

Sounding Line

News of the Florida Keys National Marine Sanctuary

Winter 2002

Ice Age Forest Discovered in Sanctuary Waters

Nancy Diersing, Sanctuary Education Specialist

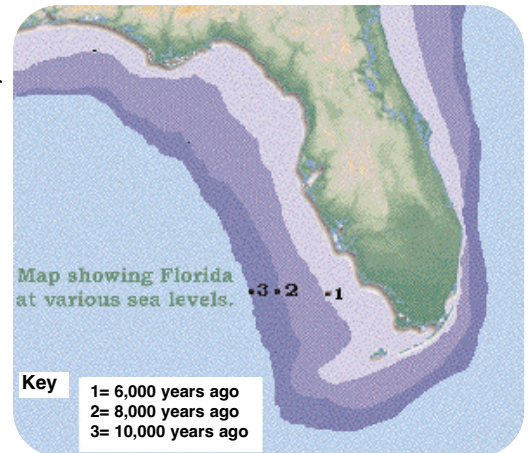


Archaeologist Corey Malcom measures wood at the New Ground site. (Photo: Dylan Kibler)

“Our immediate thought was that it was dunnage or firewood from a ship, and this generated excitement among the team members. Further excavation, though, just left everyone feeling perplexed,” commented Corey Malcom, Director of Archaeology for the Mel Fisher Maritime Heritage Society (MFMHS), in reference to the piece of aromatic pine that was brought to the surface last summer by George Robb, founder of RPM Nautical Foundation and supporter of the MFMHS.

The archaeological team came across the pieces of wood during their pursuit of artifacts from the slave ship, *Henrietta Marie*, which sank off Key West in 1700. They received a permit from the Sanctuary to excavate the small sandy area in 45 feet of water after detecting magnetic anomalies at that location during an earlier survey conducted from the surface. The team had hoped to find cannons from the

Henrietta Marie at the New Ground site, but instead came across an unusual layer of marly sediment containing bits and pieces of organic material, tree branches, a pine cone, small snail shells, and oysters. The snail shells and oysters, which were attached to wood in some cases, did not appear to be modern marine creatures. “Suspicious arose that this might be something completely unrelated to the *Henrietta Marie* and represented a time well before the colonial period,” recalled Malcom.



Map showing Florida at various sea levels.

Key
1= 6,000 years ago
2= 8,000 years ago
3= 10,000 years ago

The shoreline of Florida has fluctuated, depending upon sea levels. Prehistoric Florida was much larger than today.

(Coastline map: State of Florida Division of Historical Resources)

In fact, radiocarbon analysis of samples from the site confirmed them to be yellow pine and red mangrove wood about 8,400 years old. Unexpectedly, the archaeologists had uncovered a portion of earth that was exposed during the Pleistocene Ice Age when sea levels were lower and the Florida peninsula was much larger than today (see map). At this time, Florida’s drier, cooler climate supported extensive pine and oak forests and local prairies, depending upon the elevation of the land and its proximity to water. As the earth began to experience a warming period about 12,000 years ago, the polar ice caps started to melt, causing the sea level to rise. By 2,000 years ago, much of what had been dry land was submerged and buried under sediments over time.

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Message from the Superintendent



Dear Readers,

Happy New Year! I hope each and every one of you had a wonderful holiday season and are looking forward to an exciting 2003. As 2002 has come to a close, the Sanctuary Team looks back on a year of major accomplishments: the designation of the no discharge zone, the world-class coral reef restoration of the *M/V Wellwood* grounding at Molasses Reef, and the international recognition of the Sanctuary as a Particularly Sensitive Sea Area (PSSA). None of these accomplishments would have been possible without the hard work of our many agency and private partners, as well as our public supporters. Thank you all for a wonderful year!

The lead article in this issue of Sounding Line, *Ice Age Forest Discovered in Sanctuary Waters*, rekindles fond personal memories. As a graduate student at Texas A&I (now Texas A&M) in 1967, working with my teammate and good friend Dr. John W. (Wes) Tunnell, we made a similar, startling discovery. Our underwater research focused on the mollusks and fish of a sedimentary rock reef located in 46 feet of water, 2 miles off the coast of Padre Island, Texas. Wes was studying the mollusks and I was studying the fish. On one dive, we were swimming along, shoulder-to-shoulder, when Wes lifted what appeared to be a rock. We both reacted and could not believe our eyes. The "rock" was a fossilized Pleistocene Columbian mammoth tooth, in perfect condition. Before our biological research on the reef was completed, we had already published a paper on the discovery of 7 species of late Pleistocene mammals that had become embedded in the rock reef about 10,000 years ago. It's hard to imagine what this continent's coastline looked like when the sea level was that much lower than it is today. At about the time yellow pine and red mangroves were growing in the vicinity of the New Ground site, where the *Henrietta Marie* later floundered and sank, Pleistocene mammals were watering in a bog off the Texas coast.

This discovery is an excellent example of how the various science disciplines such as geology, biology, ecology, and archaeology overlap. It represents the junction between the natural environment, the physical environment, and the effects of the forces of time and energy on both of them. It also serves as a reminder of the importance of utilizing sound scientific principles and accepted scientific methodologies in the pursuit of answers to complex questions. Such discoveries reveal an often overlooked perspective on the relationship between humans and their environment. It is critical that we are able to tease out natural changes to earth's environment such as those described above as opposed to those changes that are exacerbated by mankind. Even in the big picture, we have to understand the details of what shapes planet earth.

It is important to note the role of the private and academic sectors in exploring and discovering exciting finds such as those associated with the site where the *Henrietta Marie* came to rest in 1700. Similarly, it is important to recognize the role of resource managers in representing the interests of the broader public when reviewing and permitting research proposals that can impact such non-renewable resources as cultural and archaeological artifacts. These historical and archaeological time capsules have much to reveal when the proper scientific methods are used to capture and record every piece of data. Good communication is critical between the scientists, explorers, and resource managers in order to preserve the scientific record on behalf of the public. Congratulations to Corey Malcom and his crew for a job well done.

Here's wishing you and your families a successful and prosperous New Year. Join us in our 2003 focus on water quality issues in the Florida Keys National Marine Sanctuary.

Sincerely,

Florida Keys National Marine Sanctuary

Billy D. Causey
Superintendent

Kacky Andrews
State Co-trustee

Sanctuary Advisory Council

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Local Elected Official

Fran Decker, **Vice Chair**
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Bruce Popham
Boating Industry

Richard Grathwohl
Charter Fishing-Flats Guide

David Hawtof
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Marine/Tropical

Tony Iarocci
Commercial Fishing-
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Nancy Klingener
Conservation and
Environment

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Environment

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Diving-Lower Keys

Todd Firm
Diving-Upper Keys

Martin Moe
Education/Outreach

Deborah A. Shaw
Research and Monitoring

R. Duncan Mathewson III
Submerged Cultural
Resources

Anita Schwessinger
Tourism-Lower Keys

Wayne Blevins
Tourism-Upper Keys

Vacant
Citizen at Large-Upper Keys

Vacant
Charter Fishing/Sport Fishing

Vacant
Recreational Fisher



PSSA Becomes Fully Effective in December

On November 13, 2002, Deputy Secretary of Commerce Sam Bodman announced the creation of a new 3,000+ square nautical mile zone of protection around the sensitive and vulnerable coral reefs of the Florida Keys. The measure, the first in U.S. waters and only the fifth worldwide, is intended to reduce the threat of large foreign flagged ships damaging coral reefs and seagrass meadows in the area. The Commerce Department's National Oceanic and Atmospheric Administration built the protection package through the International Maritime Organization over the past few years.

The Particularly Sensitive Sea Area (PSSA) became official on December 1, 2002. A major benefit of the new designation is that it provides international recognition of the "Areas to be Avoided" and no-anchoring zones meant to prevent large ships from damaging delicate coral reefs. Nautical charts of the Florida Keys published throughout the world must now display the PSSA designation and outline these protective measures.

Educators' Seminar Focuses on Keys Research

"I enjoyed learning about current projects that address Florida's water quality and coral reefs," commented Deanna Healy, a Coral Shores High School science teacher who attended the Sanctuary's Educators' Seminar held on Big Pine Key on November 16. "Without seminars like this one, it is easy for classroom teachers to get out of touch with current research."

The half-day seminar featured detailed presentations by Dr. Bill Kruczynski, U.S. Environmental Protection Agency scientist, and Dr. Erich Mueller, Coral Biologist with Mote Marine's Center for Tropical Research on Summerland Key. Dr.



Dr. Bill Kruczynski explains the Water Quality Protection Program to teachers. (Photo: Joy Tatgenhorst)

Kruczynski presented data used to evaluate water quality and provided an overview of the Sanctuary's Water Quality Protection Program, which outlines actions needed to reduce water quality degradation in the Sanctuary. Coral diseases and the trends in coral cover were discussed by Dr. Mueller, an expert in the cellular physiology of corals and related topics. Dr. Mueller also provided an overview of the **Marine Ecosystem Event Response Assessment (MEERA) Project**, which is designed to collect information about, and respond to, events that have the potential of harming the marine environment of the Sanctuary.

"Since water quality is essential for healthy reefs, the topics of corals and water quality tied together nicely," stated Sanctuary Educator Ivy Kelley, who coordinated the seminar. After a question and answer period following the presentations, teachers broke into small groups to discuss developing lesson plans to be used in the classroom with their students.



Surface Currents Connect South Florida and the Keys

Nancy Diersing, Sanctuary Education Specialist

The entire coastal ecosystem of South Florida is connected by water exchanges through the tidal channels between the Keys and by the patterns of stronger oceanic currents, according to scientists from the National Oceanic and Atmospheric Administration and the University of Miami's Rosenstiel School of Marine and Atmospheric Science. The interconnected coastal ecosystem consists of three distinct subregions: Florida Bay, a shallow lagoonal system of banks and mangrove islands; the Southwest Florida Shelf, an underwater extension of the Florida peninsula on the Gulf side; and the Florida Keys Coastal Zone, a narrow shelf on the ocean side which contains the Florida Keys coral reef tract and the Keys (Figure 1).

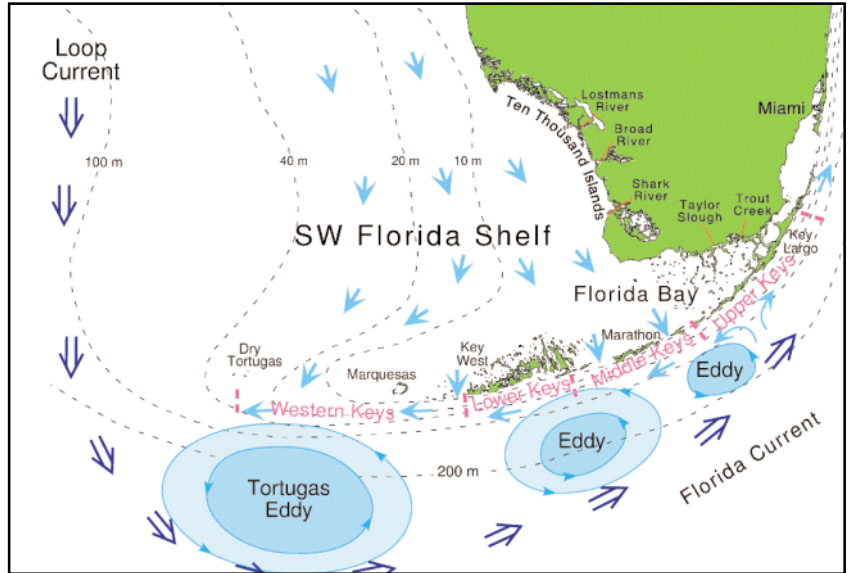


Figure 1. The southwest Florida Shelf, Florida Bay, and the Florida Keys form the three main subregions in the area. Note the Loop Current, which becomes the Florida Current on the Atlantic side of the Keys.

Eddies, temporary circular currents that spin off the larger oceanic currents, are found on the ocean side of the Keys and strongly influence the Keys Coastal Zone (Figure 1). In fact, these currents appear to be important for keeping marine larvae spawned in the Keys and elsewhere in the Caribbean in the region.

Scientists have measured flow rates through the Keys tidal channels for several years. These measurements indicate that the net flow of water is from the shelf/Gulf toward the reef tract, with most of the water moving through the Long Key and 7-Mile Bridge Channels (Figure 2). The intrusions of salty, cold Bay and shelf waters that flow toward the reef tract commonly during the winter dry season may remain intact well past the shallow reef and down to intermediate depths.

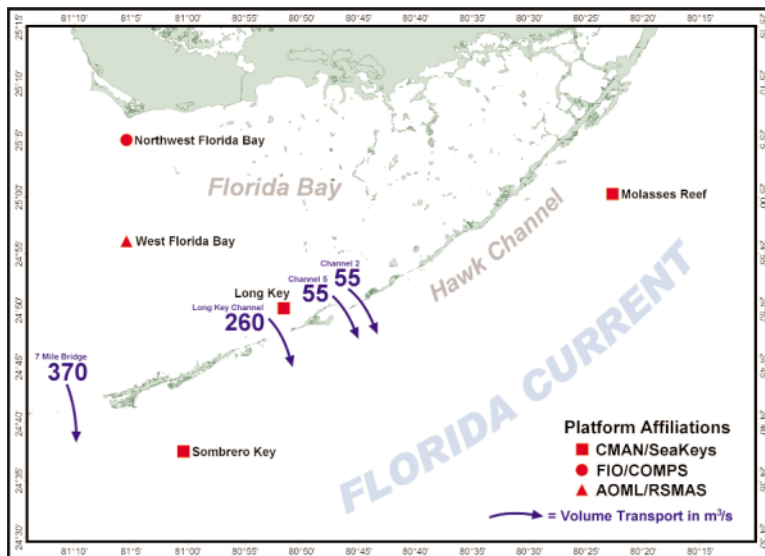


Figure 2. Arrows depict the average (subtidal) flow rates through the tidal channels of the Keys, measured in cubic meters per second. Average flow rates are greatest through the 7-Mile Bridge Channel.

Scientists have also been using surface drifters, which are released off of southwest Florida and tracked by satellites, to study the pathways of surface waters in South Florida. Based on several years of drifter data, they have concluded that there are three common pathways, which vary depending upon the season of the year. Generally, in the winter and spring, the primary movement of drifters is to the southeast through the channels between the middle Keys (Figure 3). In the fall, the typical pathway is toward the Dry Tortugas. During the summer months, drifters tend to move northwest off southwest Florida to join the Loop Current. After reaching the Keys coastal waters, drifters following all three pathways either recirculate in coastal eddies and

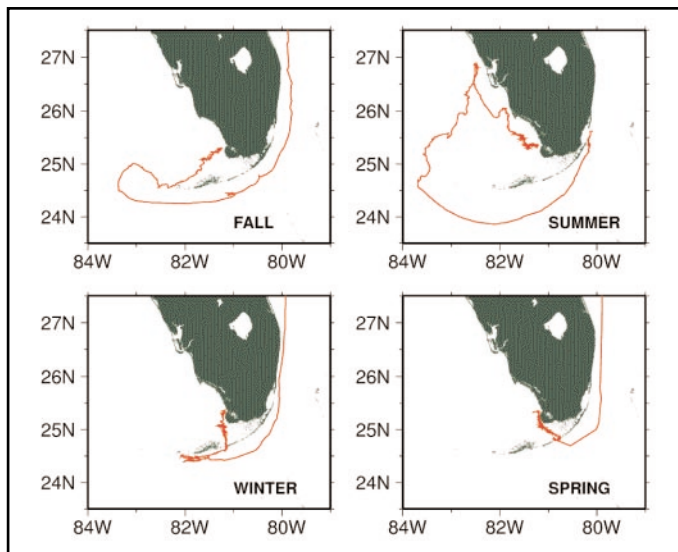


Figure 3. Satellite-tracked surface drifter trajectories help to trace the surface water flow through the region. Three common pathways are apparent based on drifter data collected over several years.

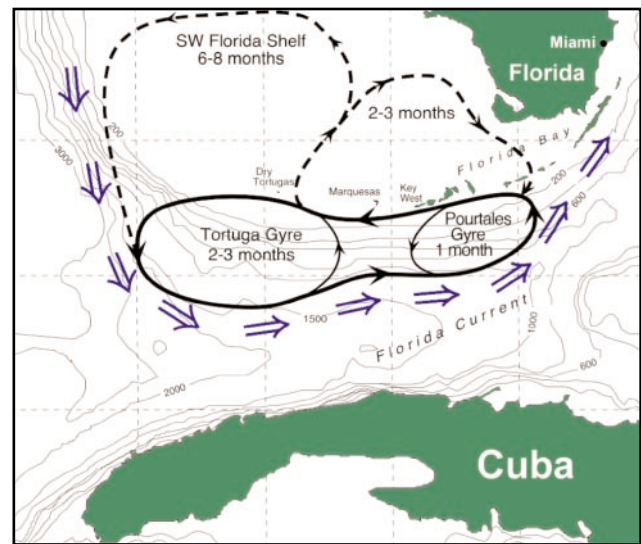


Figure 4. A schematic map portrays the regional circulation pattern. The Loop and Florida Currents are shown by the large open arrows. Approximate time scales are indicated within the various eddies.

wind-driven countercurrents for several months or become entrained in the Florida Current and are moved out of the coastal ecosystem (Figure 4). All pathways demonstrate that water from the Shelf/Gulf/Bay flows into the nearshore areas of the Florida Keys, underscoring the connectedness of the marine and estuarine environments in the South Florida region.

Note: The information and figures for this article were presented by Dr. Elizabeth Johns, NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML), at the Florida Keys National Marine Sanctuary Science Symposium in Washington, D.C. in December 2001. A written report, "Monitoring Circulation and Exchange of Florida Bay and South Florida Coastal Waters with Real-Time Data Links" appears in the **Sanctuary Science Report 2001**, available on the Sanctuary home page: www.fknms.nos.noaa.gov/research. The study is a joint effort between Dr. Thomas Lee, University of Miami Rosenstiel School of Marine and Atmospheric Science and Drs. Elizabeth Johns and Peter Ortner, NOAA's AOML. *Sounding Line* thanks Drs. Elizabeth Johns, Thomas Lee, and Peter Ortner for their contributions to this article.

Circulation and Currents in South Florida and the Keys

For more information about physical oceanography in the Florida Keys and South Florida, visit:

University of Miami Rosenstiel School of Marine and Atmospheric Science www.rsmas.miami.edu/research
 NOAA's Atlantic Oceanographic and Meteorological Laboratory www.aoml.noaa.gov/ocd/sferpm
 NOAA's Coastal Marine Automated Network (CMAN Stations) www.ndbc.noaa.gov/cman
 NOAA's National Data Buoy Center www.ndbc.noaa.gov

For information about science education in physical oceanography visit:

Ocean Science Education Resource Center, The Bridge www.vims.edu/bridge
 NOAA's Ocean Explorer www.oceanexplorer.noaa.gov
 NOAA Education Oceans and Coasts www.education.noaa.gov/socean.html
 NOAA's National Data Buoy Center www.ndbc.noaa.gov/educate/educate
 NOAA's Center for Operational Oceanographic Products and Services www.co-ops.nos.noaa.gov/about2.html



People Can Make a Difference in Water Quality

The Sanctuary Advisory Council (SAC) of the Florida Keys National Marine Sanctuary has named water quality as its number one priority. Why are citizens and resource managers so concerned about water quality? Simply put, degraded water conditions resulting from nutrient enrichment and pollution damage the seagrass and coral reef communities that are national treasures and critical to the fishing- and tourism- based economy of the Florida Keys.

What can individuals do to help restore water quality to the clean and clear conditions that once existed in the Keys? According to U.S. Environmental Protection Agency scientist Dr. Bill Kruczynski, "There are many ways for residents and visitors to help improve water quality. First, it is important to understand that the Keys are made of porous limestone rock. Any chemicals or pesticides that are deposited on the ground can seep into the underlying limestone rock, reaching the groundwater and then eventually the nearshore waters." In fact, the geology of the Keys makes it easy for substances to reach the nearshore waters by way of the groundwater in a very short period of time. Scientists have observed that when the tides change, the groundwater in the limestone flows back and forth, just like the water does in the passes between the islands. "Thus, if chemicals, detergents or pesticides must be used in the house or yard, use them sparingly and dispose of containers properly at hazardous waste sites," he added.



Using a pump-out station to properly dispose of sewage is one way boaters can reduce nutrient inputs to nearshore waters.

To decrease nutrient inputs into local waters, citizens should support efforts to improve sewage treatment to Advanced Wastewater Treatment (AWT) standards. High treatment standards will help restore water quality by removing nutrients. Approved treatment methods will also prevent bacteria that are potentially harmful to humans from getting into nearshore waters. Lower nutrient levels mean less chance of triggering a microalgal "bloom," or sudden population explosion of microscopic algae in the water column. Blooms reduce water clarity and often lead to lower dissolved oxygen conditions, which can be harmful to fish and other marine life. Lower dissolved oxygen levels occur after the microalgae die and begin to decay, a process that uses up dissolved oxygen in the water. Lobster and fish carcasses should be placed in the trash, not thrown back into the water, especially a canal, for the same reason--they use up dissolved oxygen during decomposition.

People who live, work and play on the water have a special responsibility to be stewards of clean water. Boaters should keep boat engines in good running condition and use pads to soak up bilge water, instead of pumping it out into nearshore waters. While underway, special precautions should be taken to stow trash and properly dispose of it on land. Old gasoline, used oil, old flares, used batteries, paint stripper and bilge pump switches containing mercury should be disposed of at proper hazardous waste facilities. Sewage generated on board should be pumped out at a marina pumpout service; it is a violation of Federal law to discharge sewage in the state waters of the Sanctuary. Marina owners can opt to join Florida's Department of Environmental Protection's **Clean Marina Program** which outlines procedures marinas can follow to protect Florida's coastal resources. By adopting the environmentally friendly landscape practices outlined by the University of Florida's **Yards and Neighbors Program**, home and business owners can decrease stormwater runoff from land into nearshore waters. Planting a berm of native vegetation along the shoreline to filter stormwater pollutants and reducing the amount of fertilizer used on lawns and golf courses are just a few practices suggested by the **Yards and Neighbors Program**.

Making a Difference in Water Quality

For more information about:

Household Guide to Coral Reef Protection
http://www.ficus.usf.edu/docs/guide_reefs/housguid.htm

Clean Boating Habits/Clean Marina Program
www.dep.state.fl.us/law/Grants/CMP/

Florida Yards and Neighbors Program
<http://monroe.ifas.ufl.edu/fyn.htm>



Reef Users Support SPAs

The true value of coral reefs and their colorful inhabitants is impossible to measure, but the economic contribution of reefs to four counties in Southeast Florida has been addressed in a recent study entitled *Socioeconomic Study of Reefs in Southeast Florida*. This study, conducted by scientists from the Florida Fish and Wildlife Conservation Commission and the National Oceanic and Atmospheric Administration with the support of the four counties involved, employed extensive survey research to calculate the economic value of natural and artificial reefs over a 12-month period for Palm Beach, Broward, Miami-Dade, and Monroe counties. To collect the necessary data, the survey was given to recreational boaters who visited the reef from June 2000 to May 2001 to fish, scuba, or snorkel. The study was designed to determine the use of artificial and natural reefs during the one-year period; willingness of reef users to spend money to maintain natural and artificial reefs; willingness to pay for additional artificial reefs; and socioeconomic characteristics. The study also calculated the economic contribution made by both natural and artificial reefs based on the money that users spent for reef-related activities such as fishing, scuba, and snorkeling.

For Monroe County resident reef users, the survey also included questions to assess user opinions about the Sanctuary's 24 fully protected ("no-take") zones, which were established to protect coral reefs in the Florida Keys National Marine Sanctuary in 1997. Seventy-eight percent of survey participants responded "yes" when asked whether or not they support the Sanctuary's "no-take" zones; and 57% said that they would support additional "no take" zones along Monroe County's coastline. Respondents indicated that, on the average, they would be willing to extend the "no-take" management tool to include almost 32% of all natural reefs off Monroe County. These statistics indicate support for the fully protected zones as a management tool. Residents of Palm Beach, Broward and Miami-Dade were also asked about the Sanctuary's "no-take" zones; 76%, 75%, and 74%, respectively, responded that they supported the current "no-take" zones in the Sanctuary. For more information about the results and methods used in the survey, please visit: <http://marineeconomics.noaa.gov/Reefs/>.

Prehistoric Forest, continued from p. 1

Some of the wood fragments obtained from the New Ground site showed evidence of being burned, indicating that the area had experienced fire, a common occurrence in today's modern pine forests. The black rocks that were recovered from the site were identified by Sanctuary scientist Harold Hudson as limestone that had been burned. This finding was later confirmed by Dr. Eugene Shinn, United States Geological Survey Scientist, who has published extensively on the geology of South Florida.

Although no evidence of human habitation has been found at the site, the possibility of finding Paleo-Indian artifacts or skeletal remains still exists. Paleo-Indians are known to have inhabited the Florida Peninsula beginning about 12,000 years ago, about the time the sea level began to rise. These early Floridians were hunters and gatherers who used the diverse food sources available. Evidence from the 9,600 year-old Cutler Fossil Site in Dade County shows that they adapted to hunting smaller game after the mammoths, dire wolves, shortfaced bears, and other large animals of Florida became extinct 11,000 years ago.

According to Dr. Robert S. Carr, Archaeologist for the Cutler Fossil Site and many others, "Evidence of Paleo-Indian (15,000-8,000 BC) and Archaic Period (8,000 to 2,000 BC) sites in the Florida Keys is thus far lacking. Undoubtedly, it will be underwater archaeologists who will make the initial discovery of these early sites, since rising sea levels have covered most of the land mass that was part of the present-day Keys." Malcom and his team from the Mel Fisher Maritime Heritage Society plan to continue their investigations at New Ground. "The hope is that interested scientists from the Sanctuary and elsewhere will join forces with us in the study of this small plot of prehistoric Florida."



Burnt limestone rocks were recovered from the New Ground site. (Photo: Corey Malcom)

Manatees Winter in the Keys



In the winter season, Keys residents and visitors may encounter West Indian Manatees swimming leisurely along the shoreline. Because these air-breathing herbivores are listed as a federally endangered species, marine scientists from the Florida Fish and Wildlife Conservation Commission's (FWC) Florida Marine Research Institute (FMRI) monitor their population levels and record all deaths and injuries due to boating accidents and natural causes. Manatees are slow-moving and therefore unable to swim quickly away from boats; the result is a collision that may cause injury or death to the manatee. In areas that are known manatee habitats, "no-wake" signs are posted requiring boaters to slow down and produce only minimal wake.

West Indian Manatees enjoy a plentiful food supply of aquatic plants. Please do not harass or feed manatees in the wild. For more information visit: www.floridamarine.org (Photo: Florida Park Service)

According to the FWC, there are several steps that you should take if you see a sick, injured, dead, or tagged manatee. Call FWC's Law Enforcement Hotline at 1-888-404-FWCC and give the location of the animal, whether it is alive, dead or injured, and how long you have been observing it. This information helps the FWC evaluate the situation.

The Florida Keys National Marine Sanctuary thanks those who contributed their articles, photographs, and editing expertise to Sounding Line newsletter. Sounding Line is produced on a quarterly basis by the Florida Keys National Marine Sanctuary. For more information or to be placed on the mailing list, email the editor at Nancy.Diersing@noaa.gov.



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