MEETING SUMMARY
Tampa Bay Regional Planning Council
FULL AGENCY ON BAY MANAGEMENT

September 8, 2011

The September meeting of the full Agency on Bay Management was held in the Council conference room located at 4000 Gateway Centre Boulevard, Pinellas Park, Florida. Mr. Bob Kersteen chaired the meeting. Those in attendance included the following:

* = ABM Member or Alternate

* Mr. Bob Kersteen, ABM Chair, TBRPC
* Ms. Andrea Alden, Florida Fish and Wildlife Conservation Commission
* Commissioner Woody Brown, City of Largo
* Captain Peter Clark, Tampa Bay Watch
* Mr. Shawn College, Hillsborough County Planning Commission
* Mr. Carlos Frey, City of St. Petersburg
* Mr. Ronn Ginn, Environmental Architect
Mr. Roberto Gonzalez, FDOT
Ms. Melissa Harrison, Pinellas County
* Councilman Sam Henderson, City of Gulfport
* Ms. Sarah Josuns, City of Clearwater
* Mr. Stefan Katzaras, CF Industries
* Mr. Ben Koplin, City of Tampa
* Mr. Charles Kovach, FDEP
Mr. Craig Kovach, CF Industries
* Mr. William Land, Mosaic Fertilizer
* Mr. Eric Lesnett, EPC of Hillsborough County
* Mr. Robert McConnell, Tampa Bay Water
Mr. Jason Mickel, SWFWMD
* Mr. Walter Miller, Port of St. Petersburg
* Mayor Bob Minning, City of Treasure Island/TBRPC
Mr. Kevin Misiewicz, Citizen
Ms. Vicki Parsons, *Bay Soundings*
* Ms. Ann Paul, Audubon Society
* Ms. Jan K. Platt, Recreational Interests
* Ms. Catherine Quindiagan, TBEP CAC
* Tom Reese, Esq., Pinellas County Citizen
Mr. Bill Richardson, FWRI
* Mr. Joseph Severson, FDOT
* Mr. Kevin Shelton, Ash Engineering
* Mr. Ed Sherwood, Tampa Bay Estuary Program
* Mr. Jim Spangler, Egmont Key Alliance
* Mr. Mark Sramek, NOAA
* Ms. Sally Thompson, Tampa Bay Conservancy
* Ms. Terrie Weeks, Suncoast Sierra Club
Ms. Suzanne Cooper, TBRPC/ABM Staff

- **CALL TO ORDER**

Mr. Kersteen called the meeting to order at 9:07 a.m.

- **APPROVAL OF THE JULY 14, 2011 MEETING SUMMARY**

Captain Clark made a motion to approve the Summary of the July 14, 2011 full Agency meeting. The motion was seconded by Mr. Shelton and carried unanimously.

- **ANNOUNCEMENTS**

Captain Clark announced that The Great Bay Scallop Search that was cancelled two weeks ago because of bad weather has been rescheduled for this Saturday. There are a few more spots open for boaters. Check out the website at www.tampabaywatch.org, or call to reserve a spot.

Ms. Cooper gave a report on the Joint Natural Resources/Environmental Impact Review Committee and Habitat Restoration Committee meeting that was held on August 11, 2011

Mr. Tom Pride of URS Corporation described the habitat creation projects undertaken in 2007 to mitigate for 5.25 acres of habitat impact associated with the construction of the St. Petersburg-Clearwater International

Airport runway safety area. The plan included filling portions of a dredged hole in Big Island Gap to create 4.25 acres of seagrass habitat. The cost of materials rose from $25 to $43/cubic yard during the project, and so the size was cut back. Ultimately 3.13 acres of seagrass habitat was created, and recent monitoring indicates that natural recruitment of seagrass is occurring. Additional habitat restoration and water quality improvements were performed in the Feather Sound area (marsh creation, oyster bars and mangrove planting) and within a 12-acre area of mangroves with mosquito-control ditches (removing spoil mounds and planting mangroves) in the Gateway portion of the bay. That project provided some valuable lessons about mitigation projects and restoration projects.

Mr. Pride also briefed the Committees' members about the mitigation project for the Mulberry Phosphate spill of phosphoric acid into the Alafia River in 1997, which destroyed estuarine fauna and habitat. Federally-required mitigation and compensation levels were determined and one mitigation project will entail creation of oyster reef near the mouth of the Alafia River. A pilot project began in 2005 to determine the best site, materials and construction methods for building a large-scale reef/fisheries habitat. Three sites were investigated. The east side of Spoil Island 2-D was chosen. Approximately 5,200 linear feet of reef, made of limestone rock and concrete rubble, will be created, with work to start within the next year.

Mr. Jason Kirkpatrick, Contractor for the 6th Civil Engineer Squadron at MacDill Air Force Base, described a project intended to control the erosional effect of storm events and ship wakes. MacDill AFB has been installing oyster domes and oyster shell bags in an effort to reduce shoreline erosion along its southeastern shore. These are creating excellent habitat but have not been effective wave barriers. The planned project would install about 1,000 linear feet of very large oyster domes or similar structures about 300-500 feet offshore of the existing wave barriers. The larger domes would attenuate larger waves at higher tides and also create fish habitat. Committee members expressed concern over expected seagrass impacts, and recommended analysis of sand movement in the area and stabilization of the shoreline using marsh grasses and mangroves. These comments and recommendations were incorporated into the TBRPC report to the State Clearinghouse.

Mr. Sramek said that NOAA has been working closely with Jason Kirkpatrick to avoid/minimize seagrass impacts from that project. They are also working through the State Clearinghouse with FWC. He is not sure it's going to quell the erosion over there, but will do his best to make sure it avoids or at least minimizes seagrass impacts.

Mr. Kovach added that FDEP has similar concerns from a permitting agency perspective. FDEP doesn't see signs of significant erosion or changes in erosion patterns, historically. He thought that a study was done in 1998 under contract to the Tampa Bay Estuary Program with money from the Hillsborough County Pollution Recovery Trust Fund, where some devices were deployed to look at wave energy on that portion of east MacDill, concluded that it appeared that tidal scour was more important to these nearshore sand movements than wave energy itself. One suspicion is that high wave energy events were probably more important to erosion, and these devices won't control that, so it's the five to ten percent of high storm events that create erosion in these systems. He asked Ms. Cooper for a copy of that report.

- **SHIPS' BALLAST WATER AS A VECTOR FOR THE INTRODUCTION OF HARMFUL MICROALGAE INTO TAMPA BAY**

Ms. Cooper introduced Bill Richardson, a Research Associate at FWRI and a member of the Harmful Algal Bloom Group for the past 15 years.

Mr. Richardson described the project that was carried out between 2003 to 2006. A survey of the microalgae, single cell algae, that is found inside the ballast water and sediments of large commercial vessels in the Port of Tampa and Port Manatee, as well as those in the port water and sediments, was conducted. The rationale for the study was that ballast water was well recognized as a vector of invasive species which threatened marine ecosystems worldwide; no prior study had examined the potential for invasive species to introduced to Tampa Bay by visiting ships; and documented cases of marine harmful algae introductions causing extensive economic damage existed.

In terms of microalgae, it is transported throughout the world, naturally, by currents, but there are a number of barriers to this natural dispersion. A couple of barriers that come to mind are land barriers, salinity barriers, and temperature barriers to the extent of dispersion. Species in the water column will be carried to new habitats, and if conditions are suitable, they will survive and establish themselves and stay. The equatorial zone has high temperature water, so it acts as a natural barrier for cold water and temperate species, but when transported across this barrier fauna can successfully reach different regions. Man has contributed to the spread of species by transporting species across natural land and water barriers and introduced them to geographic regions beyond their natural distribution for centuries. One early mechanism for this inadvertent transport was <u>on</u> the hulls of ships where some species would colonize the underside of ships, particularly sailing ships where they would actually bore into the vessel. So for centuries we had transport of organisms across these barriers where they were introduced to ranges that were not natural, so they would be a nonnative species. Also these ships were loaded with rock in order to add weight to the ship. These cargo ships were constructed to carry a lot of cargo, so when they were empty or didn't have a lot of cargo, rocks were placed below deck to add weight, and the term for that is ballast, so that would be ballast in the form of rocks. In fact, Ballast Point on the shores of Tampa Bay, as early as the 1800s, was an important cattle-shipping point and got its name because inbound sailing vessels dumped overboard their rock ballast before loading cattle and other freight. The accumulated ballast is said to include rock from almost every sea coast in the world. So these early sailing ships transported, primarily on the hulls of the vessels, the fouling type of community and organisms associated with those species. With the development of steel ships, we still have fouling organisms, but to a lesser degree. Instead of rocks on the ship to add this weight, now water has become the preferred form of ballast or weight. These new ships were designed to use water as ballast and it is stored in tanks along the ships' outer walls. There are also fore and aft tanks, and some ships have tanks in the very bottom. When a ship unloads cargo it takes on ballast water for the transit to another port. This is not optional, but essential based on how these ships are designed. If they discharge all of the cargo they will take on maximum ballast and what comes on board with that water is everything that's suspended in the water.

Marine organisms are in this ballast water: algae, potentially harmful algae, planktonic organisms and also organisms that are suspended in the sediments. Normally, this discharging and loading of cargo occurs in ports, and those are estuarine waters, then they travel across oceanic barriers and in many cases cause an unnatural dispersion of species. When they come in to load cargo they get rid of the extra weight that isn't needed any more, so they just pump out the ballast water, then head out with a full load of cargo. This loading and unloading of cargo and the loading and discharging of ballast water in estuarine waters is the concern. The tanks aren't very hospitable to the survival of any species for a long duration, in dark conditions with changes in oxygen, pH, etc. The only method that's practiced now for treatment of ballast water is to conduct an open-ocean or mid-ocean exchange of ballast water, usually 50 to 200 miles offshore in oceanic water which is generally low in plankton and salinity. The tanks are flushed out and in the process organisms are flushed out. Ocean water of higher salinity, which would normally act as a barrier to estuarine species, is less favorable for their survival. This is the only method for treatment right now, and it's voluntary. It has been estimated that more than 3,000 species are being carried daily in ships' ballast tanks around the world. The ballast water exchange in ports and harbors worldwide has been shown to be a primary vector for the introduction of nonnative harmful microorganisms, and the introduction of invasive marine species has been identified as one of the four greatest threats to the world's oceans. The other three are land-based sources of marine pollution, over exploitation of living marine resources, and physical alteration/destruction of marine habitat. There are 65 known, suspected or likely nonnative species that have either successfully invaded the Tampa Bay ecosystem or are in a position to do so.

Shipping moves over 80 percent of the world's commodities and transfers approximately three to five billion tons of ballast water internationally each year, and a similar volume may also be transferred domestically within countries and regions each year. Ballast water discharged into Tampa Bay is on the order of one gallon per minute, while ballast discharged into all U.S. ports is 40,000 gallons per minute. This includes single-celled, multi-cellular organisms as well as bacteria and pathogens. The vast majority of marine species carried in ballast water do not survive the journey, as the ballasting and deballasting cycle and the environment inside ballast tanks can be quite hostile to organism survival. Even for those that do survive a voyage and are discharged, the chances of surviving in the new environmental conditions, including predation by, and/or competition from, native species, are further reduced. However, when all factors are favorable, an introduced species may survive to establish a reproductive population in the host environment, and it may even become invasive, out-competing native species and multiplying into pest proportions. As a result, whole ecosystems are being changed. A damaging group of Florida's invaders may have arrived in ballast water. Green Mussels were found in Tampa Bay in 1999 and have spread to Florida's east coast. They clog power plant intakes, foul underwater structures and displace native shellfish. Also, thousands of Australian spotted jellyfish were in the Gulf of Mexico in 2000 and were packed so tight that fishing gear was damaged and trawling was impossible. Harmful algae that cause red tides are regularly found in ballast water. Blooms of numerous harmful algal species are being reported in areas where they were previously not known to occur and may be the consequence of introduction via ballast water. Microalgae, particularly dinoflagellates, present a particular concern because they may remain viable in ballast water for weeks and their dormant stage (cyst) may be viable for years.

For the study, ballast water samples were collected by accompanying the U.S. Coast Guard on their safety inspections. Large commercial vessels are all privately owned and only the U.S. Coast Guard has authority to board them. The only other option would have been to contact each ship owner individually and request permission which would have been unsuccessful, since there was no advantage to the ship owners to have sampling performed on their vessel because sampling is not required. The vessel selection and sampling strategy was really opportunistic, since vessels from certain regions couldn't be selected and there were a number of other limitations.

The Coast Guard would introduce the sampling crew and ballast records would be reviewed. The ships are required to maintain records of where they collect the water, how much, where they discharged the water and they have to send this information into a clearinghouse that's operated by the U.S. Coast Guard and the Smithsonian Institute. The salinity of the ballast water is checked, being particularly interested in sampling water with salinity characteristic of estuarine waters (20-30 psu) and not indicative of having undergone an open ocean exchange (32-36 psu). The sample is retrieved and passed through a series of large sieves with a mesh size small enough to retain the bulk of the phytoplankton and their cysts. The material caught in the mesh, as well as some of the unfiltered water, was transported back to the lab for analysis. The filtrate caught by the bucket was poured back into the tank.

A variety of data was collected from the ballast water management ship logbook to complement the biological samples from the ballast water, including: vessel name, date sampled, ballast tank sampled, tank depth/water depth, sampling method, volume filtered, ballast source locations, ballast source date, source water age, open ocean exchange and salinity. The ballast water sampled came from Central and South America, Europe, the Mediterranean and the northwest Pacific. Eighty-two ships were boarded, the bulk of which were bulk and cargo carriers. Seventy-two samples were collected from 63 ships. The results of the sampling were: 36% of the ships had live algae in the ballast water; 42% of the tanks had live algae in the ballast water; a total of 83 species of algae were found in the ballast water; diatom species outnumbered dinoflagellate species; nine nonnative species were found; and one of the nonnative species was recognized as a harmful species (*Dictyocha fibula).* In terms of cysts, they were abundant as well: 39% of ships tanks contained algal cysts; 46% of the tanks contained algal cysts; the number of cysts per sample ranged from 0 to 418; 2,969 cysts were isolated and incubated. Two potentially nonnative species were found, one of which may be a recently identified toxin-producing species from Asian waters. The port water and sediment survey yielded 107 species of live algae, all native to Tampa Bay; there were 3,488 cysts isolated and incubated; 14 to 276 cysts per sample; excystment overall was 23%; and there were 15 species identified, all native to Tampa Bay. The inventory of "resident" species was updated. No new nonnative species were identified, i.e. no species new to the region were recorded that might be indicative of a recent introduction. Photodocumentation resulting in a searchable digital library of thousands of ballast and port cyst images, approximately 7,000 each, has been compiled.

In conclusion, ballast water discharge into Tampa Bay poses a real risk for the introduction of nonnative microalgae. Additional nonnative harmful microalgae species will likely be detected in ballast and/or port water/sediment samples in the future, given an ongoing monitoring program and advances in molecular detection techniques. In addition, the potential for introduction to the Gulf of Mexico region and then dispersal by local domestic shipping ballast is considerable, since the Gulf of Mexico is home to six of the ten largest ports ranked by tonnage. Port vulnerability or risk can be estimated using total tonnage, export tonnage, types of vessels and cargo, trade partners, origin of ballast, port water environment and HAB species, etc., but, reducing the risk based on these assessments may not prevent a single successful invasion, which is all it takes.

Recommendations are for an intermittent long-term monitoring program of ballast water and port water and sediments targeted primarily toward the higher risk species, and for ballast sampling directed toward high risk ships. Although these are the recommendations regarding ballast water sampling and monitoring, the focus first needs to be on minimizing the potential for introduction because of the difficulty in spotting all potential invasive species and the difficulty in containing or eradicating a newly introduced species. In other words, the efforts should be directed first toward ballast water treatment to greatly reduce the potential for invasion, and second, if funds are available, for monitoring for invasive species.

Mr. Richardson said that the first piece of ballast water legislation was in 1990, establishing the U.S. Coast Guard as the regulatory agency for ballast water management, mandating that a regional ballast water management program for the Great Lakes, and calling for studies to document the need for a national ballast water management program. In 1996 the National Invasive Species Act (NISA) addressed the coastal waters and charged the U.S. Coast Guard with establishing a voluntary ballast water management program for all other U.S. ports. It also created the mandatory ballast water reporting and record-keeping requirements and prompted voluntary BWM practices (including ballast water exchange) for all vessels entering all waters of the United States after operating outside the exclusive economic zone. A major weakness of NISA was that it exempted coastwise traffic along the U.S. from ballast exchange regulations, e.g. between San Francisco (highly invaded) and Puget Sound (less so). There have been a number of bills introduced in the U.S. Congress that propose a ballast discharge standard, but none of them have become law. Ballast discharges in U.S. ports have also been regulated by the Vessel General Permit (VGP) for the National Pollution Discharge Elimination System (NPDES) program under the Clean Water Act. The International Maritime Organization (IMO) is a United Nations' agency responsible for improving maritime safety and preventing pollution from ships. In 1991 the IMO issued voluntary guidelines for open ocean exchange and the ships ballast water management plan and record keeping. Compliance with the voluntary ballast water management plan and reporting was so low that in 2004 they made it mandatory.

Recognizing the threat posed by ballast water introductions of nonnative species, the IMO, in 2004, proposed the following regulations take effect after ratification by its members: Regulation D1: requires mandatory open ocean ballast water exchange that achieves a 95% volumetric exchange; and Regulation D2: sets the standard for the amount of viable organisms in the ballast water, less than 10 viable organisms/m^3 (for organisms $\geq$50 um); less than 10 viable algal-size organisms/ml (for organisms 10 - 50 um); and they set concentrations on indicator bacteria, such as *Vibrio, E. coli* and *Enterococci*. These regulations will require ships to conduct a ballast water exchange or meet a concentration-based discharge standard. Acceptance of the Convention has been slow. Entry into force will occur 12 months after ratification by 30 "states" representing 35% of the world merchant shipping gross tonnage. Until such time as the Convention enters into force and the implementation schedule becomes binding globally, actions to address the issue of invasive species are increasingly occurring at national, regional and local levels. More than a dozen individual nations, in addition to regions as diverse as northwest Europe, the Great Lakes, ROPME Sea Area and Antarctica have introduced specific regulations addressing the discharge of ballast in their waters. Further complicating the issue, government authorities such as those in California, Michigan, New York and others within the United States, and the State of Victoria in Australia, have introduced local ballast water management requirements. The current status on ratification of the IMO-proposed regulations as of April 15, 2011 is: States, currently 28 (30 are needed); and Percent Tonnage, currently 25.43% (35% is needed). Because of the slow pace of adoption, the implementation deadlines written into the Convention have become obsolete before they could become mandatory. This has required adjustments to the implementation schedule. This uncertain regulatory schedule makes it all the more difficult for owners, builders and manufacturers to plan for the necessary equipment. The tug of war is shown by the 110th Congress' consideration of regulations that would preempt state standards that were more stringent than federal standards. The Coast Guard released a notice of proposed rulemaking in 2009. The proposed treatment regulation calls for a two-phase implementation schedule. The Phase 1 standard is the same as the IMO D2 and the implementation schedule is similar to the IMO schedule. The Coast Guard Phase 2 limits are 10-fold stricter for organisms >10 um than the IMO D2. The Coast Guard Phase 1 is scheduled to begin in 2014 for existing vessels, and in 2012 for new vessels. Phase 2 will be implemented after a practicability review in 2013. The issuance of the final Coast Guard regulations, originally scheduled for 2010, was delayed. The Ballast Water Discharge Standard Notice of Proposed Rulemaking (NPRM) was published in the Federal Register on August 28, 2009 for public review and comment. The comment period for this proposed rule was extended from November 27 to December 4, 2009. The EPA, in response to a court ruling as a result of litigation by environmental groups, is developing its own national standard, expected to be announced later this year, that will ensure that vessels comply with the Clean Water Act by restricting the discharge of invasive species in ballast water. The public will have an opportunity to comment on a draft of the new legislation by the end of November 2011. Ship owners will then have about a year to comply with the new rules.

Many different treatment technologies have been developed, scaled up for use, and tested. Worldwide, companies have been involved in development to meet the future demand of this market using a variety of technologies. In the United States Hyde Marine, Inc. has a treatment system that uses filtration and ultraviolet light. A lot of money is driving the ballast water treatment technologies since estimates place a cost of approximately $1 million per vessel, for approximately 68,000 existing ships, for a total of $68 billion for the global market for ballast water treatment systems. The good news is the outlook is promising in that the technology is available, tested and cost effective to meet the needs of ships of various sizes and designs.

Mr. Richardson responded to a question by saying that concerns are all specific to port of origin and port of destination because compatibility is critical. Ships bring foreign species to Florida but the chance of survival is really low, so the risks are low. Ships come from all different countries and the goal is to be in port a minimal amount of time. The studies weren't looking to identify the bad or the good, but some countries are really moving ahead with targeting some ships for inspection; for example, Australia.

Ms. Platt surmised that, for security purposes, the lack of monitoring of ballast water tanks is a loophole as far as national security is concerned, and also for economic development purposes. This might be a good time for us to take a position to get federal government to join in the International Maritime Organization's BWM Convention, on behalf of national security, as well as economic development purposes.

She made a motion that ABM send a letter to our Congressmen and Senators and the President to request them to ratify the IMO 2004 BWM Convention for economic and security reasons and for ecosystem health.

Ms. Paul seconded the motion.

Discussion ensued.

Captain Clark asked about the motivation of the 28 countries that are part of this Convention now. Are they concerned about invasive species, or is that something that's been documented in their ports? Is this issue applied to large vessels like cruise ships and other types of non-cargo vessels?

Mr. Richardson replied that he has no knowledge of the management aspect, but the Convention would apply to all ships that have ballast water. Cruise ships don't change their ballast levels often because they are discharging passengers and loading food and beverages, and whatever at each port.

An audience member asked that of the ten nonnative species found, were any of those species known in the Tampa Bay area prior to the research?

Mr. Richardson responded that a number of them were oceanic but listed as nonnative. Some are of no concern.

Ms. Paul asked for the definition of harmful algae.

Mr. Richardson responded that the harmful ones produce toxins that will interfere with gills of fish in large concentrations.

Mr. Richardson responded to a question that there have been studies that have used geological and preserved cysts from sediments in ports to demonstrate that something was an introduced species. *Pyrodinium* is one of those organisms that is very abundant in port sediments. It did show up in tanks and so did some other harmful algae that were in the bay. On the east coast *Pyrodinium* is a toxic problem, but here in Tampa Bay it's not a toxic problem. In the Pacific there's another variety of the species that is extremely toxic.

Mr. Richardson responded to a question that some of the vessels could be categorized as high risk in terms of harmful algae, they would be ones that transit quickly, e.g. container vessels, so there would be a better chance of survival. Another high risk would be where they are coming from. Time of year could be a factor if a vessel is coming from an area where there are high blooms of harmful algae.

Mr. Sherwood requested a modification to the motion to also support the national (U.S. Coast Guard and U.S. EPA) regulations that coincide with the IMO.

The maker and seconder of the motion accepted the modification.

The motion, as modified, carried unanimously.

- **TAMPA BAY INTEGRATED SCIENCE STUDY**

Dr. Kimberly Yates is a Senior Research Scientist, U. S. Geological Survey. She said that a very large number of people contributed to the study, not just USGS people, but a number of folks from all over the state and federal agencies here in the Tampa Bay area. USGS colleagues who provided a lot of leadership for developing the project and carrying it out over the years included Mark Hansen, Peter Swarzenski, Carole McIvor, Terry Edgar and her from the local USGS office; Tom Cronin from the West Virginia office, Jimmy Johnston from Lafayette, LA, and Mike Crane from the Sioux Falls office.

USGS is, historically, a multidisciplinary agency, with scientists from four different disciplines: geology, biological resources, water resources and national mapping. About a decade ago the managers and scientists recognized that effective ecosystem management really requires an understanding of how ecosystems function as a whole, and sometimes multidisciplinary science alone isn't enough to understand the complex interplays among ecosystem components. In 2001, the USGS director ordered development of a science and management strategy to be able to begin engaging in integrated science and using the Tampa Bay Estuary as a place to start with a pilot study and a model for how USGS would engage in integrated science across the nation. The first task was to define what was meant by integrated science and how to undertake that. The official USGS definition of integrated science is: "Multidisciplinary teams of scientists working together, across their scientific fields, to understand complex relations among the biology, geology and chemistry of an ecosystem." Most multidisciplinary studies are also integrated at some level, and there is a lot of that here in Tampa Bay. The director ordered the integration of people, including scientists, local resource managers, citizens, the integrated science disciplines, all four USGS disciplines and science culture, so for example, getting the biologists to speak the chemists' language, and the chemists to speak the geologists' language and that was huge cultural shift for USGS.

Why choose Tampa Bay? Nationally, Tampa Bay is viewed as a success story with respect to ecosystem conservation and restoration. At the time the project began there was about $250 million per year being spent conservation and restoration, so that speaks volumes to the commitment that the Tampa Bay community has to pursuing further ideas and strategies for continued conservation and restoration. There were lots of anthropogenic impacts going on: baywide dredging, the expansion of three ports, $55 million in trade, tourism, development and fishing; the desalination plant was going in; the gas pipeline coming in, just many, many events and activities that really posed lingering and potential threats to success stories such as the Tampa Bay story. So one driving motivation was to help provide some regional perspective to how continued urbanization may pose threats to this success story. Additionally, there is a very long and respected history of excellent research and resource management that has gone on in Tampa Bay, and this has really been based on community-based goals. The Tampa Bay Estuary Program had recently completed their Comprehensive Conservation and Management Plan and this was really a new resource management direction for Tampa Bay, based on adaptive ecosystem management and relying on integrated science. That provided an opportunity to not start from ground zero but to come in and learn from such foundation. One of the major gaps in the science area was the physical science, and relating the physical sciences to a lot of biological and chemical work that was already being done in the bay. This was a niche to be filled.

In 2001 we called the very first workshop. About 24 federal, state and local agencies, universities and private entities helped to define the goal of USGS work in Tampa Bay on developing integrated science strategies. The main goal for the entire project was "Establish relations among estuarine system components to develop conceptual and predictive models that describe the natural and anthropogenic changes impacting estuarine health." So understanding the interactions among estuarine components of water and sediment quality, hydrodynamics, ecosystem structure and function, and geology and geomorphology was desired. Six tasks were identified: mapping, water and sediment quality, history and prehistory, wetlands, benthic habitats, and data and information management tasks. Within these tasks, 39 subtask objectives were named, each of which represented an individual project. In 2003 the fully funded study began, and that ran from 2003 to 2006, when the bulk of the science was done. In 2007/2008 the synthesis of results occurred, when the data interpretation and product development was underway. Production of publications continued into 2009/2010.

By 2003, which was the end of the Pilot Phase of the study, we had about 120 contributors to the project, from 56 different agencies, municipalities, universities, private entities and NGOs from all four USGS disciplines from across the nation. A full list of all our partners and collaborators and the roles that they played, is available on the website that is still active for the project. This particular document also lays out all of those subtask objectives and projects in detail.

Within Mapping the primary objective of this task was to characterize and model natural and anthropogenic changes in the physical structure of Tampa Bay and their impact on ecosystem health. This task was really designed to develop the spatial, physical and structural context of the bay for the rest of the research and monitoring components. This fell under the geology and geomorphology ecosystem category. Some of the tasks under this particular section of work are topographic and bathymetric mapping, seismic mapping; water quality mapping to complement some of the other water quality monitoring programs that were ongoing in the Tampa Bay at the time. One of the most significant results from this task was one of the first seamless vertical elevation models of Tampa Bay. This was a project done in partnership with USGS, NASA and NOAA and tied together for the first time the bathymetric portions of elevation in Tampa Bay, across the intertidal area which had not been mapped before because of difficulties in mapping intertidal zones with the upland area in the Tampa Bay region. This was highlighted by the National Research Council in 2004 as "an excellent example of interagency collaboration and a viable approach for development of a seamless vertical datum for the coastal zone." As a result of this particular first mapping exercise, this provided the foundation for development of a full blown program area that is currently being applied USGS nationwide for mapping the coastal zone and intertidal zone. One of the other interesting results was completion of a dynamic urban growth model. This was developed to model urbanization, land use and land cover out to 2025. This particular model provided the foundation to look at other components and to assess urban thermal characteristics.

The second task was water and sediment quality, with the primary objective to quantify and assess the source, quality and impact of groundwater, sediment and surface water on benthic and coastal habitats. One of the big gaps identified was that the coastline of Tampa Bay and the Tampa Bay region are like a sponge. There's a lot of groundwater that is draining to the bay. The big question was where is it located, where is it coming in and what is the quality of that water? Some of the activities undertaken included characterization of submarine groundwater, so the seismic mapping from Task 1 was used to locate subsurface features that may provide conduits for local groundwater into Tampa Bay, for example, sink hole features. Resistivity mapping, where a series of electrodes is installed through the surface of the water, send down electrical signals that penetrate the sea floor to about 30 meters, and that sends back a resistivity signature. That helps to identify pressure of water masses that lie below the sea floor. In order to look at the flow rates and quality of that water piezometers were installed, and then a series of isotope studies were preformed to look at flow rates of sources of groundwaters in the bay. Other pieces of this task included looking at the benthic bioturbators, specifically ghost shrimp and their affect on the distribution of nutrients and contaminants in the bay, and also the accumulation of metals in seagrasses. Dr. Yates showed a graph of a three-dimensional look at freshwater masses beneath the sea floor of Tampa Bay. On average, submarine groundwater discharge to the bay is about 20 to 50% of streamflow, so there is a significant amount of groundwater coming into the bay. The groundwater quality study showed that nutrient loads from freshwater submarine groundwater discharges to the bay represent about 40 to 100 percent of the stream discharge loads. So we have this tremendous source of freshwater coming into the bay and there's a significant contribution of nutrients to that, and these types of results should be considered in future water budgeting.

The third task was History and Prehistory with the primary objective being to model the historical and pre-historical evolution of the bay to develop the structural setting for estuarine processes, provide the basis for predictive modeling, and serve as a guide for restoration planning. Over 100 sediment cores were taken throughout Tampa Bay, correlated along seismic track lines, to examine both prehistorical and historical environmental conditions in the bay and the evolution of those conditions. A French research vessel took very long cores out of the center of Tampa Bay that were essential for providing some of the results on the evolution of Tampa Bay. Some of the significant results from the analysis of these cores is that Tampa Bay actually formed as a series of collapsed sink hole features that became inundated with water, as opposed to the drowning of a river valley. The transition from terrestrial environment to marine environment began about 7,000 years ago, so that's an indication of when those sink hole features began. Also at various periods in the pre-history of Tampa Bay there were very rapid, 50 years or less, order of magnitude changes in abundance of forest vs. marsh due to climate variability, something that hadn't previously been recognized. This is a very short timeframe for those kinds of large scale transitions. From the short cores some of the anthropogenic conditions that were found: the presence of human influence brought significant increases in things like total organic carbon and total organic nitrogen. More interesting and surprising is that the sedimentation rate was about 0.3 to 0.5 centimeters per year, pre-anthropogenic, and it increased ten-fold when human influence became predominant in the Tampa Bay area. The decrease in carbon and nitrogen ratios is indicative of transition from vascular plants to algal domination in the bay. A series of nitrogen isotope studies helped delineate which areas are most influenced by wastewater, agricultural and residential nutrient input. These results are actually available in one of the Tampa Bay Estuary Program technical publications.

The fourth task was Wetlands and the primary objective was to assess the current ecological status of wetlands, and characterize natural and anthropogenic factors impacting wetlands health and restoration. One of the big gaps was a poor sense for ecological function with respect to some of the vegetation. A fairly high resolution habitat change analysis was performed at key locations throughout the bay - in the Terra Ceia area, around the Alafia River area and Old Tampa Bay. A couple of different biologists focused on looking at the impacts of various ditching techniques, e.g. mosquito ditching, stormwater ditching and natural creeks and how those affected the distribution of flora and fauna in wetland areas, and then also how some of the restoration techniques for restoring some of those ditched areas were impacting the vegetation. The impact of PAH contamination on mangroves was also studied, important with respect to source areas for acquiring mangroves to transplant to other areas. Some of the significant results related to this task was on the distribution of nekton. Some 65 different fish species were looked at in the mosquito ditches, stormwater ditches and the natural creeks, and it was found that the distribution of these species was actually very similar in the natural creeks and mosquito ditches. There is much less species diversity in stormwater ditches. The habitat change analysis indicated a 40 to 100% conversion of emergent marsh to mangroves at all the study locations. This is consistent with the qualitative observations that the Water Management District put out in 2009, and this type of transition is due to a combination of climate change, river discharge and anthropogenic impacts.

Task 5 was Benthic Habitats and the primary objective was to quantify and model the impacts of urbanization on benthic habitat distribution, health and restoration. The focus was primarily on seagrass. This was the smallest task, because there has been much done on benthic habitat characterization and research has been done mostly by our partners. Seagrass productivity in relation to infinite sunlight was studied to help derive some of the relationships that exist between photosynthesis and light and light attenuation. A researcher from the University of Louisiana, Lafayette, worked to characterize seagrass epiphytes in areas that were the least impacted and the most impacted in Tampa Bay. The organization model was correlated to the seagrass distribution model and showed the history of coincident increases and decreases in seagrass distribution along with urbanization. Dr. Yates showed a time series images from the model itself, with seagrass coverage declining as urbanization increased from about 1940 to 1985, and recovery of seagrass starting in 1985 in spite of continued urbanization. This was one of the key pieces of evidence that helped push forward looking into issues affecting seagrass distribution, for example, focusing on sediment quality, propeller scarring and all of those issues.

The sixth and final task was Data and Information Management. The data and information management system was developed to facilitate communication - a really powerful website. The project website, http://gulfsci.usgs.gov. The management system has been using a model for all writers and public studies for the Gulf of Mexico and the website now houses all the data information from all major ongoing USGS Gulf of Mexico studies. On this website is a digital library with results from the study and an interactive mapping system. Dr. Yates encouraged everyone to take a look at that site, and to contact her if access problems arise.

A total of 75 publications resulted from the study, not including abstracts. That number includes peer-reviewed articles, books, open file reports, special publications and book chapters. There were 28 posters, not including non-USGS collaborators; we had 105 professional presentations; 12 workshops and five project conferences. The final synthesis product will be one of the first major synthesis of research and integration into resource management since the 1980s, with the exception of the BASIS reports that came out. This USGS Circular was developed in partnership with the Tampa Bay Estuary Program, and it really covers, not only the USGS research, but the full history of research and resource management activities that have been ongoing in Tampa Bay. It places the USGS context work in the larger context of the Tampa Bay resource management and research that has been ongoing. It is due out in November 2011, there are about eight chapters covering all of the topical areas discussed today, there are pieces that highlight integrated science and demonstrate how that fits in among the various different tasks and activities and ecosystem categories. And there is a future anticipated challenges section at the end of each of those chapters,. This will become available online first and this will be available at the USGS publications warehouse, which is at this website, http://pubs.er.usgs.gov. Dr. Yates said she will probably send Ms. Cooper a notice when it's available, to pass on to everyone.

Mr. Kovach said that new raw data is available on impaired waters and the state and federal government have the data bases. If desired, as a part of this project, FDEP has good data on impervious surface within the watershed and this urbanization model focus.

In response to a question, Dr. Yates said that there was no attempt to correlate the effect that salinity change from subsurface groundwater flow has on the seagrasses.

Ms. Thompson noted that 1985, when seagrass recovery was first identified, was the year that the Agency on Bay Management was started, the first organization to be coordinating bay issues.

Ms. Cooper noted that in 1968, the first conference was held at USF about Tampa Bay being understood as an ecosystem. At the time we didn't have satellite imagery and the many tools available today to analyze the interaction o the various components of the ecosystem. The main thing going on in Tampa Bay at that time was monitoring - documenting conditions. That has provided the baseline for so much that followed.

- **TAMPA BAY SCALLOP POPULATION STATUS AND TRENDS**

Ms. Sarah Stephenson, Assistant Research Scientist, Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute, provided a snapshot of scallop monitoring and recovery in Tampa Bay over the past two years. Scallops only live about a year in Florida. In the fall the adults spawn by throwing their sperm and eggs out in the water and, dependent upon current, hopefully relatively close to where they were spawned. Spawning is triggered by a change in the water temperature, usually in the late fall at that first really cold cold front. Occasionally there will be a spring recruitment and that's probably triggered by the waters warming up. It's not unusual to get a spring recruit peak in Tampa Bay, but the majority of the recruits are landing in January and those are the adults seen in the Great Bay Scallop Search. During the 10 to 14 day larval stage their dispersion is reliant upon physical parameters, e.g. current, wind, and if a real cold, cold snap occurs like two years ago, that can delay the development of that larval stage, so instead of 14 days it could be 30 day before they would actually recruit and settle, which puts them more susceptible to predators in the water column so there might be a reduction in number of larval scallops. When they do sink out of the water column they attach to seagrass blades and they prefer *Thalassia*. They can swim, they generally don't go very far, they use it mostly for predator evasion, but they generally remain close to where they settled. They are extremely sensitive to water quality and habitat loss, seagrasses are vital and salinity must be more than 15 parts per thousand. They are sensitive to harmful algal blooms such as red tide. Historically in Florida, there was a commercial fishery for scallops and the majority of those landings came from Pine Island Sound and St. Joe Bay. The Pine Island Sound population was near zero by the 1960s. The Fish and Wildlife Research Institute started a nominal scallop program in 1992. The commercial harvest was closed in 1994 and the recreational harvest was limited, with a few extra revisions to get to what it is today. Tampa Bay surveys began in 1995, but there have not been consistent methods until recently. Recruitment monitoring began in 1996, but it wasn't continuous until 2001. Restoration had been going on in some form or another in Tampa Bay before then, but nothing large scale, or successful. Tampa Bay Watch has had the Great Bay Scallop Search since 1993, skipping the years 2001 to 2003 due to poor water quality. FWRI started working with Tampa Bay Watch in 2004, transplanting scallops for some caged restoration. The research for the Adult Abundance Survey is normally done once a year before recreational scallop season opens on July 1st. This year it will be performed again in the fall to try to determine if there has been increased fishing impact. Recruitment monitoring is performed year round and clusters are collected every month. There is a good history of recruitment in Tampa Bay and restoration effort depends upon funding. Ms. Stephenson showed a map of all areas that are monitored for adults and recruitment in Florida. Efforts are focused on Boca Ciega Bay, although FWRI has a grant right now funded by the Pinellas County Environmental Fund for expanded monitoring.

The survey method is very similar to the Great Bay Scallop Search, where are 300 meter weighted transects are placed at each station. In Tampa Bay 20 stations per site are set up. Two divers measure one meter each, on each side of the transect, equaling $600m^2$. For recruitment, citrus bags with black vexar mesh that interlock are used. The bags are thrown out, six to 18 per site: six for regular monitoring and six additional stations. The traps stay out for eight weeks at a time, and every four weeks alternating sets are deployed, so if recruits are about to attach to the trap on the day the traps are pulled, hopefully they will still land and be detected. The bags are visually inspected and the number of scallops in the bag are counted, then multiplied by the number of days. Restoration began when USF farmed and raised about 30,000 scallops which were planted and chased under water at Crystal River in the Anclote area. After that grant ended the larval release approach was adopted. It has been increasingly harder to get money to restore and study scallops so FWRI started throwing out a couple of collectors during the winter months. Any recruits that land on the collector are brought back to the Institute and raised in Bayboro Harbor. Two years ago a cage program was started in Sarasota, Charlotte and Lee counties, with county-organized volunteers. Restoration efforts now are totally dependent on natural recruiting.

For the surveys, if the average number per station is less than five population is considered to be collapsed; if the average is 5 -25, it's considered transitional; and then healthy is anything above 25 scallops per transect line. Most all the sampling stations have scallops, of varying abundance. Ms. Stephenson showed data compiled for Florida. The Florida scallop population is up and down. The low years can be attributed to increased fresh water, so hurricane years or the year right after a hurricane, the red tide event, etc. The populations of the Panhandle - mainly Pensacola and St. Andrews Bay - had collapsed and recreational scalloping was closed in 2002. Restoration was started there in about 2004 and it's slowly coming back. The Core population is from St. Joe Bay down to the Anclote area - a healthy population. For the past four years at least 10 stations in Tampa Bay had scallops, but this year only three. So, why the 2010 - 2011 local declines? Cold water, low larval development, stunted growth and predator behavior affected results. Water quality is another important factor.

Monthly monitoring in Tampa Bay; the annual abundance surveys; the volunteer cage program in Tampa Bay through Pine Island Sound; and the free release juvenile scallops in areas of greatest concern will all continue..

Ms. Platt noted that while growing up she and her father covered much of the bay in Pinellas County, doing all kinds of things, and there were always lots and lots of crabs in Tampa Bay, but they never, ever saw a scallop in the seagrasses.

Ms. Stephenson responded to a question by saying that there really aren't any scallop populations on Florida's east coast.

Mr. Sherwood commented that he is on an ad hoc working group with Sarah, with other southwest Florida estuary programs. There is great interest in promoting restoration of scallops throughout southwest Florida estuaries and it's largely dependent on that core population. With that being said, as Sarah mentioned, one of the strengths they have is direct funding. The possibility of going forward with a scallop stamp that would provide a direct source of funding that would go toward restoration has been discussed and he asked if there is interest in ABM supporting it. He made a motion to send a letter to FWCC to investigate the idea of creating a scallop (recreational fishing) stamp that would direct funding for restoration efforts in Tampa Bay as well as southwest Florida.

Captain Clark seconded the motion.

Ms. Cooper noted that the people that harvest scallops, all in the Core area in Florida's Big Bend, see lots of scallops, and may not appreciate the need to restore them any place else. Is there value to putting them back in Tampa Bay, which is closed to shellfish harvesting?

An audience member asked how quickly after the scallops spawn do they usually die, and why not have the harvest season kind of overlap that a little bit.

Ms. Stephenson responded that tourism, not biology, drives the permitted harvest period.

Ms. Cooper read the motion: Send a letter to the Fish and Wildlife Conservation Commission supporting a scallop stamp to raise funds for scallop management, monitoring and restoration.

The motion carried unanimously.

- **OTHER ITEMS**

Ms. Cooper said that Ms. Platt had asked water quality monitoring at Gandy and Ben T. Davis beaches being stopped. Has anyone heard of that? She had read in the Florida Specifier that the state is going to cut back monitoring of beach water in north Florida in the winter time.

- **ADJOURN**

There being no further business, Mr. Kersteen adjourned the meeting at 11:40 a.m.

Respectfully submitted,

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Bobbi Jaroy, Recording Secretary | Council Member Bob Kersteen, Chair