times, dates, age restrictions, and other info on classes or Chats call (813) 516-6210

**21<sup>st</sup> Century Tools** (continued from p. 1)

integrate MIP technology into the undergraduate Marine Science Program curriculum. The new MIP Lab will focus to a much greater extent on the use of computers, statistical and graphical data analysis and interpretation, and modeling. The priority has been to upgrade courses and laboratory exercises to include and integrate MIP technology into the curriculum because of its importance in marine research.

With this initial support from the National Science Foundation and with equipment and renovation support from the Dean's Office, College of Science and Mathematics, the MSCI Program will now be able to provide students hands-on experience utilizing MIP tools in lecture and lab settings by maintaining a 15-seat computer lab, a turn-key High Resolution Picture Transmission (HRPT) satellite imagery acquisition and processing station, computer software and hardware necessary for processing environmental data, and field-capable instruments, including laptop computers, radiometers, and hand-held global positioning system (GPS) units.



NASA-JPL

## Stormwater Management Addressed

Stormwater Management for Cleaner Coastal Waters was the subject of the second in the series of coastal issue workshops sponsored by the North Inlet-Winyah Bay National Estuarine Research Reserve and the Office of Ocean and Coastal Resource Management (OCRM), SC Department of Health and Environmental Control. Fifty people representing state agencies, coastal city and county councils, environmental groups, and private industry, participated in the workshop held March 19 at the Baruch Marine Field Laboratory.

Invited speakers addressed various aspects of this important issue. Dr. Dan Tufford from the University of South Carolina summarized results of the Urbanization and Southeastern Estuarine Systems Project. This project compares two similar estuaries: the essentially pristine North Inlet and urbanized Murrells Inlet. Information on Best Management Practices for minimizing impacts from stormwater runoff was shared by Ward Reynolds, an environmental planner with OCRM. The Belle Halle Planning Charette, a project that analyzed two different development scenarios for a parcel of land in Mt. Pleasant, SC, was summarized by James Hackett, Environmental Planner, OCRM.

Participants were particularly interested in the US Environmental Protection Agency's mandates for municipalities to develop stormwater management plans. Joe Fersner, Manager of Engineering and State Certifications, OCRM, and Arturo Ovalles, Environmental Engineer, SC Department of Health and Environmental Control, presented information on these mandates and more in "State and Federal Guidelines for Stormwater Management Along the Coast."  
*(see Stormwater Management p. 8)*



The afternoon field trip to provided the opportunity to observe and discuss stormwater challenges being faced by the Murrells Inlet coastal community. Trip leaders Tom Swatzel, Bill Chandler, and Hobie Kramer are seen here with Rosanna Howard.

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***MISSION** The Belle W. Baruch Institute conducts basic and applied research in marine and coastal environments—research that addresses the critical need for knowledge and improved understanding of these essential ecosystems. Our collaborative research efforts bring together scientists whose perspectives and expertise enable a more complete approach to wise use and sustainability. We are dedicated to fostering discovery, advancing existing knowledge, and providing a sound understanding of marine and coastal environments. Excellence in both basic and applied research of these complex and diverse ecosystems is the governing principle.*

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