

# Workshop on Estuarine and Coastal Science

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## INTRODUCTION

On 6 January 1998, eleven faculty representing nine colleges of the Keck Geology Consortium converged on Naples, Florida, for a four-day field-based workshop on estuaries. The workshop was sponsored by the Keck Geology Consortium, Rookery Bay National Estuarine Research Reserve (RBNERR), and Florida Gulf Coast University (FGCU). The workshop served two purposes: (1) to educate the faculty involved regarding estuarine and coastal science, emphasizing the interdisciplinary natures of such, and (2) to determine interest in and feasibility of a student-faculty research project at Rookery Bay. Thanks to the organizational skills and professional contacts of Michael Savarese (FGCU) and Ginger Hinchcliff (RBNERR), both goals of the workshop were accomplished.

## ASSOCIATION WITH RBNERR AND FGCU

Estuarine research is interdisciplinary by nature. Therefore, it is not surprising that the workshop attracted Keck participants having broad backgrounds in geology, including sedimentology, paleontology, geomorphology, and structure. The collaboration with RBNERR and FGCU broadened the field of expertise to include those with biological, environmental, educational, and resource-management specialties.

RBNERR provided an ideal location for a workshop on estuaries as well as an excellent and diverse staff. RBNERR is a research facility on Florida's southwest coast just south of Naples, one of the fastest growing cities in the U.S. The Reserve comprises 110,000 acres that include modern barrier islands and mangrove islands with many estuarine bays, oyster reefs, and freshwater feeder streams. Because of its location, the estuary is affected by urban growth, agricultural runoff, the introduction of exotic species, and change in patterns of groundwater flow and surface runoff. RBNERR is managed by Florida's Department of Environmental Protection and is one of NOAA's 21 National Estuarine Research Reserves, which are protected for long-term research and education. The Reserve staff is composed of 3 groups: research, resource management, and education. Current research includes monitoring of water quality, fisheries, and mangrove ecology. Staff would welcome more research on geological aspects of the estuary.

FGCU is a new university, opening its doors in Fall 1997. The university embraces the ideals of the liberal arts and stresses interdisciplinary education. The Natural Sciences faculty is committed to using and teaching an Earth-systems approach to solving environmental problems. Most of the students in their program will have strong ecological backgrounds. A Keck Geology Consortium-FGCU relationship would benefit faculty and students alike in promoting an interdisciplinary understanding of estuarine systems. Mike Savarese worked at RBNERR for one year and maintains research ties to the Reserve for himself and students.

## OTHER PARTICIPANTS

Two geological guests, Hal Wanless (University of Miami) and Lenore Tedesco (Indiana University - Purdue University at Indianapolis) shared their collective expertise on all aspects of Florida coastal sedimentation for three days. Through several talks and field activities, they wove together the current knowledge of Pliocene to Recent history of southern Florida, thus providing us with a geologic framework for understanding the distribution of modern coastal environments. The Naples area is underlain by Pliocene limestones, which we had a chance to observe during an afternoon field trip to a local quarry. Wanless described how coastal geology of Florida today reflects long-term sea-level rise; a decrease in the rate of rise about 3200 years ago coincided with extensive mangrove development, prograding shorelines, and reefs building to sea level. Since 1930, however, tide records indicate that the rate of sea-level rise has increased, one result being increased coastal erosion. Tedesco stressed that catastrophic events (fires, freezes, and especially, hurricanes) greatly modify communities and sedimentation patterns.

The occurrence of shell lenses in sediment cores have been interpreted as evidence of earlier hurricanes.

Both Wanless and Tedesco emphasized aspects of the geological history that could lead to both short-term and long-term projects for undergraduate students. For example, little work has been done in the estuary to document the sea-level rise or catastrophic events. One of Wanless' students (Martin Perlmutter) has completed a dissertation on sedimentation history in the Ten Thousand Islands area, just to the south of Rookery Bay; this thesis could be used as a guide for student research. Baseline studies of beach profiles and sedimentation patterns are sorely needed throughout the area given the potential for catastrophic change (historically, on average, South Florida has been affected by a hurricane every 7.5 years) and long-term steady change due to the increased rate in sea-level rise.

In addition to Wanless, Tedesco, and staff and faculty from RBNERR and FGCU, Savarese and Hinchcliff invited other guests who have research experience at or near the Reserve. Participants came from universities and government institutions, and represented interests including archeology, soils, botany, and nutrient fluxes in coastal environments. These participants, along with those from RBNERR and FGCU, are listed in the table on the following page; their diverse backgrounds promoted much interdisciplinary discussion and a learning atmosphere for all concerned. They participated in discussions and field activities as permitted by their schedules.

## WORKSHOP ACTIVITIES

Workshop activities struck a balance among lecture, field trips, discussion, and conviviality. On Tuesday evening, Mike Savarese and Mona Wright hosted a reception and dinner for Keck Consortium faculty, which gave us the opportunity to meet the organizers and special guests. The cassoulet and company were outstanding and energized us for the following four full days of activities.

**Wednesday, 7 January.** All participants convened at RBNERR headquarters where Gary Lytton described the mission of Reserve. Hal Wanless and Lenore Tedesco then set the geological stage for all subsequent discussions and field excursions, as discussed above. After a 45-minute drive to the north, we arrived at the FGCU campus, complete with its signs reminding everyone that alligators live on campus (the newly built campus retains many natural areas to be used as campus laboratories). A discussion of the philosophy of the university was followed by a tour of laboratory facilities and campus ecosystems. A short drive brought us to a quarry where we spent the rest of the afternoon examining the Tamiami Formation, which represents Pliocene equivalents of many environments of offshore areas of the Reserve. A variety of Pliocene fossil bivalves, serpulid worms, and sponge borings undoubtedly have found their way to the collections of the represented Keck schools. The long day was brought to a close back at RBNERR headquarters with an entertaining talk by Ted Below on the coastal birds of the Reserve.

**Thursday, 8 January.** Michael Shirley greeted us the next morning with a presentation about water quality and water-flow patterns, and efforts at the Reserve to restore/maintain estuarine flow. Inclement weather forced a change in plans; the scheduled all-day excursion to the outer islands changed to a shorter boat trip through the protected estuary. Along the way, Hal Wanless skillfully demonstrated the art of underwater sediment coring. Rain drove us inside where Lenore Tedesco and Hal Wanless continued their account of coastal geology. A break in the weather permitted an impromptu tour by Dolph Widmer (University of Houston) of an archeological site that evidences prehistoric use of Rookery Bay.

**Friday, 9 January.** Michael Savarese and Larry Brand (Rosenstiel School of Marine and Atmospheric Science, University of Miami) began the morning relating their ongoing studies. Mike is interested in the establishment and productivity of oyster reefs throughout the Reserve. Larry presented his hypothesis to explain grass die-offs in Florida Bay, which he believes relate to groundwater introduction of phosphates, the origin of which is far to the north. Both talks fit in well with the geologic framework constructed by Wanless and Tedesco.

We then piled into cars, each equipped with a resident expert, and set off to the South Golden Gate Estates, a wetland area that had been slated for development and drained by a system of canals in the late 1960s; few residences have been built, but flow patterns have been greatly modified. Here, Jim Burch (RBNERR) and Howard Yamataki (U.S. Dept. of Agriculture) provided expert commentary on a variety of topics including cypress-swamp and short-grass prairie ecology, changes in water-flow patterns as evidenced from soil types, and restoration efforts.

In the late afternoon, the group traveled via boat to Canon Island where several of the experts from RBNERR and FGCU led us on a nature walk around the island. A house on the island serves as a live-in field station for RBNERR researchers; for our group, it served as a dining facility featuring fantastic Cajun fried turkey (three varieties no less)—a culinary first for all Keck participants. Following an evening talk on sea turtle nesting behavior by David Addison (The Conservancy of Southwest Florida), we boarded the boats for nearby Keewaydin Island for a moon-lit walk on the beach, a chance to collect shells, and a glimpse at mating horseshoe crabs.

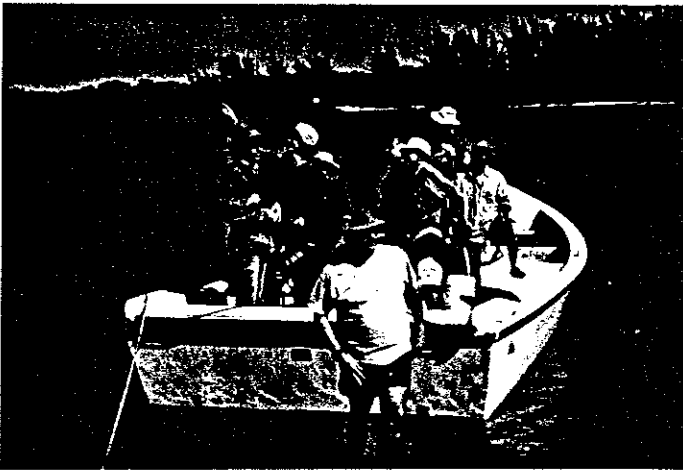
**Saturday, 10 January.** Saturday morning brought us back to the boats and heading out to oyster islands exposed at low tide. Sieving of subtidal sediment left the screen filled with a variety of infaunal invertebrates. Under Ginger Hinchcliff and Steve Theberge's excellent guidance, we successfully set out nets for trawling, catching a diverse assemblage of invertebrates and fish (Fig. 1). Steve's heroic ability to lecture about aquatic wildlife while his hand was partly imbedded in the mouth of a skate will be remembered by all. We had one more chance to study barrier-beach processes before returning to headquarters (Fig. 2).

The afternoon was reserved for discussing interest in student-faculty research projects for the summer of 1999 and beyond. Most of the faculty present indicated interest and potential to probable involvement in such an endeavor. We agreed that Carol Mankiewicz would write a proposal for a 1999 project; others will probably carry that task on in future years. Mike Savarese will approach NSF for additional funding to involve FGCU students and faculty, thereby promoting a greater chance for interdisciplinary pursuits.

All agreed that the workshop was a success.



**Fig. 1.** Steve Theberge shows the group a horse shoe crab, one of many animals caught while trawling.



**Fig.2.** Part of the group gets ready to disembark to study beach processes.

Participant	Affiliation	Interests and *Specialty Shared with the Group
David Addison	The Conservancy of Southwest Florida	Plant biology and community ecology; wildlife biology; *sea turtle nesting behavior; *plants of Cannon Island
Ted Below	RBNERR	Ornithology; *coastal birds of Rookery Bay
Larry Brand	University of Miami	Ecological research, primarily on algae; *nutrient quality and cycling in coastal environments
Jim Burch	RBNERR	Wetland ecology; botany; management and restoration of terrestrial ecosystems; *all discussed on field excursions
Peter Corcoran	FGCU	Environmental education
Win Everham	FGCU	Tropical botany; forest ecology; exotic plant mitigation; environmental education; *all discussed on FGCU campus tour of habitats and Cannon Island nature walk
John Fitch	FGCU	Ornithology; behavioral ecology; environmental public policy and management; *FGCU campus tour of habitats
Donna Henry	FGCU	Science educational methodology; human physiology; *philosophy of FGCU
Ginger Hinchcliff	RBNERR	Environmental education; ecotourism; technology in education; *field guide throughout the Reserve; *Reserve biology
Todd Hopkins	RBNERR	Fish biology and physiological ecology; impact of water flow on estuarine fish distribution and abundance
Gary Lytton	RBNERR	Estuarine/watershed management; native biodiversity and resoration; coastal land-use decisions; *mission of the reserve
Diane Murray	RBNERR	Community outreach and education
Nancy Nalley	RBNERR	Mangrove ecology; shoreline erosion
Pat O'Donnell	RBNERR	Fisheries biology; juvenile fish taxonomy
Michael Savarese	FGCU	Paleobiology; physiological ecology and biomechanics of benthic invertebrates; *effects of changes in estuarine water quality on oyster reefs
Angela Shekell	RBNERR	Fisheries research
Michael Shirley	RBNERR	Resource management/ecosystem resoration; eco-toxicology; *wetland and and estuarine flow restoration
Heather Stoffel	RBNERR	Water quality monitoring; crab larval recruitment and reproductive biology; effects of pesticides on non-target species
Steve Theberge	RBNERR	Education; *field guide for estuarine aquatic biology and ecology
Randolph (Dolph) Widmer	University of Houston	*Prehistory and archeology of southwestern Florida
Howard Yamataki	U.S. Dept. of Agriculture	*Soil morphology and its use in interpretation of landscapes for wetland and agricultural purposes

**Table 1.** Additional participants.