

Sounding Line

News of the Florida Keys National Marine Sanctuary

Summer 2004

Changes in the South Florida Ecosystem

Alex Score and Dr. Chuck Jacoby, University of Florida – Sea Grant Extension

The Florida Keys is a chain of islands extending 110 miles south from mainland Florida. Residents and visitors treasure the difference between the Keys lifestyle and the mainland's hustle and bustle, yet they should remember the two are connected. Drinking water carried by the aqueduct, the 18-Mile Stretch, Card Sound Road, and the intracoastal waterway are readily apparent physical connections. One connection that is often overlooked supports the marine waters, mangroves, seagrasses, coral reefs and fish that form a critical base for the lifestyle and economy of the Keys. This connection, which forms the core of the South Florida ecosystem, is a unique watershed known as the Kissimmee–Okeechobee–Everglades, or KOE, watershed.

What is a watershed? A watershed is an area of land that drains to a common endpoint. High ground separates watersheds, and water falling on different sides of the high ground travels to different endpoints. In the Pacific Northwest, mountain ranges rising several thousand feet divide many watersheds, but in Florida, elevations of only 10–20 feet separate most watersheds.

South Florida Ecosystem: Past

The KOE watershed appeared in its current form about 5,000 years ago when sea levels fell. The original watershed drained 18,000 square miles of land. By following drops of water flowing through a pristine KOE watershed, we can highlight connections to the Keys.



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The journey starts when rain falls near Turkey Lake, just west of Orlando. Water runs into the lake and drifts south through the Kissimmee Chain of Lakes. At one point, the water passes through Lake Tohopekaliga, where it may provide oxygen and food to a trophy bass lurking in the shallows.

Eventually, the water leaves the last lake in the chain, Lake Kissimmee, and enters the Kissimmee River. This pristine version of the Kissimmee River meanders south through many long, winding turns.

After a few days, the water reaches Lake Okeechobee, 730 square miles of shallow, highly productive water that supports fish, birds and other wildlife. If water levels are low, the water stays here until more rain causes the lake to overflow.

Eventually, enough rain falls to push the water over the southern bank of Lake Okeechobee. It passes through acres of custard apple trees growing in thick, mucky soil.

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**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
Citizen at Large-Middle Keys

Bruce Popham
Boating Industry

Richard Grathwohl
Charter Fishing-Flats Guide

David Hawtof
Citizen at Large-Lower Keys

Ken Nedimyer
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Marine/Tropical

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Nancy Klingener
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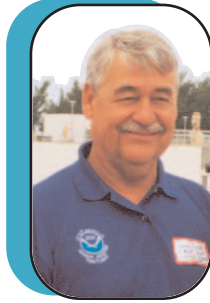
Anita Schwessinger
Tourism-Lower Keys

Wayne Blevins
Tourism-Upper Keys

Jack Curlett
Citizen at Large-Upper Keys

Captain Brad Simonds
Charter Fishing/Sport Fishing

Mark Klingbeil
Recreational Fisher



Dear Readers,

If there is any one concern that unifies people in the Florida Keys, whether they are visitors or residents, it is that good water quality is important to our coral reef environment and our economy. The issue of degrading water quality was so important that, as the Sanctuary was going through the congressional designation process, Congress directed the U.S. Environmental Protection Agency to work with the State of Florida and NOAA to develop the first-ever water quality protection program for a national marine sanctuary. When the Florida Keys National Marine Sanctuary and Protection Act of 1990 was signed into law, it was clear that there was a national interest in the water quality problems in the Florida Keys. Congress had codified into law a high-level Water Quality Steering Committee, whose task is to guide the development of the Water Quality Protection Program for the Sanctuary.

It became very apparent at the first meeting of our Sanctuary Advisory Council (SAC) in 1992 that SAC members too viewed water quality as a priority issue. The SAC recognized our water quality problems as they relate to nutrients entering our nearshore waters from stormwater runoff and inadequate wastewater treatment. They also recognized the threats from pesticides and other harmful pollutants as they degrade the quality of our marine environment. What was not anticipated was the direction the SAC took on pursuing what they thought was the greatest threat to our water quality.

Under the leadership of the late George Barley, Allison DeFoor, Mike Collins, Allison Farrer, Sandy Sprunt and 17 other knowledgeable citizens from the Florida Keys, the SAC began raising concerns about the problems with water quality upstream of the Florida Keys, especially in Florida Bay. By the early 1990s, Florida Bay had matured to a marine lagoon that was on the verge of ecological collapse. Previously, the bay had been a functioning and productive estuary where freshwater and saltwater mixed. The extensive canal system built on the South Florida mainland for flood control was preventing freshwater from reaching Florida Bay. The canal system presently in place effectively drains 80% of the rainfall that falls on south Florida, depriving both the natural environment and the built environment of the freshwater necessary to function.

The pressure exerted by George Barley, as the chair of the SAC, and other members, prompted Secretary of the Interior Bruce Babbitt to convene a meeting of the South Florida resource managers. They were charged with identifying problems and establishing ecosystem restoration goals. This meeting led to the establishment of the South Florida Ecosystem Restoration Task Force and its Working Group. Today, the Task Force oversees the implementation of the Comprehensive Everglades Restoration Plan (CERP), a plan designed to restore the quality, quantity, timing and distribution of freshwater through the system.

The cover article in this issue of *Sounding Line* provides more information about CERP. Until CERP is fully implemented, Florida Bay and the waters directly upstream of the Keys will continue to degrade during catastrophic weather events, and there will still be too little water during periods of drought and too much water during wet times.

There is still some confusion in the Keys about the impacts of restoring the South Florida ecosystem. I can only stress that what we have today is still broken. At this time, very few of the major projects that will have a positive impact on Keys' water quality have been made operational. To learn more about ecosystem restoration or to become involved, please visit the South Florida Ecosystem Restoration Task Force web site (www.sfstore.org) or give us a call at any one of the Sanctuary offices in the Keys.

Sincerely,

Billy D. Causey



Groundbreaking Event Held for Keys Eco-Discovery Center

Lori Arguelles, Executive Director of the National Marine Sanctuary Foundation



Leaders attended the groundbreaking of the Florida Keys Eco-Discovery Center in Key West. From left to right: CeCe Roycraft, co-owner of Dive Key West and co-chair of the local fundraising committee for the National Marine Sanctuary Foundation; Billy D. Causey, Florida Keys NMS Superintendent; Jean-Michel Cousteau, Ocean Explorer; Florida Congresswoman Ileana Ros-Lehtinen; Jim Connaughton, Chair, Whitehouse Council on Environmental Quality; Tim Keeney, NOAA's Deputy Assistant Secretary of Commerce for Oceans and Atmosphere; and Pat Romanowski, President of the National Marine Sanctuary Foundation.

(Photo: Larry Benvenuti)

On a sunny day in February, national and local leaders joined Deputy Assistant Secretary of Commerce for Oceans and Atmosphere Tim Keeney at the groundbreaking of the Florida Keys Eco-Discovery Center in Key West. President Bush's chief environmental advisor Jim Connaughton, Congresswoman Ileana Ros-Lehtinen, ocean explorer Jean-Michel Cousteau and Key West Mayor Jimmy Weekley participated in the event. The groundbreaking was hosted by the National Marine Sanctuary Foundation (NMSF), the non-profit partner of the U.S. Department of Commerce's National Oceanic and Atmospheric Administration's (NOAA) National Marine Sanctuary Program.

The Eco-Discovery Center will be a world-class visitor facility, part of the three-building Dr. Nancy Foster Florida Keys Environmental Complex, which is slated to open in the summer of 2005 at Truman Annex in Key West. The center will feature 6,000 square feet of interactive, professionally developed exhibits on the Florida Keys, and focus on human interaction with the environment, the management of marine protected areas, and the maritime culture and history of the area.

"The Florida Keys Eco-Discovery Center will help NOAA and our federal partners reach the public with important information about how we can all contribute toward the protection and conservation of the coral reef ecosystem for future generations," said Keeney. "Conservation starts with education."

New Sanctuary Advisory Council Members Named

The National Oceanic and Atmospheric Administration (NOAA) recently named three Florida Keys residents to the Florida Keys National Marine Sanctuary Advisory Council. Mark Klingbeil is now serving as the Recreational Fishing representative; Jim Trice is the alternate for this seat. Jack Curlett is the Upper Keys Citizen-at-Large representative; Jeremy Smith is the alternate for this seat. Captain Brad Simonds is the new Charter Fishing representative.

"Each member brings a unique perspective to the Sanctuary Advisory Council based on their long experience in the Florida Keys," said Billy Causey, Sanctuary Superintendent. "We are pleased that they have chosen to offer their considerable talents to help us protect the resources of the Florida Keys National Marine Sanctuary."

"As a frequent traveler to the Florida Keys for 25 years, I have joined countless others in enjoying their ecological beauty, marveling at their rich marine history, and basking in their warm hospitality and the recreational adventures they provide," said Connaughton. "I am pleased to represent President Bush and his Administration in helping to break ground on the new Eco-Discovery Center that will inspire even more Americans to cherish the natural wonder of the Keys and preserve and protect its shores, waters, reefs, and vibrant ecosystems for generations to come."

"The Florida Keys possess one of the most unique and beautiful environments on the planet," said Ros-Lehtinen. "It is only fitting that a visitor center of this caliber dedicated to the environment and our ecosystem be built in Key West. The Florida Keys Eco-Discovery Center will have a significant impact on how the public views these resources in the future and will motivate both residents and visitors to help further protect them."

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In Search of the Slave Ship *Henrietta Marie*

Corey Malcom, Director of Archaeology, Mel Fisher Maritime Heritage Society

The wreck of the *Henrietta Marie* is one of the most significant historical shipwreck sites found in the waters of the Florida Keys National Marine Sanctuary. The remains of this English merchant slave ship are found on remote New Ground Reef, nearly 35 miles west of Key West. The site was first discovered by Mel Fisher and his Treasure Salvors, Inc. in 1972 during their search for the galleon *Nuestra Señora de Atocha*. After some explorations of the site, and recovery of artifacts during that and the following summer, the *Henrietta Marie* was essentially forgotten for the next ten years.

In 1983, renewed efforts were made at the site by shipwreck salvor Henry Taylor, under an agreement with Mel Fisher. Most important, Fisher and Taylor employed archaeologist David Moore to oversee the excavation and research that was conducted. For the next two years, they examined the portions of the wreck that had been seen in the 1970s and made many more important discoveries, including that of the ship's bell, which bore the inscription "Henrietta Marie 1699." With this find, the site, which had long been known as the "English wreck," suddenly had a name and a date, allowing historical researchers to flesh out her story. Through the

combination of archaeological and documentary research, it became clear that this long-lost ship had been responsible for transporting captive Africans across the Atlantic for the slave trade. Beginning in the late 1980s, the Mel Fisher Maritime Heritage Society began to spearhead further research into the ship. Additional fieldwork in 1991 saw the recovery of two iron cannons from the site. A monument, dedicated to the Africans forced to sail on the ship, was placed on the site in 1993 by the National Association of Black Scuba Divers. In 1995 a traveling museum exhibition began its nationwide tour of the United States, telling the tale of the *Henrietta Marie*'s cruel venture, and the ship's place in history.

The *Henrietta Marie* made two voyages as a slaveship. The first was in 1697-98 and resulted in the sale of over 200 people at Barbados. For her second, she loaded English goods – iron and

copper bars, pewter ware, glass beads, cloth, and brandy – for trade on the west coast of Africa. Evidence suggests she traded at New Calabar, in what is now Nigeria. There, she took on a cargo of Africans, most likely Igbo tribesmen, and elephants tusks. In May of 1700, she arrived at Port Royal, Jamaica, selling 191 Africans to sugar planters. After purchasing 48 tons of sugar, logwood, cotton and ginger with the proceeds garnered from the sale of her human cargo, the *Henrietta Marie* set sail for London in late June. Having rounded the west coast of Cuba to avoid pirates and catch the Gulf Stream current, the *Henrietta Marie* wrecked on New Ground Reef. The circumstances of the

loss are not recorded, as there were no survivors, but from the archaeological evidence, it would appear that a violent storm drove the ship onto the reef, smashing it to pieces. The last contemporary evidence for the ship is a legal notation from November 1700 granting the estate of her captain, Thomas Chamberlain, to his creditors. By then it had become clear that the *Henrietta Marie* would not return to England.

Work on the site continues today. The Mel Fisher Maritime Heritage Society, and RPM Nautical Foundation, both of Key West, have joined forces to re-examine the wreck, and to locate sections of the ship known to be missing. Since

2001, these groups have been conducting magnetometer surveys and excavations to identify not only the remains of the *Henrietta Marie*, but any cultural materials that might be found on New Ground. To do this, an area of nine miles by three miles is being systematically investigated for variations in the earth's magnetic field. Such magnetic anomalies are often caused by iron from shipwrecks. In the case of the *Henrietta Marie*, it is known that six cast-iron cannons are missing, along with iron trade bars and many other ferrous components. Over 30 years after its initial discovery, the *Henrietta Marie* continues to be a vital and important part of our maritime past. It has made the mechanics of the Transatlantic Slave Trade a tangible reality, and with new discoveries on the horizon, will further reveal the secrets of the past in its eloquently unique way.

For instructional materials and more information, visit:
<http://www.melfisher.org/henriettamarie/>.



The *Henrietta Marie* was an English merchant slave ship that wrecked off Key West in 1700.
Artist drawing by Peter Copeland, Mel Fisher Maritime Heritage Society.



Historical Cannon Recovered for Public Display

Nancy Diersing, FKNMS Education Specialist

Nearly 10 years ago, while snorkeling off Key Largo, volunteers in the Sanctuary’s Submerged Resource Inventory (SRI) program came across a set of 13 iron cannons that may date to the eighteenth century when gun sloops from Britain’s Royal Navy patrolled the waters of the Keys. When a ship grounded on the coral reef, it was customary for its crew to jettison heavy objects such as cannons in order to float the ship off. If successful, the cargo and ship were saved, and the crew could possibly return at a later time to salvage the cannons.

The circumstances that led to the 13 cannons being deposited on the seafloor are not known. A more thorough investigation of the site uncovered an anchor and several items of mostly hardware, suggesting that the ship was demasted, a fact that lends credence to the idea that the crew jettisoned these items to lighten their grounded ship.



Upper Keys Regional Manager LCDR Dave Score (left) and local maritime historian Denis Trelewicz (right) prepare the cannon for lifting.
Photo: Brenda Altmeier



Abe Lopez (left) is overseeing the conservation of the cannon at the Mel Fisher Museum. Lawrence Campbell (right) will be building cannon’s gun carriage.
(Photo: Denis Trelewicz)

Denis Trelewicz, local maritime historian and Vice President of the Historical Preservation Society of the Upper Keys, was one of the SRI volunteers who came upon and documented the site in 1993, which is now known as the “Bunn Cannon Patch.” According to Trelewicz, “information that is engraved and embossed on the cannon may be useful in tracing where the gun was produced and to which ship it was issued. This information could help establish the name of the ship and the circumstances surrounding the incident. If the ship’s identity can be determined, a gap in maritime history of the upper Keys will be filled.” Based on archival research conducted by Trelewicz and historians in England, Trelewicz believes that the cannons may have been on a British warship, dating back to a time when Florida belonged to Great Britain, between 1763 and 1783.



Denis Trelewicz examines the cannon being conserved at the Mel Fisher Museum in Key West.
Photo: Larry Campbell

The historical value is the primary reason Trelewicz applied to the Sanctuary for a permit to remove one of the cannons, conserve it for future generations, study the information embossed and engraved on it, and eventually mount it for public display. After a careful consideration of the request and review by state and federal archaeologists, the Sanctuary granted permission to remove and conserve the cannon.

Trelewicz generously agreed to fund the conservation process, which will take almost two years and is being carried out by Conservator Abe Lopez in the conservation lab at the Mel Fisher Museum in Key West. Trelewicz is also providing funds for the gun carriage that will be built to hold the cannon after conservation. Lawrence Campbell, a member of the Historic Maritime Education Foundation, has graciously offered to design and build the gun carriage. When completed, plans call for the cannon to be on display for the public at the Key Largo Chamber of Commerce.

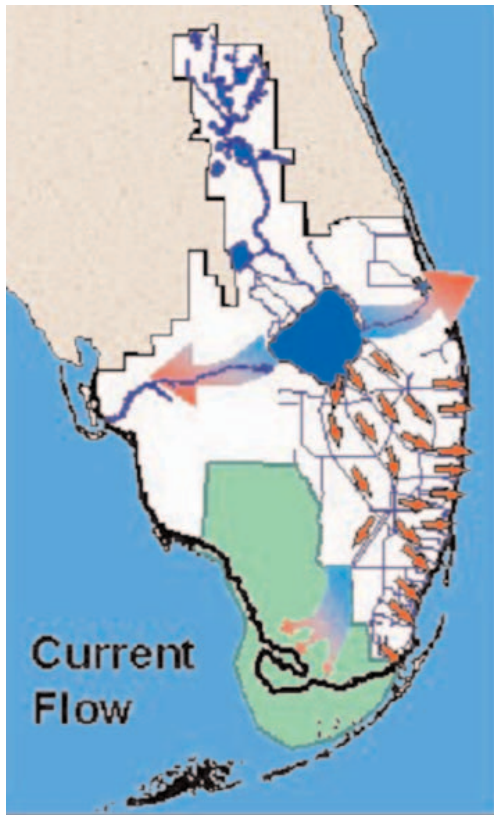


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Further down the pristine KOE watershed, the water travels slowly south as it spreads out across the vast sawgrass marshes that make up the “river of grass” or the Everglades. Here, it delivers nutrients, oxygen and food that support tree islands, cypress domes, fish, alligators, birds and other wildlife. Eventually, the water enters Shark River Slough, where it begins to mix with salt water. In this estuarine environment, mangroves appear and young snook escape predators by hiding among their trunks and roots.

Near the end of the slough, the water pulses in tune with the changing tides in Florida Bay. An outgoing tide pulls it into the bay. As it flows to the Keys, the water passes mangroves, seagrasses, sponges, soft corals and stony corals.

At the Keys, the water flows freely from Florida Bay into the Florida Straits and the Atlantic Ocean, where it encounters the fringing reef that stretches from Key West to Miami. Past the reef, the Florida Current takes the water northeast to merge with the Gulf Stream that sweeps it north along the Atlantic coast.



In total, this journey covered over 300 miles. In general, it was a slow drift because the KOE watershed is very flat. In some areas of the Everglades, the water traveled more than 8 football fields (over 800 yards) before it fell the thickness of a penny (3/50 of an inch). It turns out that the duration of the journey is important to the health of the seagrasses, corals and other habitats in Florida Bay and the Florida Keys. These habitats do best in water with low nutrient levels. The slow journey allowed plants in the watershed to remove most of the nutrients before the water reached Florida Bay.

The journey just described doesn’t fit what we see today between Orlando and the Keys. Over time, we’ve changed the KOE watershed. Although people have drawn on the watershed’s resources for over 10,000 years, we only started making significant changes about 100 years ago.

South Florida Ecosystem: Present

The first major changes in the South Florida ecosystem took place in the downstream end of the KOE watershed. In 1905, Henry Flagler decided to extend the Florida East Coast Railway past Key Biscayne to Key West. Construction was completed in 1912. Fill used to provide a base for the railroad reduced tidal exchange between Florida Bay and the Florida Straits. In some places, tidal circulation was cut off completely as an estimated 22 miles of fill was placed between the Keys to provide a land bridge for the railroad.

Significant changes to water flow in the upstream section of the KOE watershed began about the same time. In 1907, Governor Napoleon Bonaparte Broward formed the Everglades Drainage District (EDD) in response to damage caused by a flood in 1903. Between 1913 and 1927, the EDD spent \$18 million on developing and improving 440 miles of canals that drained 7,150 square miles of the KOE watershed.

Another major project began in 1930 as a response to hurricanes in 1926 and 1928. These storms, and the floods they produced, claimed over 2,500 lives and caused \$75 million of damage. With support from President Herbert Hoover and funding from Congress, the U.S. Army Corps of Engineers helped construct the 85-mile long Herbert Hoover Dike to control flow from Lake Okeechobee.

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Canals, levees, and water control structures were built to control the flow of surface waters in South Florida. (Photo: William Nuttle)



Florida Keys CERP Outreach Partnership

The south Florida ecosystem, including the Everglades, is stressed by human activities. The Comprehensive Everglades Restoration Plan (CERP) represents a critical part of “getting the water right” in these systems. Although CERP focuses on water flow in the Everglades, coastal areas ultimately receive the effects of restored flow. Healthy coastal systems, including Florida Bay, the Florida Keys and Biscayne Bay, represent critical outcomes for CERP.

CERP relies on the best available science and adaptive management, which means making predictions to choose among alternative restoration plans, acknowledging uncertainties, monitoring performance measures and adjusting plans according to the results of monitoring. Thus, key decisions will be made throughout the 30-year program, and these decisions will benefit from informed public participation.

In an effort to improve decision making, we have formed a partnership to deliver an outreach and education program focused on CERP. At this time, the Everglades National Park, Florida Keys Aqueduct Authority, Florida Keys Community College, Florida Keys National Marine Sanctuary, Florida Sea Grant College Program, National Oceanic and Atmospheric Administration, South Florida Water Management District, and University of Florida IFAS Cooperative Extension Program have joined forces to leverage their expertise, experience and resources. In addition to other contributions, the South Florida Water Management District is supporting the partnership with three years of funding.

The Florida Keys CERP Outreach Partnership will initially focus on a three-year pilot project. The Keys represents a critical region for CERP education and outreach for at least three reasons: the economy relies on a healthy ecosystem, other education and outreach efforts dealing with CERP may not reach the Keys or include the downstream effects of CERP, and the partnership can leverage existing efforts including experience with partnering. The pilot project will use television segments as a way to raise awareness and attract participants for follow-up activities. These activities will provide detailed information and tools in attempts to improve short-term decision making, medium-term awareness and incorporation of messages by businesses, long-term understanding by youth, and local capacity to deliver education and outreach. Evaluations of materials and activities will be used to make improvements during the pilot project.

For more information contact:

Cecelia Weaver, Florida Keys Service Center Director, South Florida Water Management District, 305-853-3219, cweaver@sfwmd.gov or Dr. Chuck Jacoby, UF/IFAS Extension and Sea Grant Specialist, 352-392-9617 ext.. 272, cajacoby@ufl.edu

In 1947, the flood-control system failed when heavy rains and back-to-back hurricanes dumped nearly 100 inches of rain on the region. Flooding damaged agricultural lands and urban areas, including West Palm Beach, Fort Lauderdale and Miami. In response, Congress authorized the Central and Southern Florida Project (C&SF Project) in 1948. Many people hailed this massive flood-control project as the best engineering effort in the history of the nation. Along with some recent additions, the C&SF Project’s 1400 miles of canals, 720 miles of levees, and several hundred water-control structures continue to play a critical role in regulating floods and supplying water for agricultural and urban areas in 16 counties.

Our use of the KOE watershed leads to some major challenges if we also want to retain its natural beauty and function. The population in the watershed is currently about triple the prediction of 2 million people used to design the C&SF Project, and it continues to grow rapidly. In fact, current predictions have the population doubling in the next 50 years. More people will create greater demands for the 1.7 billion gallons of fresh water that currently flow through canals to the coast each day. We’re challenged to meet these demands while restoring a more natural flow to the freshwater marshes, rivers, sloughs, pine flatwoods, prairies, hardwood hammocks, mangrove swamps, seagrass meadows, estuaries, and bays that support corals, fish, birds and wildlife. We have already decreased the flow through these systems to 70 percent less than pre-1900 levels.

The timing and duration of flow also pose challenges because flood-control structures alter the naturally slow, sheet-flow of water. Changes to the variation or pulsing of freshwater flow can affect the natural system in many ways. For example, it can alter the

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Cultured Corals Transplanted to the Wellwood Site

Kelly Nedimyer, Keys High School Student

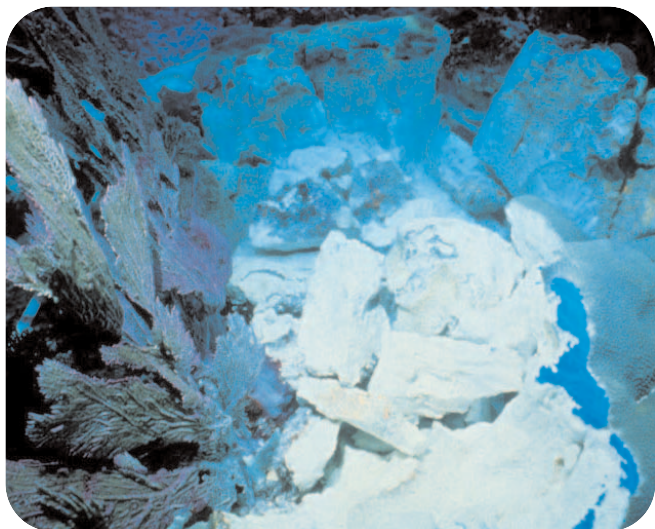


Kelly Nedimyer holds a fragment of staghorn coral during a recent dive trip to transplant corals onto the Wellwood Restoration site. (Photo: Ken Nedimyer)

In late 2003, a trio of sanctuary reef restoration specialists joined my dad and me on what we hope will be a long-term project designed to restore corals to damaged reef areas. On our trip, we successfully moved six staghorn coral (*Acropora cervicornis*) colonies from our coral nursery located on my dad's live rock lease site to the *Wellwood* grounding site on Molasses Reef off Key Largo. These corals were propagated from the donor colonies that had settled on his live rock farm over the last 9 years.

The effort of coral propagation using staghorn coral began two years ago. Staghorn coral is a fast growing, branching coral that can be easily propagated by fragmentation. Thus, it was a great candidate for aquaculture. Our propagating method actually begins on land where we used epoxy to attach fist-sized rocks to concrete blocks. The blocks are then moved and organized onto my father's rock site. We take small uniform cuttings from the settled donor colonies and affix them to these fist-size rocks on the blocks. We attached the corals to small rocks so that we could remove the corals from the blocks without damaging or stressing the corals. Our method was successful and the corals were thriving.

Last summer a large outbreak of an unidentified coral disease, which scientists are attempting to characterize, swept across the Upper Keys (especially White Bank Dry Rocks, off Key Largo) killing numerous staghorn corals. During the disease outbreak at White Bank, we noticed that our corals were doing well and except for two colonies on one section of the site, none of ours became infected. We were contacted to see if we had some healthy corals that could be taken to White Bank for a comparison study, and it



Boats running aground on the coral reefs of the sanctuary can crush reef-building corals and leave toxic (blue) bottom paint behind. Restoration biologists are charged with restoring this damage.



Kelly Nedimyer cuts a growing tip of staghorn coral for transplanting onto the Wellwood restoration site. Healthy colonies of staghorn that had reached one year old were chosen for this project.

(Photo: Ken Nedimyer)



was at this point that we decided our initial goal of using our propagated coral for the marine aquarium industry needed to be changed. We believed that our corals could serve a better purpose restoring damaged reef sites than selling them for aquarium decorations.

We spoke with Sanctuary Restoration Managers Harold Hudson and Bill Goodwin about donating some of our corals for restoration work. After some checking with their colleagues, and after the white band disease outbreak had subsided, we got the go ahead for a pilot project to take place on one of the restoration modules on the *Wellwood* site.

On a nice day in October, Harold Hudson, Ben Richards, and Amy Massey joined my father Ken Nedimyer and me on our boat to transplant the developed coral colonies. First, we went to the coral nursery to select appropriate corals for transplant. Six nice colonies were chosen and detached from the blocks. The corals were then taken to the boat, where they were placed in five-gallon buckets of water to be transported to the *Wellwood* site.

At the site, Hudson located the selected module, and we tied up to the nearest mooring buoy. Then we carried the corals to the bottom, and with Hudson's help, six suitable sites on this module were chosen for the attachment of the corals. The sites were then prepared using a wire-brush to remove the algae and make the surface flat and receptive for cementing the new colony in place. While Massey, Richards, and I finished the cleaning process, my dad and Hudson went back to the boat to mix the cement that we would use. When sites were ready, Hudson mixed the cement to just the right consistency, formed it into a ball and handed it to Richards, who then swam it down to me. Then I pressed the cement ball into the cleaned area and quickly picked up the selected coral rock and pressed it firmly into the cement. Finally, we smoothed out any cracked or rough areas in the cement. We had to work quickly because the cement hardened in less than 10 minutes. The process was repeated until all six corals were in place.

After several months, all six corals are alive and appear healthy. Before and after photos indicate they had grown considerably and have even started to develop new branches. We will continue to watch these transplanted colonies over the next year and record their progress. In the meantime, our plans are to continue to propagate more corals for future restoration efforts.



The sites were prepared to receive the colonies of coral using a wire-brush to remove the algae and make the surface smooth. (Photo: Ken Nedimyer)



After several months, all transplanted coral fragments were doing well. Some even started to develop new branches. (Photo: Ken Nedimyer)



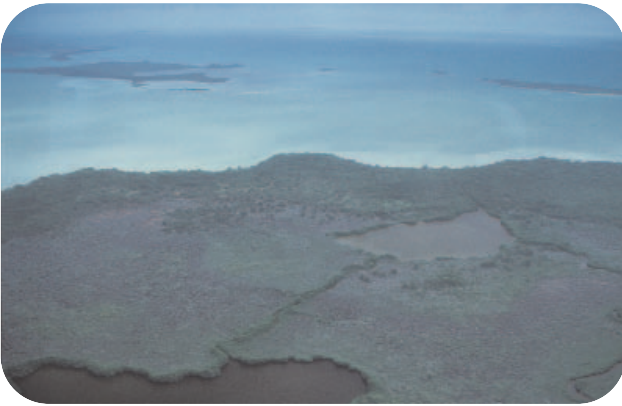
Florida Bay and the Florida Keys Connections

Alex Score and Dr. Chuck Jacoby, University of Florida – Sea Grant Extension

Although the Comprehensive Everglades Restoration Plan (CERP) is primarily designed to restore a more natural sheet flow of high quality water, scientists and managers realize that this altered flow will affect Florida Bay and the Keys. Currently, there are two initiatives in CERP designed to address these issues: 1) the Florida Bay and Florida Keys Feasibility Study and 2) the Florida Keys Tidal Restoration Project.

Florida Bay and Florida Keys Feasibility Study

The Florida Bay and Florida Keys Feasibility Study, seeks to evaluate information on the “downstream” effects of increased freshwater flows through the Everglades. The study will assemble existing data and use computer models to determine the quantity, quality, timing, and distribution of freshwater flows required to meet restoration targets. It will help make predictions on salinity variations from the expected future changes in freshwater flow. Currently, restoration targets and ecological performance measures are being developed. If results of the models indicate that the predicted effects are undesirable, the study will identify and evaluate alternative flow regimes that eliminate or minimize undesirable changes. The study will finish in late 2005, and it will cost about \$6 million.



Waters from the Everglades on the mainland meet Florida Bay at the southern tip of the Florida peninsula. The effects of increased water flows on Florida Bay and the Keys will be assessed in the feasibility study. (Photo: Heather Dine)

A creek south of Mile Marker 56 between Fat Deer Key and Long Point Key has been selected for the pilot project. This site was selected since it will benefit the most environmentally in comparison to other locations that were evaluated. This creek currently has no flow between Florida Bay and the Atlantic Ocean and is an area where there is significant silt and debris build up. It has been identified and described as a “dead zone.”

These two initiatives represent only one component of the overall plan to restore and maintain healthy ecosystems in Florida Bay and the Florida Keys. For more information on these studies and other CERP projects visit www.evergladesplan.org.

Florida Keys Tidal Restoration Project

In addition to being connected to the mainland by freshwater flow, ecosystems in Florida Bay and the Florida Keys are connected to the Atlantic Ocean by tidal exchanges. A second initiative under CERP, the Florida Keys Tidal Restoration Project, will restore a more natural connection between Florida Bay and the Atlantic Ocean through a tidal pass that was blocked during construction of the Flagler railroad in the early 1900s. Water flow between many of the Keys was diminished by the construction of causeways for the railroad, and in some places, tidal circulation has been cut off completely.

Reduced tidal circulation leads to many undesirable changes. Higher water temperatures, higher salinities, lower water clarity, and lower concentrations of dissolved oxygen harm seagrasses, corals, fish, and other plants and animals. Less tidal exchange also results in a build up of silt and debris that damages habitats and prevents larvae, fish, and other animals from moving between bay and ocean habitats in the way they formerly dispersed.



An aerial view of a portion of the seven-mile bridge shows the tidal cut between Vaca Key and Pigeon Key. Tidal waters flow through the cuts between the Keys, connecting the Atlantic Ocean and Florida Bay.



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spawning behavior of sportfish. In addition, water that flows to the coast rapidly often will contain higher levels of nutrients and other chemicals. In combination, these factors have caused damage to habitats, 90-95 percent reductions in wading bird populations, health advisories across 1 million acres in the Everglades due to mercury contamination of fish, declining numbers of commercial and recreational fish in Biscayne Bay and Florida Bay, saltwater intrusion into our drinking water supplies, and other detrimental impacts on the KOE watershed and South Florida ecosystem.

South Florida Ecosystem: Future

In an effort to address these challenges, the South Florida Ecosystem Restoration Task Force was created in 1993. Initially, the task force consisted of federal agencies, with state, local governments and tribal representatives added as formal members in 1996. The task force directs work to restore the South Florida ecosystem and KOE watershed. It coordinates and develops consistent policies, strategies, plans, programs, and priorities for South Florida Ecosystem Restoration (SFER) including the Comprehensive Everglades Restoration Plan (CERP).

SFER involves cleaning up the environment and restoring more natural water flow, habitats, and plants and animals throughout the KOE watershed and South Florida ecosystem, including Biscayne Bay, Florida Bay and coral reef tract off the Florida Keys. Restoration of the South Florida ecosystem will involve hundreds of projects, supported by extensive research. Federal, state, tribal and local governmental representatives, along with representatives from agriculture and other industries, will make decisions as restoration unfolds. The cost of this 30-year effort has been estimated to

be between 10 and 15 billion dollars, which will be shared equally between federal and state government. In total, SFER is the largest ecosystem restoration project in history.

CERP is a major component of the restoration effort. It resulted from the C&SF Project Comprehensive Review Study (*the Restudy*), an initiative that investigated how to modify the C&SF Project to improve the sustainability of South Florida. CERP is the framework that will guide restoration, protection, and preservation of water resources in central and southern Florida. CERP is the cornerstone of getting the “water right.” The projects in CERP will restore a more natural quantity, timing, and distribution of high-quality water through the KOE watershed, while retaining or enhancing flood control and water supply for a growing population. Successful management of all these factors in combination is critical to restoration and preservation of healthy coastal marine environments.

In an effort to consider all key factors and their interactions, SFER and CERP rely on the best available science to produce ecological forecasts of the downstream effects from alternative restoration scenarios. Efforts to improve our understanding and these forecasts continue through research funded by the National Oceanic and Atmospheric Administration (NOAA), the South Florida Water Management District, the National Science Foundation and other state and federal organizations. Although the best available science will underpin predictions and plans, the ultimate changes resulting from restoration remain uncertain. A key to the success of SFER and CERP is the explicit recognition that these uncertainties exist and the application of adaptive management to deal with them. Adaptive management will rely on monitoring of performance measures to detect unforeseen and undesirable changes, and it will use these results to formulate changes in management designed to get restoration “back on track.”

For more information about the **South Florida Restoration and Comprehensive Everglades Restoration Project**, visit: www.sfrestore.org and www.evergladesplan.org.

For more information about **The Everglades Case Study**, contact Dr Tom Marcinkowski, Florida Institute of Technology, 150 West University Blvd, Melbourne, FL 32901-6975.



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NMSF Trustee and ocean explorer Jean-Michel Cousteau helped launch the Foundation’s ‘Sea Star’ campaign in conjunction with the groundbreaking ceremony. The Sea Star campaign is a critical part of the Foundation’s overall efforts to raise \$1.5 million in private sector funds to outfit the Eco-Discovery Center with state-of-the-art exhibitory that will interpret the South Florida ecosystem.

“The Eco-Discovery Center will be a world-class visitor facility focused on the Florida Keys,” said Cousteau. “We want people to have an opportunity to be a permanent part of this incredible environmental education center. This way we can all be Ambassadors for the ocean.”

“The Florida Key Eco-Discovery Center will give visitors and residents an opportunity to experience the natural environment of the Florida Keys without ever having to put on a snorkel or hike through a mangrove forest,” said Florida Keys National Marine Sanctuary Superintendent Billy D. Causey. “The center also will offer visitors a compelling look at our fragile coral reef ecosystem.”



Jean-Michel Cousteau (right), ocean explorer and Foundation Trustee, was in Key West to launch the Sea Star campaign. Sea Star donors will have their names engraved in star-shaped tiles that will be embedded in the walkway leading up to the Eco-Discovery Center. For more information on how to become a Sea Star, visit: www.nmsfocean.org or contact Sea Star local co-chairs and co-owners of Dive Key West: Bob Holston (center) and Cece Roycraft (left) at: (305) 296-3823. (Photo: Larry Benvenuti)

The Florida Keys National Marine Sanctuary thanks everyone who contributed their articles, photographs, and editing expertise to Sounding Line newsletter. Sounding Line is produced 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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