"Harbor Harvest"

October 4-5, 2005

Charlotte Harbor Conference

Mote Marine Laboratory
Keating Marine Education Center
1599 Ken Thompson Parkway ~ Sarasota FL 34236
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The Charlotte Harbor Program was funded by the Mote Scientific Foundation in recognition of William R. Mote's enthusiasm for the sea and desire to promote its wise stewardship. Mr. Mote had a personal interest in southwest Florida and made it possible for the Laboratory to conduct numerous seminal studies of Charlotte Harbor.

“When you get right down to it, we've been taking from the sea for a long time, and it's time we start giving back more than we take.”

W.R.M.

The scientific staff of Mote Marine Laboratory and our partners in research respectfully dedicate this review of 2004-2005 research in Charlotte Harbor to Mr. Mote.
Preface

This October conference marks the conclusion of a year of productive research in Charlotte Harbor, Mote Marine Laboratory’s fourth year of field study in a long-term, multi-disciplinary investigation of the Harbor. The conference is our chance to sit back and enjoy the harvest from our many fields of science.

The scientific objective of the Charlotte Harbor Program is to understand and predict how natural and human-caused changes to freshwater quantity and quality will affect the structure, function, and condition of the estuary and its valued ecosystem components. These research questions developed in 2000-2001 guide the study:

How do freshwater inflow and its constituents structure the ecology of the estuary and regulate its productivity and what will be the long-term consequences of flow alterations?

How do riverine and other algal blooms affect the onset, duration, and extent of hypoxia?

What is the role of natural perturbations, particularly hypoxia, in controlling the distribution and abundance of estuarine plants and animals?

What processes mediate trophic links in the estuary’s food-web, and how strongly are hydrological and chemical factors made manifest in secondary production, especially of fishes and other top carnivores?

What estuarine areas are important to large mobile fauna, including endangered species, and how do natural and anthropogenic stressors affect the quality of the areas or health of the species?

Conference lectures and posters will describe a remarkable diversity of discoveries by Mote scientists and research partners. This work promises to write new chapters in the book of what is known about Charlotte Harbor, and thereby enrich public appreciation as well as scientific understanding of the region’s most productive and beautiful natural resource.

The challenge for next year’s work will be to develop and expand upon our research partnerships, and further coordinate the many sampling and measurement programs developed in 2004-2005. Scientists have developed viable systems of study within their respective disciplines and the past year has seen many new partnerships among colleges and universities, agencies of government, and non-governmental organizations.

On a personal note, I wish to thank all of the staff and volunteers at the Laboratory and our partners in research for bringing so much enthusiasm to this Harbor program. I have especially appreciated the excitement of collaboration and discovery that has been evident both in Sarasota and at the many locations that house, field, and enable research around the Harbor, and wish each investigator a safe and productive new year of research.

E.D. Estevez
Appreciation

Hurricane Charley's destruction of Mote's Field Station at Pineland, serious damages to facilities at other institutions, and setbacks in their research created difficulties that persist to the present. For their extraordinary assistance in arranging temporary facilities in 2005, without which many Mote studies would have not been possible at all, we sincerely thank:

~ Mote Scientific Foundation ~

~ Don and Dorothy Gulnac ~

~ J.N. "Ding" Darling National Wildlife Refuge ~

~ Derek Templeton and Don Hayward ~

~ Appleby Foundation ~

Charlotte Harbor Conference
"Harbor Harvest," October 4-5, 2005
Acknowledgments

We would like to acknowledge the following individuals for their contributions.

Special thanks are expressed to Kim Churchill for assistance with abstracts, posters, power-point presentations, and this attractive program.

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Charlotte Harbor Conference
“Bountiful Harvest, 2005”

AGENDA

Tuesday October 4: MORNING

0830 Morning Reception
0900 Opening Remarks. Ernie Estevez

Moderator—Bob Hueter

0920 Preparing Marine Science Centers for Hurricanes and Other Coastal Catastrophes. Kumar Mahadevan.


1000 Watershed land-use and estuarine water quality: patterns and processes involving color in the Peace River and Charlotte Harbor. Jason A. Hale and Emily R. Hall.

1020 Break

1040 Historical and Modern Patterns of Fish Species from Freshwater through the Tidal Peace River Continuum. Tom H. Fraser.

1100 A Fresh Look at Ecological Condition Indices for Southwest Florida’s Urbanizing Tidal Streams. Ernie Estevez.


1200 Lunch

Tuesday October 4: AFTERNOON

Moderator — Randy Wells

1300 Habitat Use of Vallisneria americana Beds in the Caloosahatchee River, Florida. Anamari Boyes, Brad Robbins, and Michelle Gittler.

1320 The Influence of Sediment Microbial Communities on Thalassia testudinum Transplants: Implications for Seagrass Restoration. Eric C. Milbrandt, Jaime M. Greenawalt, and P.D. Sokoloff.

1400 Short-term Effects of a Low Dissolved Oxygen Event on Fish Communities Following the Passage of Hurricane Charley. Phil W. Stevens, D.A. Blewett, J. Patrick Casey, and D. A. Tomasko.

1420 Break

1440 Fatty Acid Signature Analysis as a Potential Forensic Tool for Florida Manatees (Trichechus manatus latirostris) and Other Marine Mammals. Dana L. Wetzel, John E. Reynolds, III, Jay M. Sprinkel, and S.A. Rommel.

1500 Pesticides in Southwest Florida Waterways – A Report Card. Judy M. Hushon

1520 Evaluation of Pesticide Monitoring Data for the Caloosahatchee River. Judy M. Hushon

1540 Fishing for a Relationship Between Seagrasses and Their Associated Fauna. Michelle Gittler, Anamari Boyes, and Brad Robbins.

1600 Posters and Conference Social

Wednesday October 5: MORNING

0845 Morning Reception

Moderator: Ken Leber


1000 Do Altered Coastal Habitats Promote Non-native Fish Invasions into Estuaries? Aaron J. Adams and R. Kirby Wolfe


1040 Break


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1200 Lunch

Wednesday October 5: AFTERNOON

Moderator: Al Cheatham

1300 Long Term Monitoring of Fish Sound Production in Charlotte Harbor. James Locascio and David Mann.

1320 Seasonal Patterns of Black Drum Sound Production in Residential Canals of Southwest Florida. James Locascio and David Mann.


1420 Break

1440 Spatial Patterns of Nutrient Concentration in Charlotte Harbor Using Continuous and Discrete Sampling Programs. Kellie Dixon, Maya Dobrzeniecka, Katherine Landsdowne, and Brad Pederson.


1540 Bringing BIOSENSE to Ocean Observing Systems on the Florida West Coast. Ernie Estevez.

1600 Rapporteur's Summation of the Conference. Catherine Corbett.

POSTERS

Lethal and Sub-lethal Effects of Reduced Salinity on the Bay Scallop, Argopecten irradians, at High Temperatures. F. J. Pollock, J. R. Leverone and J. Greenawalt.

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Mike Savarese, Greg Tolley, and Aswani Volety
Bruce Ackerman, Luiz Barbieri, Dave Blewett, Margie Barlas, Paul Carlson, William S. Arnold, Alex Costidis, Bill Curnow, Kristen Fick, Mindy Foley, Andy Garrett, Patti Haase, Steve Geiger, Elsa Haubold, Karl Higgs, Chuck Idelberger, Lucy Keith, Kevin Madley, Andy May, Anne Meylan, Bob McMichael, Tom Pitchford, Gregg Poulakis, Sentiel Rommell, and Phil Stevens
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Randell Research Center

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Sarasota County

South Florida Water Management District

Southwest Florida Water Management District

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U.S. Fish & Wildlife Service

U.S. Geological Survey

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Mike Jones

Tomma Barnes, Bob Chamberlain, and Peter Doering

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Tom Smith, III and Chuck Holmes

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Bob Welsberg, Lianyuan Zheng, David Mann, Ping Wang, and Jim Locascio

Jeff Stott

Donna Surge
Seminars, Presentations & Publications


Seminars, Presentations & Publications, continued


Seminars, Presentations & Publications, continued


Seminars, Presentations & Publications, continued


Tucker, T. Teach Live- Save the Bay, Narragansett Bay website <www.savebay.org/exploretobay/turtlemania/index.htm>

Tucker, T. Teach Live -Cornerstones of Science website <www.cornerstonesofscience.org/COSprograms/sea.turtles.htm>

Tucker, T. Charlotte Harbor turtle research website-<www.artravels.com/Program9.htm>


Walsh, CJ. Florida Gulf Coast University, Ft. Myers, FL. Invited Speaker, seminar series in the College of Arts and Sciences. April 7, 2005. Effects of environmental stressors on immune function in the Florida manatee.

Interns

Alcorn State University
Lesley Magee

Bard College
Erin Kollitz

Barry University
Marsha Thompson

Cape Coral High School
Erik Wiggs

University of California, Los Angeles
Elda Varela-Acevedo

University of North Carolina, Wilmington
Jessica Atwell
Response of Bay Scallop Populations to Larval Releases and an Update on Current Restoration Activities in Pine Island Sound.

J. Leverone1, S. Geiger1, W. Arnold2, and J. Greenawalt3

1Mote Marine Laboratory, Benthic Ecology Program, Sarasota, FL
2Florida Fish and Wildlife Research Institute, St. Petersburg, FL
3Marine Laboratory, Sanibel Captiva Conservation Foundation, Ft. Myers, FL

In 2003, we undertook a novel restoration approach to enhancing bay scallop populations in North Pine Island Sound, FL. This approach involved releasing competent, late-stage larvae into containment booms which isolated the water column, thereby preventing the larvae from excessive dispersion. Three booms were used for larval releases and an additional boom served as a control (no larvae added). Larval settlement and juvenile recruitment were monitored the following year. Scallops recruited to artificial substrates in all three treatments. Juvenile scallops, surveyed in Feb 2004, were found in all treatments while being absent from the control. Adult scallops, surveyed in Jul 2004, were two orders of magnitude greater at the restoration site than the resident scallop population within Pine Island Sound. Adult scallops were again surveyed in Jun 2005. This year, the entire survey area experienced a 100-fold increase in bay scallops from the previous year (Table 1). (Pine Island Sound had the highest abundance of bay scallops in 2005 than any other Florida estuary). These results demonstrate that the controlled release of competent larvae is a viable method of ultimately restoring bay scallop populations in Pine Island Sound. This fall, we plan to expand our restoration efforts to South Pine Island Sound, a region that has also experienced reduced scallop densities over the past several decades. We will discuss some of the potential problems associated with restoration success at this location, including freshwater inputs and reduced salinity.

Table 1. Bay Scallop Population Abundance from Pine Island Sound, FL.

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<td>52</td>
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<td>110</td>
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<td>28</td>
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<tr>
<td>South PIS</td>
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Contact: J. Leverone, Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota FL 34236. Phone (941) 388-4441, Fax (941) 388-4312, jleveron@mote.org.

J.A. Hale¹ and E.R. Hall²

¹Charlotte Harbor Environmental Center, Inc., Watershed Resource Center, Punta Gorda, FL
²Mote Marine Laboratory, Chemical Ecology Program, Sarasota, FL

When inspecting a sample of whole, unfiltered water, descriptions of the apparent color may range across nearly the entire spectrum: red to gold to green, blue or brown, whitish, and so on. However, when describing the true color of a filtered sample of water, the hues are dominated by yellow, rust, brown, or even black in cases of very high concentration. Hence the term black-water refers to streams that drain a swamp (for instance), where decaying vegetation releases a host of organic molecules that give the water its characteristic color.

True color is an extremely important component of water quality. Color affects the light field in terms of both intensity and wavelength, it enhances the capacity of water to hold heat, and it provides a substrate for bacterial respiration. Hence, color can influence processes that depend on water column dissolved oxygen and photosynthesis.

Aside from dilution by seawater or clear spring water, there are three primary processes which cause a decrease in the concentration of color in water. First, the molecules that contribute to color may react with salinity, producing flocs that coalesce in the water column. Second, UV radiation from sunlight may break chemical bonds, producing smaller molecules that may or may not contribute to the concentration of color. Finally, heterotrophic bacteria may consume the compounds as food, and make a significant contribution to the microbial loop.

From 1998 through 2003, monthly values of color in the Peace River measured near Bartow were about 200 PCU (range 50 – 350), while values just upstream of the river mouth were generally below 100 PCU (range 50 – 350). Color in the middle of Charlotte Harbor is generally below 50 PCU, but was near 200 PCU following Hurricane Charley, and has exceeded that value in the past. Therefore, while central values decrease from river to estuary, the range of values of color remains the same. These observations of color between Bartow and Charlotte Harbor raise several important questions: (1) what is the significance of each of the processes affecting the concentration of color as river water approaches and enters the estuary? (2) how does the rate of river flow affect the timing and location of these processes?

Contact: J. Hale, Charlotte Harbor Environmental Center, Inc., Watershed Resource Center 10941 Burnt Store Rd, Punta Gorda FL 33955. Phone (941)575-5854, jah@checflorida.org.
Historical and Modern Patterns of Fish Species from Freshwater Through the Tidal Peace River Continuum.

Thomas H. Fraser¹,²

¹Mote Marine Laboratory, Sarasota, FL
²W. Dexter Bender & Associates, Inc., Ft. Myers, FL

Comparative species diversity between time periods and salinity habitats are examined by using calculated and raw data species accumulation curves. Data about the fishes of the Peace River upstream of the U.S. 41 bridges, excluding Shell Creek are in the process of being examined.

In the freshwater portion of the Peace River distinct changes may have occurred in Payne Creek over time. The fish diversity of Whidden and Payne Creeks were very similar in the early 1990s. Fish diversity from Payne Creek in 1978 was more similar to Horse Creek in 2003. Horse Creek has as many freshwater species as found in the Peace River. A significant fraction of the fish species present in the main stem of the Peace River are not freshwater fishes.

Species accumulation curves in the Peace River from the Gardner - Nocatee region between different data sets taken in an 10 month period in 1976 and from 1983-1992 were similar. In the tidal Peace River ichthyoplankton data taken during 1997-1999 and fishery independent data taken during 1989-2003 were examined. Other fish sampling occurred in 1968-1969, but suitable data have not been located. Species lists suggest fewer fish enter the tidal river via planktonic stages than by juvenile stages.

Pooling the tidal Peace River fishery data about the US 41 bridges by salinity intervals across time for species accumulation curves result in some interesting comparisons. The 0-1 ppt interval had significantly more species than any other interval. The raw accumulation curve for freshwater species from the estuary to freshwater is very different than the accumulation curve for marine species from the tidal freshwater to the estuary.

Contact: T. Fraser, Adjunct Scientist, Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota FL 34236. Phone (941) 388-4441, Fax (941) 388-4312. W. Dexter Bender Associates, Inc., 2052 Virginia Avenue, Ft. Myers FL 33901. Phone (239) 334-3680, cardinalfish@comcast.net.
Fresh Look at Condition Indices.

Ernest D. Estevez¹

¹Mote Marine Laboratory, Center for Coastal Ecology, Sarasota, FL

Biologically-based indices of ecosystem health are useful for comparing multiple systems and for documenting the condition of a system through time, as in the case of system preservation or restoration. The conventional method for index formulation is to identify a homogeneous number of systems, and one or more "reference" systems among them; measure a large number of biological attributes, and then apply a posteriori analysis to identify the ensemble of metrics that distinguish systems at a preset level of significance. Ideally, rapid-survey protocols then are developed. Standard procedures are defined and training ensures uniformity of their use. Biologically-based condition indices have been developed for lakes, rivers, estuaries, and large marine ecosystems but there has been less success in developing indices for small tidal streams. A project has begun for tidal streams from Sarasota to Lemon Bays, inclusive, to determine whether a biotic index of stream health can be developed. Tidal streams of this coastal reach, like the larger area of southwest Florida's sub-ecoregion, are homogeneous with respect to their dominant geographic features, although they do vary with respect to age of human settlement and use. In the present study, sixteen neighboring streams have been selected for assessment. Watershed characteristics for each were assembled from existing data and: watershed condition varies greatly. In order to determine whether sufficient scope in biological condition existed, to merit further index work, reconnaissance-level surveys were made in one example of a stream with an impaired watershed, and in one example of a stream with a relatively natural watershed. A comparison of results found that biological conditions in the two streams were substantially different. The next step in this study will be to measure a prototypic set of metrics, modeled after Florida methods for lotic systems, to all sixteen streams in order to observe the performance of the metrics. Although the specific metrics identified for this coastal reach may not be transferable to tidal streams in other biogeographic areas, the development method may. This project has been funded by Sarasota County, with valuable assistance by Mike Jones, Kathy Meaux, Jon Perry and (at Mote Marine Laboratory) Brad Robbins.

Contact: E.D. Estevez, Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota FL 34236. Phone (941) 388-4441, Fax (941) 388-4312, estevez@mote.org.
Estimating the Salinity Influences of Freshwater Withdrawals in the Lower Peace River.

R. Montgomery and S. Stone

1PBS&J, Inc., Tampa, FL
2Peace River Manasota Regional Water Supply Authority, Sarasota, FL

Historically, a number of statistical modeling efforts have been undertaken in conjunction with the long-term (1976-2004) lower Peace River/upper Charlotte Hydrobiological monitoring program (HBMP) in attempts to quantify the magnitude of Peace River Facility withdrawal impact on both the salinity structure of the lower river and the movement of the freshwater/saltwater interface (and isohalines). In the late 1980s and early 1990s, a series of statistical models were developed based on monthly point estimates of the relationships among salinity, flow and freshwater withdrawals at the series of “fixed” sampling site locations in the lower Peace River, as well as the relative spatial location of four major estuarine isohalines (0, 6, 12 and 20 ppt). More recently (2003) the Southwest Florida Water Management District has recently had Janicki Environmental update much of the previous work on statistical salinity/flow withdrawal models in conjunction with its ongoing efforts with regard to developing minimum flows for the lower Peace River. All of these statistical modeling efforts have been used to develop predicted daily differences between actual and permitted withdrawals in comparison with expected conditions under no withdrawal scenarios. The conclusions of all the statistical models efforts developed to date have similarly suggested that the predicted impacts of maximum permitted freshwater withdrawals by the Peace River Facility on salinity should typically be between 0.1-0.3 ppt and probably could not easily be detected given the normal distributions or daily tidal ranges of salinity along the lower Peace River/upper Charlotte Harbor HBMP monitoring transect.

In 2002 PBS&J and Janicki Environmental developed a series of spatially based statistical models used as predictive tools in further assessing the magnitude of salinity impacts due to both historic and future potential maximum freshwater withdrawals under the Peace River’s Facility’s existing twenty-year permit. Again, these the results of these models indicated that changes in lower Peace River salinity predicted due to expected future maximum permitted Facility withdrawals would typically be less than 0.5 ppt and again probably not easily measured given the normal tidal variability of salinity in the lower river.

Recently a series of analyses have been conducted utilizing actual field measurements from 15-minute continuous recorders located downstream of the Facility. Unlike pervious statistical models, these graphical analyses of these actual field measurements also include the influences of tidal stage. The results of these first preliminary graphical analyses support the proceeding conclusions reached by the statistical models, and suggest that salinity impacts directly attributable to permitted Facility withdrawals may in fact be slightly conservative. Plans are currently underway to expand the array of exiting continuous to further validate these findings.

Contact: Ralph Montgomery, PBS&J Inc., 18971 McGratch Circle, Port Charlotte FL 33948.
Natural Hybrid Form: Can They Record Hurricanes?

G. Kelly1, D. Surge1, W. S. Arnold2, and K. J. Walker3

1University of North Carolina, Department of Geological Sciences, Chapel Hill, NC
2Florida Marine Research Institute, St. Petersburg, FL
3University of Florida, Florida Museum of Natural History, Gainesville, FL

Geochemical variation in northern and southern quahog shells has been used in numerous studies. It is unknown whether species-specific geochemical differences occur. Three genotypes (M. mercenaria, M. campechiensis, and their natural hybrid) occur in coastal Florida waters. This co-occurrence provides a unique opportunity to study whether all three genotypes record the same environmental information preserved as variation in O and C isotope ratios. Individuals collected alive in Pine Island Sound were classified to genotype using allozyme electrophoresis. Three juveniles from each genotype were selected for isotopic analysis to control for any age-related differences. Isotopic variation among shells is nearly identical (Fig. 1). These results indicate that no significant species-specific differences occur and any of the genotypes (or a combination) can be used for environmental and climate reconstruction.

Individual quahogs collected for this study survived Hurricane Charley as did one pair of our temperature loggers. The loggers recorded no diurnal temperature change on August 13, 2004 typical under normal conditions (Fig. 2). For several days after the hurricane passed, daily temperatures were ~3°C cooler than previous daily temperatures. We predict that Hurricane Charley left its fingerprint in the geochemical record preserved in these shells.

![Image of Figure 1](image1.png)

**Figure 1 (above).** Cross-plots of oxygen and stable carbon isotope composition in shells of three genotypes of Mercenaria.

![Image of Figure 2](image2.png)

**Figure 2. (left).** Water temperature measured in Pine Island Sound from August 10-15, 2004.

Contact: D. Surge, University of North Carolina, Department of Geological Sciences, CB #3315, Chapel Hill NC 27599. Phone (919) 843-1994, donna64@unc.edu.
Habitat Use of *Vallisneria americana* Beds in the Caloosahatchee River, FL.

Anamari Boyes¹, Brad Robbins¹, and Michelle Gittler¹

¹Mote Marine Laboratory, Landscape Ecology Program, Sarasota, FL

Studies conducted to understand the salinity tolerances of *Vallisneria americana* within the Caloosahatchee River in support of minimum flows and levels (MFL) criteria have not considered faunal utilization of this freshwater macrophyte habitat. Furthermore, faunal responses to season, salinity changes, or plant/bed morphometry are poorly understood in the River. Historical maps depicting macrophyte distribution indicate that *V. americana* was found in monospecific and mixed (with *Ruppia maritima*) stands from the railroad trestle bridge on Beautiful Island downriver to the MidPoint Memorial Bridge. *Vallisneria americana* has re-established itself in the River following the 2000 drought but has not achieved the pre-drought sizes nor has reproduction been observed. Data presented here represent a summary of the first four years of an ongoing project designed to further our understanding of which organisms (fish and invertebrates) utilize *V. americana*-dominated habitat. Samples are being collected from 9 sites using a temporal strategy that corresponds with three distinct seasonal conditions: 1) high recruitment (March/April to June/July); 2) high flow (July to November); and 3) low productivity (November to March). In addition to faunal collections, water quality and SAV data are being collected.

Contact: Anamari Boyes, Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota FL 34236, Phone (941) 388-4441, FAX (941) 388-4312, anamari@mote.org.
The Influence of Sediment Microbial Communities on Thalassia Testudinum Transplants: Implications for Seagrass Restoration.

E.C. Milbrandt1, J.M. Greenawalt1, and P.D. Sokoloff1

1Marine Laboratory, Sanibel-Captiva Conservation Foundation, Sanibel, FL

The influence of the sediment microbial community on turtle grass, Thalassia testudinum, transplants was investigated in a field experiment in cooperation with the J.N. “Ding” Darling National Wildlife Refuge. Seagrasses were removed from an area to be dredged and transplanted into an area designated for seagrass research. There were three treatment groups; T. testudinum with donor site sediments (D), T. testudinum with transplant site sediments (T), and T. testudinum with sterile (S) sediments. T. testudinum growing at the transplant site (N) were also included. There were 30 T. testudinum in each treatment group that were individually tagged and planted. Blade width, blade lengths, the number of blades per shoot, and color were recorded bi-weekly for three months. Removal of the microbial community through pressure and heat sterilization decreased the performance of transplanted T. testudinum. The sterile sediment (S) T. testudinum exhibited significantly higher mortality and slower growth than the other treatment groups. Overall, there was 20% mortality in D, T, and S treatments during the first month compared to N treatment, likely due to transplant shock. However, there were very few losses in D and T treatments after the initial transplant shock. Meanwhile, the S treatment- T. testudinum continued to die throughout the duration of the 3 month experiment. A 16S rDNA community analysis of the sediments revealed that the S treatment had a different microbial community at the end of the experiment than D, T, and N treatment groups. These results raise the possibility of “microbial enhancement” of seagrass through a concocted inoculum of beneficial bacteria prior to seagrass restoration.

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Bottlenose Dolphin Abundance, Distribution, Seasonal and Long-term Site Fidelity in the Charlotte Harbor Ecosystem.

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Long-term studies documenting abundance trends and site fidelity of bottlenose dolphins in coastal estuaries can provide clues to the health of the ecosystem and stocks for management decisions. Dolphin distribution within these estuaries can be indicative of environmental features and prey distribution. We completed multi-week photographic identification surveys during September 2001, 2002, and 2003 and February 2002, 2003, and 2004 to determine dolphin abundance and distribution within Charlotte Harbor, as a continuation of NMFS sponsored surveys conducted in 1990-1994 and 1996. Smaller scale opportunistic surveys were done on occasion in some spring and summer months, for example, after Hurricane Charley passed through the study area in August 2004. Since 2001 we have spent 255 days on the water and collected 1710 group sighting records. Two types of search effort were used: (1) a 1 km randomized grid transect which included cross-harbor, edge, and contour transects and (2) opportunistic transects both within the defined study area and in surrounding waters. We attempted to collect dorsal fin identification photographs of all dolphins in each sighting along with information on location, group size, numbers of calves, activities, and environmental parameters. Preliminary mark-recapture analyses indicate comparable numbers of dolphins in the region during the 1990’s summer surveys and the more recent summer surveys, with a potential increase in numbers in winter. Preliminary examination of the distribution of sightings show relatively low numbers of dolphins near the river mouths during the summer rainy season when hypoxia was recorded and larger numbers in these areas during the drier winter months when waters had higher salinities and were well mixed. To date we have identified 676 different marked dolphins, each with between one and eighteen sightings since 2001 (Fig. 1). Repeated sightings of at least 471 marked individuals show they are present year-round and at least 390 dolphins show long-term site fidelity of five years or longer. Though most of the identified dolphins demonstrated strong site fidelity as reported for other Gulf of Mexico estuaries, a few individuals were documented traveling between estuaries. At least 32 dolphins with 10 or more sightings have been observed before and after Hurricane Charley and there was no obvious change in the distribution of their sightings.

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Figure 1. Number of individuals sighted (n=676) with between 1 and 18 sightings since 2001.
Short-term Effects of a Low Dissolved Oxygen Event on Fish Communities Following the Passage of Hurricane Charley.

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Hurricane Charley, a Category 4 storm, passed directly over the Charlotte Harbor estuary and Peace River watershed on Friday 13, August 2004. Following the storm’s passage, the dissolved oxygen level in the Peace River fell below 1 mg/L, and the hypoxic conditions extended approximately 15 km into the estuary. A long-term fisheries-independent monitoring program (1989 to present) was in place in Charlotte Harbor and sampling was intensified in the month following the storm. Changes in fish communities that resulted from the hypoxic event were determined using nonmetric multidimensional scaling and similarity percentages analysis. At the mouth of the Peace River, fish abundance decreased dramatically after the hurricane, and the typical estuarine fish community was replaced by one dominated by a few resilient estuarine and freshwater species including the exotic brown hoplo (Hoplosternum littorale) and armored catfish (Loricariidae spp.). Similar results occurred within the hypoxic area of the open estuary; fish abundance declined and the community was reduced to a few species tolerant to poor water conditions. Fish community structure in the Myakka River, located only a few kilometers west of the Peace River, was unaffected. The hypoxic event was short-lived as dissolved oxygen levels and estuarine fish communities in the Peace River and upper Charlotte Harbor recovered within a month following the hurricane. Results of this study are consistent with other hurricane-related hypoxic events in the literature, which report acute effects to estuarine systems in the short-term, rapid recoveries, and long-term resilience.

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Fatty Acid Signature Analysis As A Potential Forensic Tool For Florida Manatees (Trichechus manatus latirostris) And Other Marine Mammals.

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Fatty acid signature analysis (FASA) has become an important tool by which marine mammal scientists gain insight into foraging ecology. FASA is also an extremely promising biomarker by which marine mammalogists may be able to assess exposure to certain natural and anthropogenic stressors. Florida manatees are well studied, and an excellent necropsy program provides a basis against which to ground truth this promising tool. Results on manatees assigned to four cause-of-death categories indicate that those exposed to or dying due to brevetoxin exposure demonstrate a unique fatty acid profile and animals suffering long-term health stress have certain fatty acids not found in animals that die quickly. If further study continues to validate that exposure to harmful algal blooms, contaminants, or other factors provides a clear and diagnostic fatty acid profile in manatee livers, this approach could: a) provide an additional forensic tool to assist scientists and managers to understand cause of death or debilitation in manatees; and b) serve as a model that could be subsequently applied to studies designed to better assess cause of death in other marine mammals.

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Pesticides In Southwest Florida Waterways – A Report Card.

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This paper describes a methodology for estimating pesticide hazards by Water Body ID (WBID) for Southwest Florida surface water. The methodology considers agriculture (citrus and row crops), mosquito management, lawn maintenance, and golf course maintenance. For each pesticide physical chemical properties are used to predict transport and fate in surface water and this is combined with acute toxicity data on fish, aquatic invertebrates, insects, and birds. This together with quantity used by WBID helps to estimate the relative pesticide hazards for each WBID. Row crops contribute the greatest hazard with tomatoes and bell peppers leading the list followed by citrus, lawn maintenance, mosquito management and finally golf course maintenance. The most hazardous pesticides were: the fumigants methyl bromide and chloropicrin followed by oxadiazon (lawn herbicide), copper hydroxide (agricultural fungicide), permethrin (lawn insecticide), bromacil (lawn herbicide), mancozeb (lawn fungicide), atrazine (lawn herbicide), diuron (agricultural herbicide), chlorothalonil (agricultural and lawn fungicide), and glyphosate (agricultural herbicide). The methodology predicted that the most affected WBIDs lie in the agricultural areas of Collier and Hendry Counties.

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Evaluation of Pesticide Monitoring Data for the Caloosahatchee River.

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Since 1980, the South Florida Water Management District has been taking samples of surface water and sediment bi-monthly from three locations along the Caloosahatchee River as part of their Pesticide Monitoring Program. This ongoing project collects samples and then sends them to the Florida DEP laboratory for analysis of 63 pesticides and pesticide breakdown products. This study focuses on the data for these three stations from 1999 to the present. Only five pesticides, all herbicides, were found to be present above the detection limit; these were: ametryn, atrazine, bromacil, norflurazon and simazine. Other monitoring by Florida DEP has also reported levels of diazinon over the detection limit along the Caloosahatchee. Diazinon, bromacil and atrazine have been measured at concentrations that may affect aquatic invertebrates. In addition, atrazine, bromacil, norflurazon and simazine are classified as potential human carcinogens and the Caloosahatchee is used for drinking water.

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Fishing for a Relationship Between Seagrasses and their Associated Fauna.

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To develop a better understanding of the relationship between submerged aquatic vegetation (SAV) habitats and their associated fish communities it is important to determine whether the seagrass species that defines the habitat influences the diversity and/or the abundance of the fish community. We hypothesized that fish community structure and size would not vary with seagrass species. To test our hypothesis, we chose nine sites (3 sites per seagrass species), which represented the three dominant seagrass species: *Halodule wrightii*, *Syringodium filiforme*, and *Thalassia testudinum* within lower Charlotte Harbor. Sites were sampled for fauna, floral characteristics, and water quality parameters during three distinct time periods: 1) high recruitment (March to July), 2) high flow (July to November), and 3) low productivity (November to March). Fauna (primarily fish) were sampled with a 21m seine pulled nine times per site per sampling period. All fish were identified to species and enumerated with a subset (n=20) measured for total length. Floral samples included seagrass percent cover by species, short shoot density and biomass (above and below ground). Water quality measures included conductivity (salinity), temperature, dissolved oxygen, and light attenuation. This presentation will summarize data from the first three years of this ongoing project.
An Autonomous PIT Tag Antenna System for Studying Estuarine-Dependent Fish. (An Update On The Fish Creekpass Toll System).

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Nursery habitats are juvenile habitats that contribute proportionately more individuals to adult populations than other habitats. Site-specific identification of nursery habitats is needed so management can prioritize conservation actions and predict consequences of habitat degradation, and for framing process-oriented research. Use of tag-recapture methods is essential to determining habitat connectivity at this resolution. A PIT-tag-autonomous-antenna system approach is being used to estimate population size and survival of juvenile common snook, *Centropomus undecimalis*, in mangrove creek habitats in Charlotte Harbor, FL. Population size is required in equations used to estimate proportional contributions to adult populations — in conjunction with recapture of tagged fish during intensive sampling of adult populations. Within-creek survival estimates help explain differences in juvenile population size and/or proportional contribution. In research to date, the high detection probability (67%) and recapture rate (51%) by the antenna system, and no tag-related mortality indicate this is a valid approach. Research is ongoing to apply this approach on a wider scale (multiple habitat locations) to quantify ontogenetic connectivity and to determine the extent that habitat quality (i.e., natural vs. degraded creeks) influences nursery function.

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The First Commercial Fishermen in Charlotte Harbor: New Insights into the Cuban Fishing Industry of South Florida

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Recent archival research in Spain and Cuba has provided substantial new documentary data regarding the Cuban fishing industry of South Florida, which emerged during the 17th century, and which flourished during the 18th and early 19th century. Systematic investigation of financial account records from the Havana treasury throughout this period, supplemented by internal correspondence among Cuban government officials, has provided remarkable details regarding not just the emergence, evolution, and decline of this industry, but also the seasonal patterns of maritime traffic associated with both fall and winter fishing as well as off-season salt production and transport during spring and summer.

Routine annual documentation has been discovered for the years between 1765 and 1821 regarding the identities of these Cuban fishermen and their vessels, the nature and timing of their seasonal activities in South Florida and along the northern coast of Cuba, and their extensive interaction with immigrant Creek Indians living particularly along the lower Gulf coastline. This information provides strong indications that the Cuban fishing fleet during this period was predominantly focused on late fall and early winter mullet fishing in the estuaries of both the Gulf and Atlantic coasts, with returns to Havana scheduled for the beginning of the Lenten season, when fish consumption was at its peak. Roughly a dozen Cuban schooners and sloops sailed north from Havana annually in October or November, returning by February or early March with something on the order of 25,000 lbs. of salted whole fish each, not counting additional quantities of mullet roe.

The strongly seasonal character of the Cuban fishing fleet is additionally demonstrated by the fact that these same captains normally used their vessels from May to August to transport salt to the Havana warehouses from Cayo Sal and Punta de Hicacos along the northern Cuba coast, but remained inactive between mid-August and mid-October, precisely corresponding to the peak hurricane season. The only exception to this seasonal pattern was a brief window in July and August when vessels sometimes transported Florida Indians to Havana for gifts, in addition to the more common fall-winter visits. This became more common during the early 19th century, when more and more Cuban fishermen seem to have taken up residence in South Florida, intermarrying with the “Spanish Indians” and visiting Havana only infrequently for supplies and sale of their catches.

Ongoing research into the Cuban fishing industry of South Florida holds considerable promise to provide important information regarding the almost continual human exploitation of the estuarine resources of Charlotte Harbor and other areas during the more than a century that passed between the departure of the indigenous Calusa and other Native American groups, and the gradual flood of Anglo-American settlers that would ultimately repopulate the Florida peninsula during the late 19th and 20th centuries.

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Do Altered Coastal Habitats Promote Non-native Fish Invasions into Estuaries?

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The ecological health of estuaries in the Gulf of Mexico is under serious threat from non-native species and habitat alterations. The rate of invasions by non-native species has increased concurrent with coastal development, and as coastal urban development spreads the ecological and economic impacts of non-native fish species can be expected to increase. It is likely that these altered coastal habitats have provided haven for invasive species, which may use these habitats as source populations for estuarine invasions. First documented in Florida in 1983 in Everglades National Park, Mayan cichlids (*Cichlasoma urophthalmus*) are now established in freshwater and some estuarine habitats of South Florida. Mayan cichlids were first recorded in July 2003 in Charlotte Harbor mangrove creeks, with > 97% captured in anthropogenically degraded creeks (vs natural creeks), suggesting that habitat and freshwater flow alterations facilitate invasion of estuarine habitats by this species. Using PIT tags and an autonomous antenna system, in conjunction with traditional recapture sampling with seines, colonization, mortality, migration, and connectivity between upland and creek habitats is being estimated. Once invasion avenues are defined, restoration and mitigation strategies can be adapted to interrupt these avenues to reduce the establishment of this species in estuarine habitats.

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A Shoreline and Bathymetry Database for Southwest Florida River and Estuary Systems.

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An accurate and up-to-date database on shoreline and bathymetry is essential to quantitative studies of estuarine systems, because it provides fundamental base information for the application of the water-budget equation. A series shoreline mapping and bathymetric survey projects were conducted in several rivers and estuary systems in southwest Florida. Detailed shoreline and bathymetry data were collected in the Upper (SWFWMD) portion of the Charlotte Harbor, Dona-Roberts Bay, Weeki Wachee River, Anclote River, Little Manatee River, and Withlacoochee River. Almost all distributary channels (e.g., creeks, sloughs) associated with the rivers are included in the present survey project. The shoreline configuration was mapped in the field using a RTK (Real-Time Kinematics) GPS system. The bathymetry was measured using a synchronized echo sounder with the GPS.

Under most circumstances, the survey lines are roughly perpendicular to the shoreline. In the Charlotte Harbor area, the survey lines were spaced at approximately 300-m apart. In the river systems, the survey lines were spaced at roughly 150 m, in addition to a centerline survey, to ensure adequate spatial coverage.

The echo sounder was sampled at 1 Hz, equivalent roughly to one measurement every 1 to 2.5 m length in the river and 2 to 3 m in the bay. This sampling interval was adopted to ensure detailed spatial coverage, especially in the river and creek channels. Concurrent 15-minute tide stage measurements by USGS gages were used to correct the tidal influence on the floating platform survey and to relate the bathymetry to NGVD29 or NAVD88. All the data and shoreline and bathymetry maps are available in digital format. The shoreline and bathymetry are also compiled into a GIS database.

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Due to their ability to impair hormone-regulated processes such as development, reproduction, and immune function, environmental pollutants that mimic the female hormone estrogen (i.e., "ecoestrogens") pose significant health risks to both terrestrial and aquatic organisms. Because of these risks, it is important to determine the sources and concentrations of these contaminants in the natural environment so that policies to reduce their release and effects can be developed. The need for such information is particularly critical for coastal ecosystems, which sustain extensive human and wildlife populations, but are increasingly threatened by environmental pollution. In this presentation, we discuss the ecological risks that ecoestrogens pose to the Charlotte Harbor estuary based on assessments of estrogenic activity in surface waters and analysis of ecoestrogen exposure levels and potential health effects in Charlotte Harbor sharks. Estrogenic activity was measured in Charlotte Harbor surface waters using the E-SCREEN bioassay, a cell culture technique that quantitatively measures the concentrations of estrogenic compounds by their ability to stimulate proliferation of estrogen-dependent MCF-7 human breast cancer cells. Concentrations of organochlorine pesticides (OCPs), a common group of estrogenic contaminants, were measured in bonnethead (Sphyra tiburo) and blacktip (Carcharhinus limbus) sharks from the Pine Island Sound region and compared with data from sharks residing in four other regions on Florida's Gulf coast (Apalachicola Bay, Cedar Key, Tampa Bay, Florida Bay) and 1 site on the U.S. Atlantic coast. Possible associations between OCP exposure levels and reproductive success were also examined in bonnethead sharks since infertility in these species has been hypothesized to be associated with OCP exposure. Lastly, the presence of a biomarker of ecoestrogen exposure, vitellogenin, was examined in Charlotte Harbor sharks to verify possible evidence of OCP (or other ecoestrogen) effects in these animals. The results of surface water analyses indicated that estrogenic activity is present in the Charlotte Harbor estuary, but is more concentrated in areas of urban development. The results from OCP measurements in shark tissues support these findings, as OCP levels in Charlotte Harbor animals were generally lower than those observed in sharks from most other study areas. Surprisingly, assessments of reproduction in bonnethead sharks indicated that infertility occurs commonly in Charlotte Harbor females, and to a degree previously observed only in populations from the highly industrialized Tampa Bay region. However, since vitellogenin expression was not detected in Charlotte Harbor sharks, there was little evidence to support a relationship between infertility and ecoestrogen exposure in this population. Alternative hypotheses to explain the high rate of infertility in Charlotte Harbor S. tiburo are presented. Based on these data, ecoestrogens appear to pose little threat to the health of Charlotte Harbor sharks (and perhaps other fauna) at this time. However, future studies should assess ecoestrogen exposure and effects in wildlife residing in the Caloosahatchee River since estrogenic substances were consistently detected in surface water from this region at biologically active levels.

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"Harbor Harvest," October 4-5, 2005
Watershed Management Strategies for Dona and Roberts Bays.

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Dona and Roberts Bays are situated along the southwest coast of Florida in Sarasota County. Both are connected to the Gulf of Mexico through the Venice Jetty and are located within the Charlotte Harbor National Estuary Program. The volume and timing of freshwater that drains to Dona and Roberts Bays has been dramatically altered primarily through the diversion of flows from the Myakka River watershed. Significant hydrologic alterations which diverted freshwater to Dona and Roberts Bays include the Cow Pen Slough canal and Blackburn Canal, respectively.

These hydrologic alterations are a focus of several objectives in the CHNEP Comprehensive Conservation Management Plan (CCMP). To restore a more natural hydrologic flow regime and develop a more natural water budget to the bays and estuaries, it is essential to understand the historical watershed hydrology. Next, biologists, water chemists, geologists, and hydrologists to work together to develop a common understanding of the cause and effects the hydrologic alterations. With a common understanding, this multi-disciplinary team can better plan and implement a watershed management plan that protects and to the extent necessary, restores the natural and historic hydrologic functions.

Over the past few years, Sarasota County in cooperation with the Southwest Florida Water Management District has embarked on a multi-disciplinary evaluation Dona and Roberts Bays and their respective watersheds. It is within this context A multi-disciplinary team consisting of Kimley-Horn and Associates; Post, Buckley, Schuh and Jernigan; Biological Research Associates, EarthBalance, Mote Marine, and Heidi Smith Communications have been retained to continue this evaluation and implement a watershed management plan. This paper presents a historical perspective of the watershed, presents what has been accomplished to date, and what is to be accomplished in the next year.

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Red drum is a preferred sport fish among recreational fishers in Greater Charlotte Harbor. Juvenile red drum are widely distributed among a variety of shoreline conditions throughout its native range in the Atlantic from Massachusetts to northern Mexico. It is suspected that manipulated water conditions through freshwater discharges into the Caloosahatchee River may adversely affect their ability to find preferred habitat. Identifying preferred habitat would allow water managers the option of maintaining conditions suitable for certain life stages of this and other estuarine species. This study, funded by the SFWMD, investigated optimum and preferred habitat of juvenile red drum (*Sciaenops ocellatus*) in the lower Caloosahatchee River/Estuary. Toward achieving this goal, the project has two distinct research objectives: 1) conduct an intense sampling effort using sampling protocols similar to that designed by the FWRIs Fishery Independent Monitoring program; and 2) release hatchery-reared red drum at sites where red drum were previously captured. For the first research objective, sampling is being conducted from March 2004 through August 2006 in lower Pine Island Sound, Matlacha Pass and in the Caloosahatchee River east to the Orange River. Over 200 sites have been sampled to date. Water quality, general weather and sea conditions, distance to shore and shoreline type (mangrove, rip-rap, sand, seawall, vegetation, none) are recorded. In addition, bottom composition (i.e., seagrass species, drift algae, attached algae, oysters), and percent bottom coverage are recorded at each sample site. Species and abundance data are recorded for all fish caught. An analysis of the sites sampled to date shows that patterns of specific/preferred habitat associations were not apparent in the Caloosahatchee River Estuary. For the second objective, over 3,000 hatchery-reared juvenile red drum were released under three treatment conditions: 1) optimal habitat (three each); 2) holding condition (acclimated and non-acclimated); and 3) fish size (three sizes). Approximately 200 fish, each with a wire-coded tag, were released in spring 2004 under each of the treatment conditions. Surveys continue to identify habitat affinities and the possible success of releasing red drum as part of a restoration effort. The REDstart hatchery (constructed and operated by Florida Sea Grant College) proved useful for conducting red drum grow-out as Phase I (20 mm TL) fish were reared to Phase II (~ 100 mm TL) and greater than Phase III (a size of over 350 mm TL) sizes. Few problems were encountered with the hatchery. Its basic function and operation may serve as a model for other communities to establish should they become interested in stock enhancement of red drum or similar estuarine species. Future research will expand on previous efforts through increased releases and more sampling.

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Long Term Monitoring of Fish Sound Production in Charlotte Harbor.

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Fish sound production associated with courtship and spawning was documented at several locations in Charlotte Harbor, Florida from 2002-2005. Acoustic recorders programmed to record 10 s every 10 minutes were deployed at various sites and recorded sounds at a 3333 Hz sample rate. Sound production was dominated by three sciaenid species: silver perch (*Bairdiella chrysoura*), sand seatrout (*Cynoscion arenarius*), and spotted seatrout (*Cynoscion nebulosus*). Sounds produced by black drum (*Pogonias cromis*), gafftopsail catfish (*Bagre marinus*), and gulf toadfish (*Opsanus beta*) were also recorded. An FFT of recordings indicated most acoustic energy of sciaenid calls was concentrated between 300-400Hz. While sciaenid sound production occurred each year, consistent with the spawning season, it was absent or greatly reduced in northern portions of the harbor affected by hypoxia due to increased river flow. Following the passage of Hurricane Charley in 2004, hypoxia was widespread in the harbor and portions of the upper harbor were anoxic. Effects of the hurricane did not appear to negatively impact sciaenid fish chorusing during the 2005 spawning season but seasonal increases in river flow had similar effects on chorusing populations as in previous years.

Figure 1. Sound pressure levels in the 300-400 Hz band showing the seasonal onset and increase of sciaenid chorusing at a study site in upper Charlotte Harbor near the mouth of the Peace River. Marked decrease in chorusing in mid June is associated with increased river flow.

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Seasonal Patterns of Black Drum Sound Production in Residential Canals of Southwest Florida.

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Sound production by black drum (Pogonias cromis) was investigated in residential canals of Punta Gorda and Cape Coral, Florida during 2004 - 2005. Because black drum produce sounds which are associated with courtship and spawning, hydrophone recordings can be used to document the time and location of spawning populations. Acoustic recorders were deployed in four different locations during the winter and early spring months and recorded 10s of sound every 10m at a 3333 Hz sampling rate. Black drum sound production was documented in December through April with peak levels recorded during February and March. Patterns of sound production were similar between different sites and years and were in agreement with the spawning season reported in the literature.

Figure 1. Black drum sound production recorded in residential canals of Punta Gorda and Cape Coral, Florida during 2004 – 2005. Black drum produce sound to attract mates for courtship and spawning. Sound pressure levels (y-axis) are in decibels relative to 1\mu Pascal.

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Characterizing an Activity Hotspot of Kemp's Ridley Turtles in Charlotte Harbor.

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Spatial distributions of turtles within Charlotte Harbor are compiled from directed searches and netting efforts by the Sea Turtle Program, a new initiative with Earthwatch Institute and the Conservancy of Southwest Florida, and from opportunistic sightings recorded by Mote personnel involved in other Charlotte Harbor projects. Location data are plotted on GIS layers assembled from a FMRI spatial data on bathymetry, benthic habitat type, and in relation to FMRI's spatial data on sea turtle strandings. Kemp's ridley, loggerhead, and green turtles are documented in the harbor, and leatherback turtles show up offshore in the fall. Kemp's ridleys captured thus far are relatively small (40 cm) which underlines that southwest Florida's estuaries are vital developmental habitat to a critically endangered species, which at maturity will migrate back to Mexican coasts to nest. Ongoing studies will include acoustic and satellite telemetry to track local habitat use and seasonal movements.

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Smalltooth sawfish (Pristis pectinata) were an important component of inshore ecosystems in Florida before bycatch in fisheries and habitat modification resulted in severe population decline. Public sightings data, surveys, acoustic tracking and acoustic monitoring have been used to study the distribution, abundance and habitat use patterns of this species in Charlotte Harbor. The mouths of the three rivers that enter the Harbor (Caloosahatchee, Peace and Myakka) appear to represent the most important habitats for juvenile P. pectinata. Acoustic tracking has examined the short-term habitat use patterns and demonstrated a close association with shallow areas adjacent to mangroves. Acoustic monitoring in the Caloosahatchee River has provided insights to the site fidelity and movement patterns on the scale of months. The passage of Hurricane Charley across the Harbor in 2004 resulted in heavy damage to the area, including the fringing mangroves. Surveys conducted in early 2005 indicate that close to the path of the hurricane the majority of mangroves had been killed or defoliated. The potential impact of the hurricane on juvenile sawfish and sawfish conservation will be discussed.

Figure 1. Mangrove damage in Charlotte Harbor following Hurricane Charley. Damage was assessed for 100 m stretches of mangroves on a 2 nautical mile grid between February and April 2005.

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Spatial Patterns of Nutrient Concentration in Charlotte Harbor Using Continuous and Discrete Sampling Programs.

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A nutrient analyzer (SubChemPak Analyzer) suitable for field deployment was operated in flow-through mode to characterize the surface waters of Charlotte Harbor for orthophosphorus, nitrate, and nitrite nitrogen at sub-micromolar levels. Surveys were run at approximately 32 kph, with data points stored every 5 sec (~every 45 m while underway). Other continuous data (Sea Bird CTD) included relative fluorescence, salinity, temperature, and density, in addition to geographic position. Discrete samples were also collected for chlorophyll, ammonia nitrogen, silicates, total nitrogen, total phosphorus, and to provide data when readings experienced by the nutrient analyzer were offscale. For those parameters sampled by both discrete and continuous methods, correspondence was generally good, but the spatial heterogeneity, mixing, and biological processes indicated by the continuous data indicates a much higher degree of complexity than can be obtained from any number of discrete samples. Compiled over a two day period, spatial patterns indicated several distinct water masses in the Harbor. A plume of water from the lower Harbor extended some distance up the Harbor. Nutrient characteristics of water from the Peace River differed from that of the Myakka. Chlorophyll concentrations increased after introduction into the Harbor, rather than being entrained in the low salinity, high nutrient riverine water. Even for the micronutrient in excess (phosphorus), dilution did not account for the variety of relationships observed with salinity. Nitrite and nitrate nitrogen were strongly coupled and displayed an expected inverse relationship with chlorophyll fluorescence in the nitrogen limited Harbor. Dilution effects were evident in inorganic nitrogen as was rapid phytoplankton uptake. Transitions between higher and lower levels of nitrogen and chlorophyll were often abrupt and indicated discrete water masses rather than a gradual dilution and increasing algal response. Additional continuous instrumentation available in the winter 2005-2006 will permit similar investigations of high density data for ammonia nitrogen and silicates. Funding by the U.S. Army Corps of Engineers, State of Florida Fish and Wildlife Conservation Commission.

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Nomads of the Sound: Residency and Movement Patterns of Bonnethead Sharks.

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The use of Pine Island Sound by bonnethead sharks, Sphyrna tiburo was examined using acoustic monitoring, gillnet sampling and tag-recapture studies. Acoustic monitoring data were used to define the residency and movement patterns of sharks within Pine Island Sound, Charlotte Harbor, Florida. Sharks were monitored for periods of 1–173 days with individuals regularly moving in and out of the detection range of the acoustic system. Patterns of movement could not be correlated with tidal level or time of day. Home range sizes within the Pine Island Sound population were typically small with individuals using core areas on a daily basis. However, core areas shifted within the study site over time resulting in eventual usage of most of the available habitat. Gillnet sampling revealed that S. tiburo were abundant in shallow water near seagrass beds, but that presence of individuals at specific sites was variable. Tag-recapture data showed that most individuals remained within the Pine Island Sound region over time and did not appear to undergo long coastal migrations. Several individuals were philopatric to the sound returning in multiple years. The movement and residence patterns of S. tiburo suggest that individuals are resident within the estuary, but do not show site fidelity to specific areas within the estuary. Although general usage of Pine Island Sound may be predictable, the actual movements of individuals are less static and vary widely through time.

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Bringing BIOSENSE to Ocean Observing Systems on the Florida West Coast.

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International and national efforts are underway to design and implement Earth observing systems with components addressing oceanic, coastal, and terrestrial environments. Coastal ocean observing systems, or COOS, will employ fixed and mobile platforms for automated measurement systems which store or relay data to centers for reduction, interpretation, and application. Presently, American COOS intend to (a) build on existing infrastructure (b) rely in their initial stages on meteorological and physical oceanographic data acquisition systems, and (c) introduce biological or ecological data streams in later project phases. Such plans largely ignore priorities of federal and national guidance documents for ocean observation, and risk the establishment of expensive COOS that are incapable of, or are only indirectly useful for, addressing critical social needs for information on pressing ecological issues such as harmful algal blooms. In collaboration with research partners throughout the state, Mote Marine Laboratory proposes to facilitate the design and implementation of "BIOSENSE" as a biological observing system that can provide robust data products to inform the public, facilitate operations of commercial enterprises, and aid decision-making by coastal resource management. The data and data products will also serve the science community's need for better temporal and spatial resolution of environmental processes essential to address issues of human impacts on the coastal environment. These uses will be achieved through the coordination and integration of existing biological observing systems, development of next-generation biological technologies, grow-out of Mote's existing SO-COOL clearinghouse, and linkages to existing and new platforms supporting geological and physical oceanography. The biological observing system will begin operation in the coastal waters between Sarasota and Tampa Bay and in subsequent phases expand seaward, and south to and include Charlotte Harbor. In its initial phase, BIOSENSE will observe biological parameters such as: phytoplankton abundance and community structure, (including harmful algal blooms), red tide toxins, local stock assessments of soniferous invertebrate and fish species, and the movements and migrations of acoustically-tagged sharks, commercial and recreational teleosts, sea turtles, and marine mammals. Within five years the project will add water chemistry, zooplankton abundance, mortality of target species, selected benthic parameters, habitat characterization, video feeds, observing systems for submarine sinks and springs, observing systems employing living and non-living mobile platforms, and public beach health. As a national center for biological observing systems, BIOSENSE will provide at-sea and land-side support for the development and application of bio-sensing technology by and for the special circumstances facing Gulf of Mexico, Southeast Atlantic, and Caribbean coastal ocean observation and reporting systems.

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Lethal and Sub-Lethal Effects of Reduced Salinity on the Bay Scallop, *Argopecten Irradians*, at High Temperatures.

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The effect of low salinity and high temperature on a Florida population of the bay scallop (*Argopecten irradians concentricus*) was investigated in laboratory and field experiments. Laboratory experiments were carried out at 10, 15, 20 and 25 ppt and at 20, 25 and 30 °C. Sub-lethal effects were determined by measuring feeding activity (=clearance rates) at different salinity-temperature combinations. Mortality was measured over a one-week exposure to the same conditions. Clearance rate significantly decreased with decreasing salinity, while temperature had no significant effect on feeding. Scallop mortality increased at lower salinities at all temperatures. At the same salinity, mortality increased with increasing temperature. In field experiments, scallops suffered 100% mortality within one week at sites where the mean salinity was less than 15 ppt, while scallops deployed at sites where the mean salinity was greater than 15 ppt experienced only 5% mortality. These findings indicate that the effects of reduced salinity on bay scallops from the west coast of Florida are exasperated at higher temperatures. These results will help determine optimum locations for future bay scallop restoration efforts in southwest Florida.

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Human Impacts in the Charlotte Harbor Sedimentary Record: an Investigation of Contamination, Anoxia and Sediment Input Rates.

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A series of 40 sediment cores collected over the past 3 years documents the natural and anthropogenically impacted development of Charlotte Harbor, FL over the past 5,000 years. Based on texture, composition, and radiometric dating using Pb-210, Cs-137, and C-14 methods, no systematic change in sediment distribution patterns have been detected over the last 100 years that can be attributed to anthropogenic activities. There have also been no appreciable changes in PAH contaminants, PCB's, and chlorinated hydrocarbons indicating very little historic influx of these contaminants throughout the past 100 years. Anthropogenic activities are manifested in the Charlotte Harbor sedimentary record, however, as a 1 order-of-magnitude increase in sediment input and accumulation.

The present focus of this study is to fine tune the geochronology, specifically the timing and sequence of events using Pb-210 and Cs-137 dating methods, in specific areas such as the anoxic zone and the upper estuary where the Peace and Myakka Rivers enter the system. In general, Pb-210 data indicate recent excursions in sediment input rates in the upper estuary that are reproducible in a number of cores. Other cores however, specifically at the mouth of the Myakka River, show that there has been no recent accumulation of sediments over the last 100 years. Cores from the anoxic zone exhibit a surficial layer of organic-rich mud accumulating at 0.16 cm/yr. The Pb-210 profile suggests that sediments are well laminated, and biological activity (i.e., bioturbation) is rare, as would be expected in an anoxic environment. No evidence of anoxic cyclicity was detected in the surficial sedimentary record. However, although the sediment accumulation rate has increased dramatically over natural rates, it may still be too low to resolve individual anoxia events. Analyses to determine metal concentrations including Rhenium and Molybdenum, both indicators of reducing environments, are currently being performed in an effort to aid in determining if periods of anoxia are indeed cyclic and if they have occurred prior to anthropogenic development.

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Rapporteur’s Biography

Catherine A. Corbett is the Senior Scientist for the Charlotte Harbor National Estuary Program. She joined the staff in February 2000 to provide staff support for the Technical Advisory Committee (TAC) and its four subcommittees and to facilitate and coordinate the implementation of the technical goals of the Comprehensive Conservation and Management Plan (CCMP) and the long-term monitoring strategy. Her work entails consensus-building and engaging staff from public agencies and outside entities to implement the technical goals of the CCMP as well as in discussions of regional issues influencing the watershed. One of her greatest successes has been the initiation of a cooperative, inter-agency ambient water quality monitoring program involving 8 agencies that collects monthly data over a 270 square mile region. From 1993-1995, she worked as a wildlife biologist in Tazekka National Park of the Middle Atlas Mountains in Morocco as a Peace Corps volunteer, conducting field research for the annual Barbary sheep (Aoudad) census, park species inventories, cave management plan and a survey of pastoral use by semi-nomadic park inhabitants. She also created educational exhibits in Arabic, English and French for a park ecocenter and facilitated the installation of fuel-efficient cookstoves to several park villages, including training of female villagers in their construction. Since that time, she has worked at several non-governmental organizations, such as IUCN-The World Conservation Union and the Atlantic Center for the Environment (QLF), on natural resource management issues. Her work included conflict mediation in her role as the coordinator of QLF’s Middle East Fellowship Program in 1996 for five environmental conservationists from Israel, Jordan, the West Bank and the Gaza Strip. Ms. Corbett received a B.S. degree in Zoology and Minor in Physical Geography from Miami University of Ohio in 1991 and a Master’s degree in International Development, with an emphasis on natural resources management, from Clark University of Massachusetts in 2000.
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Mote Marine Laboratory is an independent, nonprofit marine research organization dedicated to the advancement of marine and environmental sciences through research and education. Since its inception in 1955, the Laboratory's mission has been the pursuit of excellence in scientific research and the dissemination of information to the scientific community as well as the general public. Although internationally recognized through the scientists' research and publications, much of the laboratory's effort is directed toward the Southwest Florida coastal region. Through this research, the Laboratory provides a center for the exchange of scientific information, hosting visiting scientists, college and high school student interns, educational programs for all ages, and conferences.