

**Southeast Florida Coral Reef Initiative (SEFCRI)  
 Land Based Sources of Pollution (LBSP)  
 Technical Advisory Committee (TAC)  
 Meeting #13  
 Report of Proceedings  
 November 18-19, 2010**

**National Coral Reef Institute  
 Nova Southeastern University Oceanographic Center  
 8000 North Ocean Drive  
 Dania Beach, Florida**

<b>TAC Members</b>	<b>Affiliations</b>	<b>Day 1</b>	<b>Day 2</b>
Joseph Boyer	Southeast Environmental Research Center (SERC), Florida International University (FIU)	<b>X</b>	<b>X</b>
Richard Dodge	NSUOC Oceanographic Center (NSUOC)		
Phil Dustan	College of Charleston, South Carolina (COC)	<b>X</b>	<b>X</b>
John Fauth	University of Central Florida (UCF)		
Piero Gardinali	FIU		<b>X</b>
Dale Griffin	United States Geological Survey (USGS)	<b>X</b>	<b>X</b>
Vladmir Kosmynin	Florida Department of Environmental Protection (FDEP), Bureau of Beaches and Coastal Systems	<b>X</b>	<b>X</b>
Judy Lang	Atlantic and Gulf Rapid Reef Assessment (AGRRA) Project	<b>X</b>	<b>X</b>
Brian Lapointe	Harbor Branch Oceanographic Institution (HBOI)		
Erin Lipp	University of Georgia (UG)		
Margaret Miller	National Oceanic and Atmospheric Administration (NOAA)	<b>X</b>	<b>X</b>
Valerie Paul	Smithsonian Marine Station at Fort Pierce		
Esther Peters	George Mason University	<b>X</b>	<b>X</b>
Michelle Wood	National Oceanic and Atmospheric Administration (NOAA-AOML)		
Gene Shinn	University of South Florida (USF)	<b>X</b>	<b>X</b>
Alexander Soloviev	NSUOC		<b>X</b>
Peter Swart	University of Miami, Rosenstiel School of Marine and Atmospheric Science (RSMAS)		

<b>TAC Organizational Members</b>	<b>Affiliation</b>	<b>Day 1</b>	<b>Day 2</b>
Ken Banks	Broward County Natural Resources Planning and Management Division, Environmental Protection and Growth Management Department (EPGMD-NRPMD)	<b>X</b>	<b>X</b>
Nancy Craig	Broward County EPGMD-NRPMD	<b>X</b>	<b>X</b>
Richard Harvey	U.S. Environmental Protection Agency (EPA)	<b>X</b>	<b>X</b>
Linda Brien	FDEP, Southeast District	<b>X</b>	<b>X</b>

James Byrne	The Nature Conservancy (TNC)		
Cheryl Miller	Coastal Eco-Group		
Chantal Collier	FDEP Coral Reef Conservation Program (CRCP)	X	X
Katharine Tzadik	FDEP-CRCP	X	X

<b>Guests</b>	<b>Affiliation</b>	<b>Day 1</b>	<b>Day 2</b>
Troy Craig	FDEP-CRCP	X	X
Alison Moulding	NSUOC	X	X
Chris Maingot	NSUOC	X	X
Dana Wusinich-Mendez	NOAA-CRCP	X	X
Bill Anderson	FIU	X	
John Evered	FDEP-CRCP	X	
Christina Llorens	DEP, Southeast District	X	
Greg Foster	NSUOC	X	X
Joshua Voss	HBOI	X	
Elizabeth Moses	USF	X	X
Doug Seba	Academy of Marine Science	X	X
Rob Menzies	University of Hypha		X
Thomas Carsey	NOAA-AOML Florida Area Coastal Environment (FACE) Program	X	X
Louis Fisher	Broward County EPGMD-NRPMD	X	X
Kevin Helmle	NOAA-AOML	X	X
Jack Stamates	NOAA-AOML (FACE)	X	X
Dusty Marshall	NSUOC	X	X
Brian Walker	NSUOC	X	X
Dan Clark	Cry of the Water	X	X
Stephanie Clark	Cry of the Water	X	X
Cesar Pantez	FIU	X	X
Brian Ettinger	NSUOC	X	X
Jeff Beal	Florida Fish and Wildlife Conservation Commission (FWC)	X	
Christopher Boykin	FDEP-CRCP	X	

## Meeting Summary

### DAY ONE, Thursday, November 18, 2010

#### Meeting Guidelines

Katharine Tzadik, FDEP-CRCP, welcomed the TAC members, organizing committee members, and guests to the 12<sup>th</sup> SEFCRI TAC meeting and asked each attendee to state their name and affiliation. She reviewed the meeting participation guidelines which included the facilitator role, guidelines for discussion, consensus rules, comment card procedures, and the use of meeting evaluation forms. Comment cards must be filled out by observers if they wish to provide comments during the meeting and have comments included in the meeting notes. Public comments were scheduled for 1:30 pm in the afternoon instead of the end of the day. Any handouts for distribution during the meeting must include at least 20 copies for the TAC organizational committee. Katharine reviewed the day's agenda.

**Presentation: Update – LBSP Project 5: Conduct a biomarker study to identify and trace specific contaminants that negatively impact coral reefs**

The purpose of *LBSP Project 5*: is to determine how *LBSP* affect southeast Florida coral reef ecosystems and the links between pollution and coral reef resources.

Phil Dustan, COC, South Carolina, presented the updates for the project on behalf of John Fauth, UCF. The two-year project has gone on for four years and is still in extension. Three sites are being used for this project, an offshore, control site with many gorgonians, an Outer Ridge site south of Port Everglades near a sewage outfall, and a site near Port Everglades. Phil photographed these sites using a digital camera, and used a panoramic editing technique to join many adjacent photographs.

The typical coverage of functional groups of the coral reef ecosystem were summarized annually from years 2005 to 2009. Functional groups included *Lyngbya*, the algal mat community, algae without *Lyngbya*, *Scleractinia*, *Porifera*, *Octocoralia*, and substrate. These data were gathered along transects at each site. There were fluctuations in coverage throughout the experimental timescale of *Lyngbya*, the algal mat community, and algae without *Lyngbya*. Corals were generally low in abundance with a statistically insignificant decrease over time. Sponges had fluctuating abundance and their detection may have been partially obscured by algal cover. Substrate cover increased. The functional groups were chosen in part by what can be identified using photography.

Stony coral coverage has fluctuated between 2.5 and 1.5% cover from 2005 to 2009 at the sites. Fifteen points per frame were used and some transects were used twice. The corals had insufficient coverage and the density of sampling was insufficient to successfully track changes at a fine scale. It can be seen from the data; however, that the cover of coral was low and some sites were lower than others. Port Everglades cover was lower than the control sites and Hillsboro Inlet. A statistically significant, positive relationship existed between the proximity of a site to an ocean outfall and the percentage of open substrate. The nearer a site was to an outfall; the less biological cover found. The structure of coral populations seemed to fall into one of three categories among the sites, (1) both adults and juveniles present, (2) only juveniles present, and (3) only adults present. The coral species that fell into category (1) both adults and juveniles present included *Montastraea cavernosa*, *Stephanocoenia intersepta*, *Solenastrea bournoni*, *Siderastrea siderea*, *Dichocoenia stokesi*, *Porites astreoides*, and *Meandrina meandrites*. These represent the core, reef-building species present in the coral reef ecosystem at the sites.

This technique of using species data to infer demographics about a coral population was presented at the International Coral Reef Symposium by the investigators and will be prepared for scientific publication in the near future. Virtually every cellular biomarker used as an indicator of pollution harmful to corals has shown elevated levels in the southeast Florida region when compared to sites in the Bahamas. Data from lesion healing has shown reduced repair rates near sewage outfalls. A negative relationship has been found between lesion repair rates and biomarker levels. All of these conclusions and

continuing work are beginning to link indicators of coral health at the cellular, tissue, and population levels.

Drew Wham, a graduate student at the University of Pennsylvania, has been working with the investigators to examine the population genetics of *Porites astreoides* in southeast Florida versus the Bahamas. From the examination of two loci, it can be deduced that southeast Florida coral populations are exhibiting all the factors associated with an inbreeding depression:

- High levels of heterozygote deficiency within and between populations
- Reduced genetic diversity
- Reduced effective population size
- Lower connectivity and thus reduced gene flow

There has been a major collapse in population size of southeast Florida corals and decreased genetic variability from the resulting bottleneck. Adaptive capacity is also lost in these conditions and the population is rendered less able to cope with future changes. A recommendation of the investigators is that conservation genetics be incorporated into the management plan for southeast Florida coral reefs. Many large, dead “tombstone” colonies can be observed in the area. The investigators are now waiting for a permit to be issued so they may complete the transplant lesion healing experiments.

Joe Boyer asked what was defined as “substrate” in this study. Phil Dustan responded that it was anything not included in the other functional groups. Margaret Miller asked what was included in the “algal mat community,” and whether it included turf, cyanobacteria, or sediment. Phil Dustan responded it included all of the above in the low turf algal rug. The “algae without *Lyngbya*” group included algae with height to it. Gene Shinn made the point that *Porites astreoides* does not grow very large before it dies. Phil Dustan agreed and stated the study measured the amount of coral cover, not individual corals, and the cover of coral now is much less than 50 years ago in the southeast Florida region. This population decrease has also occurred in the Keys. Vladimir Kosmyrin stated there is no doubt that coral wounds heal very quickly in pristine waters. Phil Dustan agreed and recalled the same conclusions in a publication by Gene Shinn about a reef that was destroyed in a hurricane and exhibited a recovery in three to four years.

Margaret Miller asked whether the types of biomarkers used were nuclear or mitochondrial. Phil replied the information can be found in Drew Wham’s thesis. Margaret also stated that inbreeding depression is likely to occur more quickly with a self-brooding coral than a spawning coral. This type of inbreeding depression has not yet been shown for several spawning corals in southeast Florida. This work has been done with two clonal species, *Acropora cervicornis* and *Acropora palmata* in the area. There are genotypic losses in diversity in these populations, where there are genetically identical individuals, however, this is different than a genetic bottleneck, where there is a loss of the frequency of alleles and what constitutes an inbreeding depression. Dale Griffin inquired if the outfalls are on the ridgeline. Phil Dustan replied they are just beyond it. There is more coral cover on the ridgeline than near the outfalls. Phil Dustan

added the study was originally intended as a two-year project and has expanded in a beneficial way and much is being learned from the allotted funding. More biomarkers are needed to perform a truly in-depth study from this point forward.

Dale Griffin added he read a news article which stated Broward County is seeking to find a way out of the State of Florida's mandate to close the sewage outfall pipes. He has seen some sponges and other organisms growing on the ends of the pipes that appear healthy and wanted to know if diversity in relation to the outfalls has been assessed from the study. Phil Dustan responded the species of sponges were not recorded; only the functional groups of the study. Some of this information could be found in the existing data. Vladimir Kosmynin recalled an observation he made in the past on a shelf south of Vietnam. In the first few meters there was no biological cover at all. With increasing depth, cyanobacteria were visible and a normal coral reef was visible at 100 meters. The presence of normal coral reefs was depressed from high phosphorous input. Phil Dustan agreed and added that some species thrive in water affected by wastewater and some do not. Should this be a political decision whether to have a rich coral reef community or a rich sewer-provided community?

Judy Lang commented the areas with increased substrate present should be ideal areas for recruitment. Phil Dustan replied that what has been considered substrate in the study usually had some small size biological cover that made it suboptimum for recruitment. Overall recruitment was very, very low. Gene Shinn asked if the fish observed around the outfalls had an effect on the bottom. Phil Dustan replied he observed few fish at the sites. Dale Griffin commented that markers of viable fecal-related microorganisms were only found around the outfalls. Phil Dustan made the point that other substances also have been observed exiting of the outfalls. Vladimir Kosmynin commented that possibly the highest biodiversity of corals are found at the entrance of Port Everglades, regardless of all the LBSP exiting the channel. This is due to the cleansing effect of a swift-moving current through that area and the presence of a wall as a substrate.

Gene Shinn asked what plans are in place for sewage treatment if the outfalls are to be turned off. Linda Brien stated a plan must be developed by 2013, with deep-well injection and recharging of the upper, middle, and Biscayne aquifers. Some water would go to irrigation, but given the population densities of Broward and Miami-Dade Counties, the infrastructure costs to get irrigation out may be too great to be beneficial. Other users are being considered, such as a bulk user like Florida Power and Light (FP&L) or for saltwater barriers at the saltwater interface.

Brian Walker asked if the sample design for the experiment assessed change over time. The habitats of nearshore and offshore sites are very different. Phil Dustan responded the original design was intended to examine distribution differences of biomarkers between the nearshore ridge and offshore ridge habitats. Brian Walker cautioned that the sample size for analyzing the data in such a perspective is very small, with variability likely undetectable in all three reef tracts. The number of sites should be increased to overcome this. The design may be suited for comparing biomarkers, but not for examining demographics. Phil Dustan responded a larger sample size would yield the same results.

More samples and sites would be beneficial; however, what has been completed is an order of magnitude greater than what was originally conceived. There is clear evidence that the coral populations in the region are just barely hanging on. Gene Shinn commented that *Porites* does not live more than 20 years, so there will be a drastic difference between a two-year-old and nineteen-year-old *Porites* sample. Phil Dustan responded that very small *Porites* were not sampled.

Alison Moulding commented that she has witnessed lesion healing to have much higher rates and more larvae to be present in the tissues of corals in the Florida Keys versus the southeast Florida region. Vladimir Kosmynin commented that the Keys and the Bahamas do not have the same type of climate, despite their similar latitudes. Declines in coral populations in the southeast Florida region cannot be readily equated with declines in the Bahamas. The best argument for the effects of LBSP on coral health and the decline observed in southeast Florida is through the use of biomarkers.

### **Presentation: Update – LBSP Projects 8 and 9: Miami-Dade County and Martin County benthic habitat mapping**

*The purpose of LBSP Projects 8 and 9: Establish a sub-work group responsible for generating required maps and acquire overlay information to map the benthic habitats of Miami-Dade and Martin Counties.*

Brian Walker, NSUOC, gave a brief overview of the benthic habitat mapping project and an update of its progress in the last year. The mapping approach included two phases. Phase I involved the visual interpretation of Light Detection and Ranging (LIDAR) bathymetry and aerial photography satellite imagery and Phase II involves acoustic ground discrimination. Both LIDAR and habitat mapping data were collected from Dade through Palm Beach Counties. Currently, these data are also being acquired for Martin County. Some LIDAR data from 2008 for Martin County was sparse due to wave activity and turbidity. Re-flights were performed in 2009 with good resulting coverage. Almost 100% coverage has been accomplished. The missing data will be supplemented with 2006 Army Corps coastal LIDAR data.

In Martin County, some obvious reef features have been delineated in the outer portion of the shelf. They are described as deep ridge and are a continuation from the ridge habitats of Palm Beach County, albeit much smaller and more sparse. There were also some deep ridge features in the middle depths at 50-60 feet. In nearshore habitats, colonized pavement and nearshore ridge habitats were visible. Martin County showed large areas of sediment bottom with interesting features. No obvious hard bottom was visible in the data. Qualitative ground-truthing will be used from this point forward and will first include the use of underwater photography on cross-shelf transects to record the substrate and calibrate interpretations from the LIDAR and to see if any features have been missed along sandy areas on the shelf. The map will be completed after this groundtruthing has been completed. Unknown target areas will be investigated after the map is complete. Efforts to begin groundtruthing the past summer were stymied by hurricanes and heavy weather.

NOAA Hydrographic has been updating their maps off of Miami-Dade, Broward, and Palm Beach Counties. Their multi-beam offshore data was combined with the LIDAR data to produce benthic maps from shore to about 160 meters depth, much deeper than LIDAR can produce alone. Deep ridges and nearshore habitats were visible with the multi-beam data. These data will be used to redesign the anchorages in Dade County. The multi-beam data exposed the ridge well offshore in Palm Beach County that has been known about for some time, but never visualized. There was a significant, deep coral habitat at 70-90 meters. The deeper features are being investigated with collaborators, and by a Department of Energy project that will extend into several hundred feet of water.

Greg Foster, NSUOC, spoke about the ongoing Miami-Dade acoustic survey portion of the project. A full scan of acoustic properties are being utilized. The colonized pavement and the reefs offshore are being acoustically surveyed. The survey began in August and is currently 40% complete. The approach to the Miami-Dade acoustic mapping is a similar approach to that of the mapping performed for Palm Beach County, with a LIDAR base and an acoustic overlay. There are seven basic habitat classes including sand, sand-deep, colonized pavement, ridge-deep, aggregated patch reef, linear reef-outer, and spur and groove. A depth-penetrating signal can be used with the acoustics to make a distinction between deep sand and sand over hard bottom.

Eight acoustic variables are being used for finer resolution of within-habitat classification. Short and tall gorgonians are being added into the training dataset which gives direct measures of gorgonian cover by different geomorphological habitats. The acoustic mapping is useful for its high resolution and can be used for measuring vertical relief, forereef slope, and small-scale rugosity. Small-scale rugosity may be useful in making correlations with the absence or presence of fish populations. Fishery metrics can be measured including location, number, and size of fish spatially co-located with the underlying acoustic topography. The current system in place is two, single beams. The best system for fisheries metrics is a split-beam transducer, which gives a finer estimation of number and size. Greg Foster extended the offer for collaboration on topographic measures to anyone interested.

Gene Shinn commented that the deep ridge feature is also present on the west coast of Florida. Brian Walker agreed and stated it is a Caribbean-wide phenomenon that correlates with the Meltwater I pulse event. It coincides with the depths of the *Oculina* Banks. Judy Lang commented that in the Caribbean, a vertical wall is usually found at 70-90 meters. Phil Dustan asked how the acoustic equipment compares to that of the commercial fishing fleet. Greg Foster replied the equipment is in line with what commercial fishing fleets use. Phil Dustan suggested the use of commercial fishing boats for calibration. Vladimir Kosmynin asked if there is a threshold for viewing gorgonians as they move from dense to sparse. Greg Foster responded there is a threshold that he will be quantifying with a series of experiments. He believes it is somewhere around 5-10% cover for small gorgonians and much less for large gorgonians. Brian Walker responded that a problem with interpreting dense and sparse gorgonian cover is in line spacing. The

area between two lines is interpolated, as what is on the lines may not represent what is truly between lines. Line spacing is wide due to cost and time limitations. Sparse *Acropora* are difficult to distinguish from gorgonians, however the differential sensitivities from the two frequencies can be used to discern them. Brian Walker added that a finer grid could be run on an area for higher resolution acoustic information.

**Presentation: Update – LBSP Project 12: Expand the Florida Keys Coral Reef Evaluation and Monitoring Project (CREMP) to Southeast Florida (SECREMP)**

*The purpose of LBSP Project 12 is to expand the CREMP project to include southeast Florida (SECREMP) and to assess and identify any gaps in data.*

Chantal Collier, FDEP, presented an update on the proposed new locations SECREMP sites and their relationship to the water quality monitoring project, on behalf of Dave Gilliam. The three regional SECREMP partners include the FDEP, the Florida Fish & Wildlife Conservation Commission's (FWC) Fish & Wildlife Research Institute (FWRI), and the National Coral Reef Institute (NCRI) at NSU. The Federal Partner is NOAA CRCP, which provides most of the funding for the project. SECREMP was built on the existing protocols of the CREMP project in the Keys and the efforts are combined to provide relevant and timely information on the status and trends of coral and hard bottom resources throughout the full range of the Florida Reef Tract. The SECREMP project began in 2003, with 10 sites in three counties (Miami-Dade, Broward and Palm Beach) established and monitored through 2005. In 2006, three new sites were established in Martin County, with monitoring of the total 13 sites continuing through 2009. Four additional sites were established in 2010, with continued monitoring of the 17 sites planned through 2011. To date, five sites exist in Miami-Dade County, four sites in Broward County, five sites in Palm Beach County, and three sites in Martin County.

In December 2009, the first large-scale water quality monitoring effort was initiated in association with the reef habitat monitoring in southeast Florida. The 17 water quality monitoring sites are located at the 17 SECREMP sites and five new water quality monitoring sites will be established in 2011. Ideally, the new water quality sites would also be new SECREMP sites, but there is currently not enough funding for benthic sampling at the new sites. Efforts will be made to select the new sites using the same criteria for the SECREMP sites in anticipation of future funding availability for benthic sampling at the new sites. A stratified random approach is being used, with a few decisions made in advance for filling gaps in area coverage and selecting suitable representative reef habitats. One new outer reef site and two new middle reef sites are planned for north Broward County, and one middle reef site and one nearshore site are planned for north Miami-Dade County. This would raise the total number of sites to 22 in the southeast Florida region.

Phil Dustan believes enlargement of the project will prove beneficial. During the selection of the CREMP sites in the Keys, habitat was the major factor. Areas were selected randomly, but the placement of transects were not randomly selected. They were required to be habitat-appropriate. He admitted that sampling may have been biased to favor areas with coral reef-building organisms. Chantal Collier stated the investigators



vacillated about the approach to site selection between selecting a number of sites and choosing the most suitable by comparing them or selecting the most suitable site in a sequence of randomly selected sites. The latter method was chosen to minimize bias in classifying coral cover. Phil Dustan and Vladimir Kosmynin agreed that in order to detect change, many more stations are needed with the current sampling design. Vladimir Kosmynin added that the random transect characteristic should simply be excluded from the sampling design. If the purpose of the study is to track changes in corals, areas with corals should be used. Brian Walker commented that this had been done with the setup of the SECREMP sites.

Originally, the areas recommended by local management agencies for monitoring sites were chosen as well as areas off Broward County with known target reef habitats, such as the *Acropora* patch. The function of the new sites will be for filling in the latitudinal gaps in data. There is little extant habitat information about these gaps, so random points are being chosen in these areas and assessed for suitability as monitoring sites. Judy Lang commented that deliberate selection of areas with dense coral reef cover will set unrealistically high baselines for coral cover in the area.

Bernhard Riegl posed the question of what the goals of the sampling design truly are. Rather than having the method drive the data, perhaps the data should be driving the method. Transects through areas with a very low coverage of coral will provide insufficient data to estimate condition. Perhaps 100 colonies should be selected for monitoring. The coral reefs in the region are actually hard bottom communities. He also inquired why there has been no mention of the upwelling event during the summer that caused bleaching and coral death. Some members replied this event only affected Palm Beach County. Dan Clark mentioned that he witnessed the water much colder than normal and staghorn coral death due to the event in Palm Beach County. Brian Walker mentioned that some coral colonies are being fate-tracked at the SECREMP sites. Chantal Collier added that the SECREMP 2009 report and all previous reports are on the CRCP website.

**Presentation: Update – LBSP Project 11: Establish an integrated management system (IMS) with Florida Fish and Wildlife Research Institute (FWRI)**

*The purpose of LBSP Project 11: is to develop an IMS to visually present LBSP and related southeast Florida coral reef data from the local, state, and federal agencies.*

Katharine Tzadik, FDEP-CRCP, provided an update for this project. FWRI is currently hosting and maintaining the IMS webpage through December 2010 and more funding has been requested to maintain and upgrade the system in the FY11-13 NOAA CRCP proposal. The upgrade will make the site more user-friendly and attractive to more potential users. The project team will be reevaluating project goals and objectives to define a target audience and marketing strategy for maximum use. Katharine Tzadik will be emailing the TAC for suggestions on these topics.

Phil Dustan suggested the use of a Facebook page to reach young users. The information placed on an independent web page would get very few hits by comparison. Troy Craig

noted that many people are unable to access Facebook from computers in the workplace. Joe Boyer asked if there is a mandate for the involvement of FWRI in the project. In the Keys the same project was done and resulted in only archived data, a few maps, and a total waste of money. He suggested using a better method of increasing awareness and simultaneously displaying the data other than through FWRI. Brian Walker stated that FWRI is moving forward with a project called The Living Map. The project team is amassing a database for research managers, scientists, reef managers, etc. He is uncertain whether the public is included in the target audience; however, it is readily accessible. Chantal Collier added that the original target audience of the project was not the public. It was intended for managers and regulatory personnel and also to be available to the public. The idea was to have as much information available as possible in GIS format for use in management actions and permit reviews. Chantal Collier believes there is a lot of potential for this project and the best format must be decided for the future. Judy Lang stated that the public expects interactive maps and graphics, not datasets to analyze for themselves.

**Presentation: LBSP Project 21 – Conduct a technical workshop to evaluate the outcomes of LBSP Project 3/19**

*The purpose of LBSP Project 21: is to assess the data collected in LBSP Combined Project 3&19: Survey agencies about LBSP programs and best management practices.*

Katharine Tzadik, FDEP-CRCP, continued with the update for LBSP Project 21. A draft report has been written and dates for the technical meetings have been set for two invited public meetings on January 26<sup>th</sup> in Fort Lauderdale and January 27<sup>th</sup> in Palm Beach County. Invitations, reminders, and personalized emails have been sent out. A better response was received in Miami-Dade and Broward Counties than Palm Beach and Martin Counties. Follow-up seemed to improve with increasing face-to-face introduction of the program and meetings. A future goal of the project is to develop specific projects, including engineering and management actions, for designated hotspots and implementing them. These are outlined in LAS Projects 20 & 23, with results available in May 2011.

Joe Boyer asked if any members of the TAC will be participating in the workshops. Katharine Tzadik replied Ken Banks and Linda Brien were invited and any other interested members are welcome. Dan Clark asked if Commissioner Gold was contacted about the meeting. He has many supporters and would be an asset to the project.

**Presentation: Update – LBSP Project 24: Educate and inform stakeholders, including the general public, about the value and importance of the coral reef ecosystem of southeast Florida, land-based sources of pollution, pollution impacts on the resource, and the strategies recommended to address the problems**

*The purpose of LBSP Project 24 is to educate and change the stakeholders' behaviors in an effort to reduce LBSP impacts on coral reefs through working in close cooperation with the Awareness and Appreciation focus team, specifically with herbicide, pesticide and fertilizer use.*

Katharine Tzadik gave an update on the fertilizer and pesticide brochure. Katharine Tzadik and Troy Craig went to speak with big retailers including The Home Depot, Lowe's, Wal-Mart, and K-Mart about the brochure and product suggestions with no success. Katharine Tzadik then gathered telephone numbers from nurseries, gardening clubs, and botanical gardens in the four-county region. The success rate was 30% and collaboration with the University of Florida extension officers was accomplished and offers for brochures were accepted by many of them as no pieces of literature connecting practices on land with coral reef health at this point. Troy Craig spoke with the Fairchild Botanical Gardens and they responded that their recommendations are in line with that of the brochure and they accepted the offer. Based on the response, ten-thousand brochures will be printed. Judy Lang inquired if anyone in the tax collection offices were contacted. Administrators in rural counties claim that the public is most accessible in tax collection offices. Educational outreach materials are distributed at these centers.

Katharine Tzadik added she would also like to contact landscaping companies about the using minimal amounts of fertilizer and pesticides. Judy Lang asked if the county gives a set of materials to new homeowners. Chantal Collier suggested homeowners associations. Troy Craig added that professional landscapers in Miami-Dade County will be required to attend an online class on correct fertilizer application. The classes will be available in English and Spanish. It was asked whether farmers in the area are required to complete an annual pesticide recertification. Chantal Collier responded that Mike Shirley and others at the Guana Tolomato Matanzas National Estuarine Research Reserve (GTM) would be the people to contact about this because they have conducted some of the trainings. Stephanie Clark added there are also a few master gardeners' clubs in Broward County and a recycling group that hands out packets from city to city once a month. Participants are likely interested in learning about correct practices, standing in line to recycle electronics, light bulbs, batteries, oil, etc. Katharine Tzadik added that the project is not only about the pesticides and fertilizers brochure, but also about the watershed brochure. The latter is only in its beginning stages and will be sent out for comments. There is a deadline for the project by the middle of 2011.

**Presentation: Update - LBSP Project 27: Quantify the flow rate and amount of pollutants being transported to reef communities by groundwater**

*The purpose of Project 27: is to quantify pollutants from groundwater entering the reef environment and contribute to the development of a mass balance budget for the region.*

**Presentation: Update – LBSP Project 33: Identify sources and signals of land-based pollutants in southeast Florida using human enteroviruses as an indicator of fecal contamination**

*The purpose of LBSP Project 33: is to identify the links between pollution and coral reef resources using human enteroviruses as indicators of fecal contamination.*

Katharine Tzadik also provided a brief update on the mass pollution budget Projects 27 & 33. A publication from Project 27 has been submitted to *Marine Pollution Bulletin*. A publication and a short combined book section for the EPA are being written from Project 33.

**Presentation: Update – LBSP Project 32: Identify sources and signals of land-based pollutants in southeast Florida using stable isotopes as sewage signals in octocorals and macroalgae/Lyngbya tissue**

*The purpose of LBSP Project 32: is to use stable isotopes to trace and identify the links between pollution and coral reef resources.*

Bill Anderson, FIU, presented the information for this project. Species of *Lyngbya* and *Dictyota* were the original targets for the study. It was later argued that these species fix nitrogen and this effect must be quantified in the interpretation of stable isotope results. The purpose of today's presentation is to introduce new data that was collected since the last meeting. The project was contracted and sub-contracts were finalized this summer. There was some delay in the contract being finalized. Initial sample collection has been completed and an extension will be requested to obtain a sufficient amount of summer sampling.

Carbon and nitrogen stable isotopes are being used for the study. Literature exists about variability in nitrogen isotope values in perturbed systems, but not all of it is supported by nutrient data. This is very important data, because there can be increases in dissolved inorganic nitrogen (DIN) and no change in nitrogen stable isotope values. It is therefore important to use literature that shows stable isotope data supported by nutrient data for the project. In general, nitrogen and carbon isotopic enrichment is observed with increasing productivity. This is due to a decrease in discrimination with nutrient limitation. This may result in an instance where an eutrophication signal in a system can be misinterpreted as a pollution signal. Seasonal surveys will be conducted along transects at established monitoring sites.

The sites on the Broward County reef tract include locations north and south of Hollywood sewage outfall and Port Everglades inlet. Control sites include the SEFCRI LBSP Project 5 biomarker sites. Nitrogen fixation is being measured by bottle experiments for different species collected from Lake Jesup and Lake Monroe, both hypereutrophic lakes. This is a reliable way to help quantify nitrogen fixation in the system. Comparison of nitrogen stable isotope values from Particulate Organic Matter (POM) and green algae have shown a clear signal of point source pollution in Biscayne Bay. More sites and sampling are needed to do a full assessment of the region. Future approaches include the deployment of automated sediment traps and bottles. A new analytical approach is available which is capable of providing carbon isotope, DIC, TOC, and DOC data on samples very efficiently.

Joe Boyer suggested nitrate be added during the incubation experiments at Lakes Jesup and Monroe. He suspects nitrate may be limiting in this type of environment. Bill Anderson answered that the data did not fall in the global curve of nutrient concentration and isotope values. Gene Shinn commented that none of the sample sites appear to be in close proximity to Black Point or "Mount Trashmore." Bill responded he thought there are sample sites close to these locations. Gene Shinn added that the use of sampling equipment near monitoring wells would be useful. Bill Anderson responded this was attempted without success. Seep data was successfully collected.

### **Presentation: Update – Reef Injury Prevention and Response Program**

*The purpose of the Reef Injury Prevention and Response Program (RIPR) is to develop and implement management actions that prevent coral reef injuries associated with commercial and recreational vessels using tools created through the Southeast Florida Coral Reef Initiative and other local action strategies.*

John Evered, FDEP-CRCP, presented the update for the project. Prior to 2006, groundings response was coordinated by FWRI. In 2006, FDEP's Office of Coastal and Aquatic Managed Areas (CAMA) took over response. In 2008, it was decided a full-time reef injury response coordinator was needed. This position is currently filled by John Evered since June, 2010. Originally, funding was through the MICCI Projects 9 & 25 and now is contracted through Florida Gulf Coast University. The responsibilities of RIPR include

- Organize and lead Florida's management of coral reef and hard bottom injuries
- Serve as a point of contact for interagency coordination of response and damage assessment for vessel groundings, anchor damage, and other coral reef injury events in southeast Florida
- Coordinate Maritime Industry and Coastal Construction Impacts (MICCI) combined Project 9 & 25 – *Management Options to Prevent Anchoring, Grounding, and Accidental Impacts to Coral Reefs and Hard bottoms*

There are three phases to MICCI Project 9 & 25. Phase I has been completed and the report has been posted to the website. Phase II is beginning now and Phase III is expected to start in July of 2011. The implementation of ways to prevent commercial and recreational impacts to coral reefs and hard bottoms has included the establishment of coral reef buffer zones (no anchor zones), buoy systems, updating of electronic navigation charts, and 19 recommendations from MICCI Project 2. Many of these recommendations were met by the implementation of the Coral Reef Protection Act (CRPA) of 2009. This includes the development of an assessment schedule, required restoration, protection of the state's right to collect penalties by the trustees, ready access to the Ecosystem Management and Restoration Trust Fund (EMRTF), and the use of Habitat Equivalency Analysis (HEA).

The relocation of the anchorage sites has proven successful in eliminating large-scale groundings. Large-scale groundings before the relocation of the anchorage sites include the grounding of the *Spar Orion* in May 2006. As part of the objectives of the MICCI projects, the changes on the sea floor after the grounding were quantified with participation from Dave Gilliam and Alison Moulding. They identified three areas of greatest impact, which did not agree with the maps generated by the contractor hired by the responsible party. This illustrates how debates can ensue between the parties involved after groundings occur. As late after the event as 2010, evidence of the impact is still visible. A professional mediator was hired to settle the large disconnect between the responsible party and the trustees.

The grounding of the *Clipper Lasco* in 2006 is currently an ongoing case. A similar mediation to the *Spar Orion* case is to be scheduled between the trustees and the responsible party for this grounding. The responsible party for the *Anzhela Explorer* grounding in 2007 was a private owner attempting to transport the boat from the east coast of Florida, through Lake Okeechobee, into the Gulf to be refitted for work in the oil fields. The catamaran sank and gouged two miles of two, long trenches in rough waters. The damage to the coral reef habitat was significant and many objects from onboard were strewn across the seafloor. After three years the tracks are still very clear. The combined damage of the *Anzhela Explorer*, a catamaran, was valued at almost twice as much as that of the *Clipper Lasco*, a large container ship.

Phil Dustan commented that he has witnessed the lasting effects of groundings in the Keys with a grounding in November, 1974 that can still be seen today. He added that the *Clipper Lasco* actually added some topographic relief to the reef by pushing boulders up. John Evered replied the view on groundings that the RIPR coordinator takes is the preservation and restoration of what was present before groundings occur. Phil Dustan added that the money taken from the responsible party of groundings in the Keys is put directly into restoration of the reef. John Evered responded that it depends on the stipulations of the settlement agreement.

Gene Shinn drew the attention of the meeting to a poster on display that reflected fifty years of change in some locations of the southeast Florida coral reef tract. The poster was a collage of chronological photographs in different locations.

### **Presentation: Update – Awareness and Appreciation Focus Team**

*The purpose of the Awareness and Appreciation (AA) Focus Team is to educate the residents and visitors to the region about diverse near shore coral resources, the benefits of these resources, as well as current threats and conservation actions that individuals can take to protect coral reefs and the marine environment.*

Christopher Boykin, FDEP-CRCP, presented an update on activities by this focus team. There were originally 38 projects in Florida's Local Action Strategy (LAS), with 37 complete and one near completion. There are also 6 recurring, core services. The AA Project #5 website gets 7,000 unique hits per year with a Content Management System (CMS) created this year for additions and modifications. The *Southeast Florida Reef News* newsletter, stakeholder list, and constant contact list are hosted at the site. There is a stony coral gallery and 158 lesson plans and activities used by 640 teachers on the website.

AA Project # 10 *Public Service Announcements* uses print media and TV/radio campaigns, ads in FWC's *Fishing Regulations*, FWC's *Fishing Lines*, and an illustrated coral reef poster. Prior projects and campaigns included movie theater public service announcements and bus wraps. Advertising on cruise ships and airlines was considered, but these options are not targeted enough to reach south Florida. The use of sky banners along the beach during major weekends and holidays is currently under consideration. Currently, ads are being run in the *Biscayne Times*, *Natural Awakenings*, *New Times*

(Broward/Palm Beach, Miami-Dade), *Florida Coastal Angler Magazine*, *In the Bite*, *Stuart News*, and FWC's *Fishing Lines*.

AA Project #23 *Outreach at Events* averages 25 community event days per year. Larger boat shows have proven unsuccessful. The focus is on environmental events and green fairs. These include Fairchild Ramble, Florida Dive Show, Port Salerno Seafood Fest, Palm Beach Boat Show, Dania Beach Flea Market, possibly Oceanfest, and various Earth Month and campus (FIU, FAU, MDC, UM) green festivals. Grocery tote bags with the SEFCRI logo are given out during the events.

AA Project #22 *Coastal Cleanup Support* co-sponsors Incentives, Convention & Cruises Events Inc. (ICC) events in three counties, Baynanza, Marine Industries Association of South Florida (MIASF) Waterway Cleanup, Environmental Coalition of Miami Beach (ECOMB) Cleanup, and has sponsored Reef Sweep in the past. AA Project #32 *Wayside Exhibits* anticipates constructing 2 large wayside exhibits at boat ramps in southeast Florida by February or March.

AA Project #35 *Coral Reef Education Trunks* currently has four trunks for different education levels that travel around from school to school, spending one month in each classroom. They have two coral replicas, an anemone replica, six posters (species keys, ecosystems, and life cycles), four books (world atlas, reef species), four DVD's, and coral reef activities. AA #37 *Coral Reef Teacher Trainings* has held six sessions to date, with 290 teachers and 100% classroom implementation in the classroom.

Vladimir Kosmynin suggested giving out small mesh bags for use by divers in picking up trash. This was attempted previously there are liabilities issues that prevented it. The mockumentary "The Majestic Plastic Bag" was shown per Phil Dustan's recommendation during the lunch break.

**Presentation: Update – LBSP Project 25: Establish a long-term regional water quality monitoring program**

*The purpose of LBSP Project 25: is to establish a long-term regional water quality monitoring (WQM) program for the southeast Florida coral reef system.*

Joe Boyer, IU, presented the update for these projects. The objectives for LBSP Project 25 include the initiation of a long-term coral reef water quality monitoring program off the southeast Florida coast, the establishment of a baseline for a larger program to assist in evaluating coral reef condition, identification of potential impacts on water quality from upstream activities, and to provide water quality data for other programs operating in the SEFCRI region. The design includes quarterly sampling upon the existing 17 SECREMP sites and the coordination with other research activities in southeast Florida, such as FACE. Due to the sparse nature of sampling sites across the region, the sites are being treated as discrete area comparisons. Dave Gilliam is the lead PI and conducting the sampling. Sampling began in December 2009. CTD casts are being used to record vertical distribution of temperature, salinity, dissolved oxygen, and light. Surface and bottom grab samples are also being collected for nutrient data.

Brian Walker commented that he has a paper in review that characterizes the change in habitat morphology across the region and it may be useful in helping define areas within the SEFCRI region. Dale Griffin asked if there are any nearshore-offshore transects near outfalls in the study. Joe Boyer replied these are the SECREMP sites, so the greatest number of sites in one area is only two or three. Joe Boyer agreed that an inshore-offshore orientation of sites would be useful, but the existing sites are located at the SECREMP sites and there is too little funding as of now for an inshore-offshore transect. Integration with Broward Monitoring and FACE will provide more data to incorporate into the analyses. The locations of the five new stations are yet to be decided for 2011. Phil Dustan agreed that a full transect of sites are needed from the lagoons to beyond the Gulf Stream. Joe Boyer responded that the Gulf Stream is used as an endpoint because Gulf Stream water is used as control water in the lab. Joe Boyer also stated that an understanding of the physical oceanography and meteorology of the region is important for understanding the water quality. He is trying to classify current and weather patterns and associated water quality conditions with the use of remote sensing and water quality data.

**Presentation: Update – LBSP Project 29: Observation of temperature and salinity variability in the Port Everglades channel**

*The purpose of LBSP Project 29: Determine the flux of pollutants exiting ocean inlets and net flux to reef communities is to quantify flow through the Port Everglades channel with simultaneous estimates of concentrations of anthropogenic waste in the inlet.*

Joe Boyer, FIU, provided the update for this project. The original objective was to quantify the exchange of water and nutrients through Port Everglades Ship Channel using an observational system approach. A side-looking Acoustic Doppler Current Profiler (ADCP) unit sends information of an approximate profile of the channel, providing approximations of flows at the surface and flows at the bottom. Conductivity, Temperature, and Depth sensor CTD casts are made across the channel for temperature, salinity, dissolved oxygen, and turbidity every hour during daylight over 36 hours. Periodic grab samples for nutrient analysis are also taken during these times. Three tidal cycles per day are typically analyzed. A six compartment flux model for the channel would be ideal. The product of the flow and the nutrient concentration yields the nutrient load. Joe Boyer stated the water at the bottom of the channel is consistently oceanic. Nancy Craig agreed and added it appears to slosh back and forth with the tide. Joe Boyer believes that patterns of nutrient flux in surface and bottom waters follow seasonal cycles coupled with tidal and meteorological conditions. Load estimates will be calculated at tidal, daily, and seasonal scales. The results will be compared with existing values from other rivers and passes in the region for the development of a LBSP nutrient budget.

Doug Sha asked about the effect of cruise ships on the channel. Jack Stamates and Joe Boyer replied that the impact is small and only lasts a very short time. Phil Dustan inquired whether water fronts are observed moving through the channel. Jack Stamates responded positively and stated they can be viewed as vertical layers. Phil Dustan noted



that fronts are aggregation areas and are active areas for feeding organisms. Joe Boyer replied that a strong tide will show a strong, deep oceanic signal.

### **Discussion: General**

Katharine Tzadik informed the TAC about an email from Greg Hendricks, Natural Resources Conservation Service, who attended the previous meeting. He is very interested in moving forward with a land-based program to address water quality benefits to the coral reefs and he has two strategies to achieve this. One is a proposal for a project supported by the national U.S. Department of Agriculture (USDA) office in Washington D.C. The other is a special Everglades Conservation Initiative to begin next year to engage land owners in south Florida to engage best management practices to directly address the concerns of the TAC about LBSP. He plans to attend the Palm Beach meeting for LBSP Project 21.

Dan Clark asked if Greg Hendricks is willing to work with nursery owners. Katharine Tzadik replied that it is a possibility, with a focus on bridging private landowners in rural and urban areas. Dan Clark asked if golf courses are included. Katharine Tzadik responded positively, along with housing associations. Judy Lang asked if the proposals are about nutrient reduction and containment. Katharine Tzadik responded positively. Dana Mendez-Wusinich added that much of the opportunity is in working with the agricultural sector. A successfully managed watershed in Puerto Rico is being used as a model for replication in all seven states and territories that have coral reef resources. Greg Hendrix is a representative from the Natural Resources Conservation Service (NRCS) that would help achieve this goal in Florida.

Esther Peters was concerned by seeing the many developments in south Florida that have grass leading directly down to water bodies with no leveraging systems and few trees. The managers of these places need to be informed. A positive point is that the “living shorelines” concept is being pushed. Phil Dustan suggested the use of medallions on sewer drains with pictures of marine life or messages stating that the water goes directly to the river. Several people responded they are in use some towns in South Florida region. Stephanie Clark commented that SEFCRI was in possession of a set of templates for spray painting.

### **Public Comment**

Dan Clark, Cry of the Water, and Stephanie Clark, Cry of the Water, provided verbal comments (See appendix A).

### **DAY TWO, Friday, November 19, 2010**

#### **Meeting Guidelines**

Katharine Tzadik, FDEP-CRCP, reviewed the meeting participation guidelines which included the facilitator role, guidelines for discussion, consensus rules, comment card procedures, and the use of meeting evaluation forms. Comment cards must be filled out by observers if they wish to provide comments during the meeting and have comments included in the meeting notes. Any handouts for distribution during the meeting must

include at least 20 copies for the TAC organizational committee. Katharine Tzadik reviewed the day's agenda.

**Presentation: Update – LBSP Project 29: Observation of temperature and salinity variability in the Port Everglades channel**

The purpose of *LBSP Project 29: Determine the flux of pollutants exiting ocean inlets and net flux to reef communities* is to quantify the flow of water through the Port Everglades channel with simultaneous estimates of concentrations of anthropogenic waste in the inlet.

Chris Maingot, NSU, presented an update of the *SeaKeeper's* Port Everglades Shipping Channel Observatory (PESCO). This is a collaborative project between FIU, AOML, NSU, and the Broward County Environmental Protection Department (BCEPD) to determine the nutrient loading in Port Everglades and the impacts of LBSP on the southeast Florida coral reef ecosystem. Observational tasks include flow measurements by horizontal ADCP, water samples by bottle sampler, and meteorological, salinity, and water temperature measurements by *SeaKeepers SK1000*. The timeline for installation includes:

- Aug. 2009 – Environmental permitting
- Sept. 2009 – SK1000 control computer and sensors
- Oct. 2009 – Meteorological station and still well
- Nov. 2009-Jan. 2010 – Initial testing and adjustments
- Feb. 2010 – Data collection started
- Mar. 2010 – WiFi link to NSU established
- Apr. 2010 – Website and real-time data
- May. 2010 – Redundant MicroCat instruments deployed

The salinity data is the only unreliable data type collected before the adjustments were made from November 2009 to January 2010. The locations of the *SeaKeeper 1000* and the MicroCat are in the channel at the naval station near Nova Southeastern University. The website displaying meteorological and water temperature real time data can be found at [www.nova.edu/ocean/pesco](http://www.nova.edu/ocean/pesco). The site also has information on the installation and a summary of the project. It was originally thought that monthly maintenance of the *SeaKeeper* would be sufficient, but the amount of suspended sediment in the channel requires servicing and cleaning of the system every two weeks. During this time, data collection is temporarily halted for two to three hours. Three MicroCat instruments were deployed as a redundant data set to verify measurements made by the *SeaKeeper*. The MicroCats were installed to the still well and on channel marker #7 near the bottom and low tide mark. Some patterns detected with the equipment include a decrease in atmospheric pressure preceding a temperature drop, lower temperature and higher salinity with depth in the channel with salinity reversed at times, and an upwelling event in July of 2010 with corresponding current and wind direction data and data from the *Calypso* ADCP Buoy.

Joe Boyer asked if there is consistent agreement of the data collected by the *Seakeeper* and MicroCat systems. Chris Maingot replied there is a consistent increase in readings of the *SeaKeeper* system compared with those of the MicroCat. Phil Dustan asked if there was ever a side-by-side calibration performed. A half hour calibration was conducted near the well. Phil Dustan asked if there was anyway to test these instruments in standard seawater. Alex Soloviev replied not yet.

Phil Dustan asked if any fronts were observed moving through the channel. Chris Maingot responded he has seen digital color changes in the water where brown water exits the inlet. He has not seen fronts enter the inlet. Jack Stamates commented the upper and lower parts of the water column have independent cycles. Vladimir Kosmynin commented the channel is not long enough for the frontal conditions that Phil Dustan is inquiring about. Phil Dustan is interested in sampling frontal boundaries for particulates and pollutants, as they accumulate there. Doug Sha stated the Miami River exhibits the kind of front that Phil Dustan was inquiring about. It oscillates back and forth and would accumulate an enormous amount of pollutants. Phil Dustan added aggregation will occur on an incoming tide and on an outgoing tide, mixing occurs and everything gets flushed out. Alex Soloviev explained that the most likely cause for the July 2010 upwelling event is wind-driven upwelling.

#### **Presentation: Update – State of Florida Numeric Nutrient Criteria Development**

The purpose of the *State of Florida Numeric Nutrient Criteria Development* is to engage local organizations, stakeholders, and experts around the state of Florida to discuss and compile data for appropriate nutrient criteria and ensure the data is available to the EPA and FDEP for the development of nutrient criteria.

Joe Boyer, FIU, presented the update. The timeline for the completion of the criteria is drawing very near. The EPA has recently produced a 380 page document for commentary by the public and DEP due by December 6<sup>th</sup> before nutrient criteria are finalized in a report due in February 2011. This accelerated timeline provides very little time for feedback by other parties before the EPA finalizes the nutrient criteria. The DEP is taking several approaches. One is to use baseline data from areas with healthy, existing conditions to define criteria. A historical approach involves using data from periods of time when areas had healthy, protective conditions to define criteria. A modeling approach, such as nutrient loading simulation models, is also being considered. The EPA document is using the approach of identifying reference conditions. Joe Boyer believes it will be difficult to find reference conditions in the region. The use of best professional judgement or a percentile approach are stressed in the document. A predictive relationship approach, empirical prediction models and trophic state classification types, and the application of nutrient-algal thresholds are used. Joe Boyer and his colleagues are trying to develop an approach using multiple lines of evidence. Background literature included nutrient criteria from Australian reefs, Hawaiian criteria, and the Florida Keys nutrient numbers and experimental data. A threshold approach was recently developed and presented to the EPA committee, which was met with lukewarm reception.

Phil Dustan suggested reading the executive summary in the document, if time constraints make reading the entire document impossible. Joe Boyer said the nutrient criteria for the inland lakes and waterways in the region have been set. Margaret Miller asked if the multiple approaches in the EPA proposal documents are designed to be used as a menu approach to be applied differently in geographical boxes. Joe Boyer replied positively. Joe Boyer replied the EPA will get a huge stack of documents from the DEP, non-governmental organizations (NGO's), and other groups submitting suggested numbers for setting nutrient criteria for the region. A five minute public comment is the only other method of submitting suggestions from now until December 6<sup>th</sup>.

Dana Wusinich-Mendez asked if there has been any thought by the EPA as to how implementation of the nutrient criteria will occur. Joe Boyer responded the DEP is suggesting a magnitude, frequency, and duration approach to exceedances based on annual geometric means for water bodies. Exceedance of one year in five is acceptable. If exceedance occurs two years in five, the water body will be classified as an Impaired Water Body and subject to the guidelines of the Clean Water Act. The guidelines of the Clean Water Act only apply to three miles offshore, which does not cover the reef tract in the Florida Keys or the Florida Shelf. There is a jurisdictional problem. Dale Griffin commented that the jurisdiction is irrelevant because the source of pollution is not necessarily land-based. If nutrients are brought in from upwelling, there is no way to control this. Joe Boyer replied variances in the standards for nutrient criteria are allowed for certain areas when they are exceeded due to natural conditions. Gene Shinn commented that it is well known that the inshore reefs are in better condition than the offshore reefs in the Florida Keys. Piero Gardinali commented that even if the TAC comes to a good consensus on the nutrient criteria numbers, the geographical areas to which variances are granted may be delineated by motives that are not protective of the ecosystem. Segmentation has already been accepted in the document according to geomorphology, variability, and other existing data. River-dominated estuaries, like most estuaries in the region, are usually segmented by salinity zones.

**Presentation: A quantitative method for ranking the condition of Florida coral reefs relative to the wider Caribbean**

Elizabeth Moses, U SF, presented the information from this study which used a multiscale approach to diagnosing coral reef condition. The study sites were four sites located off Key Largo on a depth transect from 3-18 meters. A second transect of six meter sites was added later. The bioindicators of reef condition help diagnose a healthy reef from a degraded reef and help determine if a reef is declining in status. The researchers draw on assessment endpoints across hierarchical levels to provide a fuller, mechanistic understanding of the causes of reef degradation. Other researchers will be able to determine whether a coral is responding to stress and whether stress has resulted in reduced physiological function. The lower levels of organization can provide information on the mechanism of decline. Higher levels of organization provide information on the effect of stress on the overall fitness and function of the organism, population, community, or ecosystem. The biological levels ranged from the regional scale down to the cellular level. Bioindicators of stress at the higher levels of

organization may take long timescales for responses to occur, but are good indicators of chronic, low-level stressors. Bioindicators at the cellular level may be affected by a wide range of factors from seasonal variability to the age of the organism.

The AGGRA project was used throughout the Caribbean to assess over 400 reefs and provided a baseline for this study. A biotic reef index was used to quantify community data which included coral cover, density, mortality, macroalgal cover, and fish densities that represent the health of the community. Cluster analysis was used to find percentage similarity of reef communities with the regional mean, regional worst, and regional best. The sites in the Florida Keys sites were not similar to the regional best values, due to low coral cover, small coral colonies, small size and low abundance of *Montastraea annularis*, high macroalgal indices, and low fish densities at the sites. The Biscayne National Park and Algae Reef sites closely matched the regional mean, due to the large *Montastraea* colonies. The White Banks and six meter Key largo site matched up with the regional worst values, due to the lack of large *Montastraea*, high macroalgal indices, and low fish densities. There are signs of recent disturbance at Biscayne National Park, due to the prevalence of large colonies of *M. annularis* combined with high recent mortality and high macroalgal abundance. The Florida Keys National Marine Sanctuary sites showed a gradient from best to worst.

Joe Boyer commented that the equal weight given to the categories in the cluster analysis may not be the best way to represent the sites. How can one know these categories are the driving factors? Phil Dustan added an advantage to the categories used in cluster analysis can be removed individually to see how the resulting values change. Joe Boyer also asked if the data were standardized. This is important when using values of parameters that are measured on different scales, such as percents (0-100) and density (0-20). The percents contain higher numbers and will have more weight in the cluster analysis.

### **Presentation – An evaluation of the correlations between water quality and coral condition, both biomarkers and lesion regeneration**

Elizabeth Moses, U SF, presented the information for this project. The populations of symbiont-bearing, larger, benthic foraminifera were used as bioindicators of water quality for calcifying organisms in coral reef ecosystems. Algae Reef had the highest densities of these organisms. Biscayne National Park had the lowest densities, with significantly higher breakage. The Key Largo six meter site had low densities and White Banks had high densities of the organisms. Analysis of the foraminifera indicated marginal to suitable conditions across the region. Lesion monitoring of corals was used to identify the presence of stressors. Energy allocation by corals for processes such as regeneration, growth, reproduction, and competitive ability are reduced in the presence of stressors and more energy is allocated to cellular maintenance. Factors that can decrease regeneration rates include increased phosphate and nitrate levels, increased turbidity, increased sedimentation, and increased temperature. Increased hydrocarbon levels can cause increases in regeneration rates. The biomarkers used as indicators of health will upregulate in response to stressors and will have a low level of production. At a point with increasing stress, the biomarkers will start to decrease as their production becomes

too energy-consuming, until an incurable state is reached along with protein damage and cell death.

Regeneration rates were used to try to place corals on this health status curve. The most consistently high regeneration rates occurred at the Algae Reef site, followed by White Banks, with the lowest rates at the Key Largo six meter site and at Biscayne National Park. In 1999, peaks in biomarker responses were correlated with temperature increases during the summer months. Some biomarkers upregulate to protect corals from stressors. Increased concentrations of all biomarkers at the Algae Reef and Biscayne National Park sites in October 2001 indicate high xenobiotic and protein-denaturing stress. This corresponded with high rainfall, increased nutrients, and decreased salinity during that time. In June 2002, there was an upregulation of biomarkers across sites, with the Key Largo six meter site showing a decrease. This was explained by the insecticide spraying that occurs at this time of year and disrupted steroid metabolism. This was supported by endocrine disruption observed in corallivore snails and peak pesticide concentrations in the livers of white grunts at the site. Coral tissue regeneration rates showed an increase during this time, explained by low levels of PCB's disturbing steroid metabolism and increasing regeneration rates. There was also a peak in total nitrogen, mostly organic nitrogen, in June 2002 at the site.

Gene Shinn commented that the effects of pesticides on corals have not been examined before this study and understanding the effects of pesticides on coral health is very important. Historically, tons of pesticides have been used in the Keys and are still in use today. Esther Peters responded that Jane Hawkrige at Mote Marine Laboratory performed a study on the effects of mosquito pesticides on corals at Summerland Key. Rob Menzies recalled a dissertation from Glen Snedigar at RSMAS and a dissertation from Julie Ferman. Gene Shinn continued that adult corals are not only affected by pesticides, but also the eggs floating on the surface during the summer months. Margaret Miller mentioned a paper that was published on a microarray expression with dibromide in corals that showed some response. The subject has not been ignored, it is just difficult to study and little can be done to remedy the problems.

Piero Gardinali commented that the use of the term "xenobiotics" is too broad for this study. Compounds such as PCB's with identical constituents in different positions will upregulate and downregulate different families of biomarkers, making correlations between chemicals and biomarker responses very difficult to determine. Natural contaminants are not xenobiotic and could cause upregulation and downregulation of the biomarkers. Phil Dustan commented that the depth and distribution of corals greatly affects their population ecology and they cannot be directly compared in terms of their response to stressors. Esther Peters stated that histopathology is her interest and how it relates to the subcellular biomarkers and population, community, and ecosystem levels of corals. She has noticed that cells in corals sampled with receding margins are essentially shells of themselves, with declining mucus production and a change in mucus quality. There should be an investigation into the reduced physiological condition of these corals. Judy Lang asked if algal mats are near the corals with receding margins. Esther Peters replied that there is sediment mixed with algae and fungi that may be releasing toxins.

Margeret Miller asked if the impairment of the coral at the deeper sites was caused by energy impairment, such as less sunlight reaching them, or a lack of stability in their populations due to less exposure to disruptive events and stressors. Elizabeth Moses responded that there is evidence for the latter, although there is also evidence of a problem with the zooxanthellae relationship at the deeper sites.

Dan Clark asked if there were any sediment traps deployed during this study. Elizabeth Moses replied there were, and no clear relationship with sedimentation resulted. She did not perform a grain analysis. The Biscayne National Park and Key Largo six meter sites had much finer grain size, which is more stressful to corals, than the Algae Reef and White Banks sites, which had coarse sediment. Phil Dustan and Piero Gardinali inquired what the control source was for the biomarker portion of the study. Sampling at sites that would have been control sites was greatly hindered by the hurricane season.

### **Discussion: Future Role of the TAC**

Katharine Tzadik, FDEP, gave a presentation on the future role of the TAC. The purpose of the presentation is to begin discussions on planning the future direction of the TAC to address the shift in goals and objectives of FDEP-CRCP management strategies. The four priority areas are integrated reef management; climate change; LBSP; and fish, diving, and other uses. Katharine Tzadik reviewed the outcomes from completed projects.

Five projects are currently unfunded, two of which are mass pollution budget projects. If these are funded, will possible outcomes lead to management actions and will this change the goal to reduce LBSP threats? The LBSP goals and objectives put together by local reef managers in the area include:

- reduce pollutant loading
- restore and preserve coral reef habitats
- educate the public and elected officials on the importance of coral reefs

Katharine Tzadik opened the floor for discussion among the TAC members about the future direction of the TAC. Vladimir Kosmynin began with stating the importance of an objective from the first session of the TAC, the development of a mass balance for the area. This work is still unfinished and work to date has been mainly on nutrients, when LBSP includes a wide range of substances and events beyond this. In the future, the sources and mechanisms of LBSP that carry pollutants to coral reef organisms should be a focus of study. From the management standpoint, the focus should be on implementing ways to reduce LBSP levels over the reefs and their sources.

Gene Shinn believes it is important to include the measuring of pesticide levels in LBSP studies. There are thousands of houses in the canal systems of the Fort Lauderdale area that have lawns leading right up to the waterways. There must be high levels of pesticides entering the canals in this way. It may be expensive to study and should be measured at low tide. Esther Peters made the point that it is not just the pesticides that are entering the waterways that are harmful, there are many other substances such as pharmaceuticals and pesticides may not be the most important focus.

Phil Dustan commented he and John Fauth originally wanted to find biomarkers that were upregulating in response to exposure to LBSP and locate their sources. There has been very little completed due to weather and mechanical issues. This area of research is a work in progress and needs to be a focus if the mass balance is to be developed. The goal of identifying LBSP components and their sources has not been completed. Phil Dustan continued that the SECREMP monitoring sites are not providing the information on the state of collapse of the southeast Florida reefs that can be seen upon simple visual inspection. Either there is dramatic undersampling or the parameters chosen are not providing useful information. The reefs are a shadow of what they were 50-100 years ago. Gene Shinn argued that less than 1% of areas near ? are reefs, however, most other areas have never been reefs. Phil Dustan added that “tombstone” corals can be seen and reports from divers have shown a dramatic decline in the coral reefs in the area.

Katharine Tzadik agreed the work in identifying LBSP and identifying their sources is indeed a work in progress, however, what can the TAC do to reduce LBSP in terms of management-based projects? Phil Dustan responded the TAC could move forward and propose a management regime based on what data has been gathered to date, however, the management agencies and the legal staff will reject them on the grounds of too little data. Dale Griffin agreed and added the management agencies are not responsive to Joe Boyer, the single person with the most data in South Florida concerning these topics. Margeret Miller stated there are fundamental scientific uncertainties within the TAC overall and concerning LBSP and their dose-response relationships with coral reef organisms.

In terms of the goals of the TAC and the CRCP monitoring, there is a need for baseline monitoring and a separate need for event monitoring. These issues must be resolved before any management actions can be suggested. These events are very influential and are likely driving the larger pattern. The unanswered questions are about the relationships between chemical soup, toxicology in general, coral health and status, and life stages. There are many factors affecting coral health and status, which makes the science and development of management actions complicated, but necessary. Phil Dustan responded there is a top-down effect and there is no MPA for the area. The microbial populations within corals have been disturbed by LBSP and models that do not incorporate this factor are not providing the correct information on coral health. There are top-down and LBSP factors that have contributed to the state of decline of coral reefs in the area. Drew Wham spent a difficult year-and-a-half trying to understand the microbiology of corals in the area. Katharine Tzadik added it may be beneficial to have Jamie Monty explain to the TAC how FDEP CRCP is addressing these issues. Ken Banks commented that this was already attempted and failed on the grounds of the TAC having too little data.

Ken Banks posed the question of why the TAC has to concern itself with only LBSP. Jamie's group is looking towards zoning and do they have a science body such as the TAC to advise them? Dana Wusinch-Mendez replied the group has individual scientists advising them. FDOU 18 & 20 is the project that is laying out the process to develop management alternatives for the northern part of the Florida reef tract and has been a



multistep process involving collecting social science data concerning stakeholders' perspectives on the area. The next step in the project is to perform analyses with the use of spatial planning tools. Ken Banks inquired if this process will be entirely social science-based. Dana Wusinich-Mendez responded it will incorporate social, biological, and physiological sciences. The results of the analyses will be used to determine the priority areas for different types of uses, followed by a stakeholder process.

Dana Wusinich-Mendez agreed it may be helpful to bring in some members of that working team such as Jamie and Jim Bonzak to speak with the TAC. Ken Banks recommended the TAC expand beyond LBSP and serve an advisory role for the working team. Judy Lang agreed and added the move toward ecosystem based management as articulated in the national Ocean Policy should occur. Dale Griffin recommended the TAC narrow in on a few topics instead of expanding and attempting to do everything. There is evidence the county officials are not intending to shut off the sewage outfalls and will continue pumping sewage into the ocean, a condition unique to south Florida. The cost of transition to reusing wastewater will be very expensive. Data from several studies have shown the inlets and outfalls to be the primary sources of pollutants.

Dale Griffin believes the effluents should be the focus of future sampling by the TAC for gathering incontestable data of their harmful effects for state managers. Alex Soloviev commented identification of the most harmful sources has not yet been quantitatively determined. The identification of individual pollutants and their mechanisms of propagation over corals reefs are also important factors to determine. The physical oceanography of the coastal southeast Florida region is very energetic and dynamic with several processes intersecting each other. Plumes are never the same and LBSP may exit the area and not return inshore. Piero Gardinali commented that managers ultimately want thresholds and numerical values as tools.

There is virtually no data on the individual pollutants and the flow in and out of the box in the mass balance model. Therefore, completing a survey of pollutants is essential before any management recommendations can be made. The threshold levels of pollutants for harmful effects on coral reefs must be also be understood before recommendations can be made. Katharine Tzadik conceded the compounds, numbers, flows, and sources have not been fully identified to date, however, there must be some way to integrate what has been gained thus far into recommendations and actions that will reduce LBSP. Phil Dustan stated the numbers will have to be determined and put into the boxes of the mass balance model if the legislators are to pass laws based on the recommendations of the TAC. He added the most effective long-term solution is promoting education and awareness in children. There should be a dual effort in these two areas.

Vladimir Kosmynin disagreed with Phil Dustan and commented the legislators will not respond to even copious data as effectively as simple answers. At this point, after six years of work, it is important for the TAC to come up with some recommendations with what data has been gathered on LBSP to date. Alex Soloviev agreed and added that two sources of pollution are controllable. Dana Wusinich-Mendez stated there is a gradient of

possible management actions and reactions, and reiterated the question of what demonstrations and targeted actions can be developed to reduce LBSP inputs into the coral reef system. Phil Dustan responded there are a host of them in the white paper.

Dale Griffin stated the budgets are only going to worsen in the coming years and this is the reason the counties are considering not shutting off the outfalls. Piero Gardinali commented that the wastewater from the outfalls must still flow somewhere in the case the outfalls are turned off and its constituents will still affect ecosystems in the area. Dale Griffin rebutted that Tampa serves two million people and they have advanced, quarternary treatment of their wastewater that is not dumped into the ocean, is pumped upriver, and undergoes bioremediation before it enters the ocean. Piero Gardinali responded that it will take eight billion dollars for that type of treatment for the amount of wastewater that flows through South Florida.

Esther Peters commented that data was not collected from the Boynton Beach outfall that was turned off for determining the effects on the coral reef system. The only data collected was directly from the plumes. No funding was put forth to study before and after effects. There may be more support and funding for management actions toward turning off the remaining outfalls if the effects can be shown. Dana Wusinich-Mendez added this type of monitoring is an important component of any good management project. Tom Carsey stated data from the outfalls and inlets in Broward County are being collected on a monthly basis for one year. Dale Griffin asked Tom Carsey if the boils and a full sweep of chemicals and compounds are included in the sampling. Tom Carsey responded they are. Judy Lang commented that during the previous meeting, the TAC was under the impression the outfalls were going to be turned off within the next decade. This is the reason the inlets were going to be the focus of TAC resources.

Gene Shinn stated the public believes the single most important conservation action performed in the Florida Keys sanctuary was the installation of mooring buoys. This should also be encouraged in the southeast Florida region. Studies and monitoring can be also carried out around them. Vladimir Kosmynin commented studies from Jim Thomas have shown mooring buoys to be conveyors of infection and invading colonies. Esther Peters inquired who will be responsible for carrying out the management actions. Chantal Collier responded that the priority setting document is for the entire Florida Reef Tract and not only the southeast Florida region. Many groups were involved in its development including those of all five counties at the federal, state, and county levels, including national parks, state parks, the sanctuary, CRCP, regulatory agencies, and legal staff. The individual projects have not yet been identified to meet the goals of the document. Groups such as the TAC are being asked to provide guidance on identifying priority areas to meet the objectives of the paper. Gene Shinn commented the installation of monitoring wells was not carried out for measuring groundwater discharge. The monitoring wells are useful for many different studies.

Chantal Collier stated there are advantages and pitfalls to focusing in on fewer topics within LBSP and expanding beyond LBSP. Phil Dustan asked how much funding is available and has been used by the FACE Program. Dana Wusinich-Mendez and

Katharine Tzadik suggested not to limit future action by funding limitations. Judy Lang commented the cumulative effects can be measured from gradient analysis from existing projects to help in developing management actions and MPA's. Gene Shinn asked what will be done if there are no significant effects discovered. Judy Lang responded the danger here is too many effects to manage. Vladimir Kosmynin suggested inviting an environmental lawyer to speak to the TAC about how legislation is passed.

Esther Peters stated that data about nutrient effects and virus accumulation on corals has been gathered. When will data on chemical contaminants in organism tissue be gathered? Piero Gardinali commented the analysis of coral eggs for contaminants has been difficult because of the high lipid content. Dilution during analysis progresses to the point of undetectable levels of contaminants. Phil Dustan summarized the general sources of LBSP – inlets, outfalls, atmosphere, and groundwater. He recommended public education outreach for reducing LBSP from inlets. “Brute force science” will be necessary to reduce or eliminate LBSP from the outfalls and we cannot address the groundwater component because wells were not installed.

Dale Griffin commented that the types of bacteria, kill rates of bacteria, and levels of fecal bacteria exiting the outfalls need to be given attention. Dale Griffin has learned through personal communication that a link has been made between human sewage and a coral disease-causing bacterium. Definitive data collected from the outfalls may lead to the use of foraminifera around the outfalls. Esther Peters made the connection between the favorable mucus-lined environment of the intestine and the accumulation of enteric bacteria on coral mucus. Dale Griffin added that early publications exhibited the belief that enteric bacteria die within 48 hours when outside of the intestine. An experiment from Caldwell showed *E. coli* can live in a test tube for three years.

Dale Griffin and Judy Lang agreed on gradient analysis along a transect around the pipe and Gene Shinn and Esther Peters agreed on transplanting healthy coral along this transect for monitoring. Margaret Miller commented there are overlapping effects of the outfalls and showing an outcome from Point A of a transect to Point B is problematic because of the complexity of the influencing factors. A demonstration project in one location will also be problematic for the same reasons. Plans should be made in advance to monitor outfalls before they are turned off. Vladimir Kosmynin suggested continuing the discussion over email to better prepare for the next TAC meeting and warned that the public outreach education may have a small effect. Ken Banks suggested if the outfalls are becoming the focus of TAC efforts, a statement should be made regarding what is known about turning them off and a plan should be developed for monitoring them before and after.

Joe Boyer and Margaret Miller stated the importance of using the sediments, seagrass, and benthic community in general for monitoring efforts and at control sites. Katharine Tzadik stated she will be following up this discussion. Judy Lang thanked the TAC for participation in developing the white paper. A new draft will be sent to members for review. Esther Peters suggested a press release for the introduction of the white paper. Dale Griffin asked if NOAA would present information about the FACE Program at the

next meeting. Dana Wusinich-Mendez announced the hiring by CRCP of a new watershed and LBSP coordinator, Rob Ferguson, for the Caribbean and Atlantic regions. He will be a direct link to CRCP activities on LBSP and watershed management and will be attending the workshops and the next TAC meeting.

**Public Comment**

Dan Clark, Cry of the Water, and Stephanie Clark, Cry of the Water, provided verbal comments (See appendix A).

**Appendix A**

**Public Comment – Day 1**

Written comments were provided for recording. Two observers provided verbal comments (Dan Clark, Cry of the Water; Stephanie Clark, Cry of the Water).

**Public Comment – Day 2**

Written comments were provided for recording. Two observers provided verbal comments (Dan Clark, Cry of the Water; Stephanie Clark, Cry of the Water).