

Southeast Florida Coral Reef Initiative (SEFCRI)

Technical Advisory Committee (TAC)

Report of Proceedings

April 27–28, 2016

Nova Southeastern University Oceanographic Center

8000 North Ocean Drive

Dania Beach, Florida

MEETING ATTENDANCE

Technical Advisory Committee (TAC)

Name	Affiliation	Day 1	Day 2
Ken Banks	Broward County	X	X
Don Berhinger	Fisheries and Aquatic Sciences UF/IFAS		
James Byrne	The Nature Conservancy	X	X
Nancy Craig	Broward County	X	X
Dick Dodge	Nova Southeastern University - Oceanographic Center/ NCRI		X
Phil Dustan	COFC	X	X
John Fauth	UCF	X	X
Piero Gardinali	FIU		X
Dave Gilliam	NSU-OC/NCRI	X	X
Lew Gramer	UM RSMAS/ Keys Marine Lab		
Kurtis Gregg	NOAA	X	X
Dale Griffin	USGS	X	X
Judy Lang	AGRRA	X	X
Diego Lirman	UM RSMAS	X	X
Jose Lopez	NSU-OC	X	X
Kate Lunz	FWC		
Arthur Mariano	UM RSMAS	X	X
Margaret Miller	NOAA/ NMFS	X	X
Valerie Paul	Smithsonian Marine Station		
Esther Peters	George Mason University	X	X
Manoj Shivlani	Center for Independent Experts (CIE)	X	
Jack Stamates	NOAA	X	X
Brian Walker	NSU-OC	X	X
Dana Wusinich-Mendez	NOAA		

Department of Environmental Protection (DEP) Coral Reef Conservation Program (CRCP) Staff

Name	Affiliation	Day 1	Day 2
David Cox	FDEP CRCP	X	X
Francisco Pagan	FDEP CRCP	X	X
Lauren Waters	FDEP CRCP	X	X
Kristi Kerrigan	FDEP CRCP	X	X

Kelly Montenero	FDEP CRCP	X	X
Meghan Balling	FDEP CRCP		
Joanna Walczak	FDEP CRCP	X	X

Additional Presenters and Observers

Name	Affiliation	Day 1	Day 2
Wossenu Abtew	SFWMD		X
Brian Barnes	USF	X	
Henry Briceno	FIU-DERC		X
Danny Gooding	UCF	X	X
Mingshun Jiang	FAU HBOI	X	
Ruben van Hooidonk	AOML	X	
Alicia Vollmer	NSU	X	X
Dave Whittall	NOAA	X	X
Wendy Wood-Derrer	NSU	X	X
Kirk Kilfoyle	NSU	X	
Dan Clark	Cry of the Water	X	X
Stephanie Clark	Cry of the Water	X	X
Ed Tichenor	PBC Reef Rescue	X	X
Leah Harper	NSU	X	
Megan Bock	NSU	X	
Eric Buck	BBAP DEP		X
Ronald Samimy	University of Massachusetts- Dartmouth		X
Maribeth Gidley	NOAA	X	
Chris Sinigalliano	NOAA	X	X
Jim Hendee	NOAA		X
Doug Seba	AMS		X
Nicole Fogarty	NSU	X	
Ivana Kenny Carmola	FDEP	X	X

Meeting Summary: Wednesday, April 27th – Thursday, April 28th 2016

Meeting Guidelines

David Cox introduced himself as the new Land-Based Sources of Pollution Coordinator for the FDEP Coral Reef Conservation Program. He welcomed everyone to the first TAC Meeting of 2016. TAC and SEFCRI members introduced themselves. He reviewed meeting participation guidelines for TAC members and observers, which included his role as the facilitator, guidelines for discussion, consensus rules, comment card procedures, and the use of meeting evaluation forms. He then reviewed the day's agenda.

There are two main topics to tackle for this meeting: coral disease and water quality due to what has happened over the past couple of years. Going from here we will be looking at the data, looking at the monitoring efforts and help Esther's upcoming studying looking to isolate causation factors for coral disease and perhaps help to better predict outbreaks in the future.

All SEFCRI TAC, FDEP staff, and public observers introduced themselves.

(Lauren Waters) *Real quick there are two agenda changes: Kristi with her presentation will go first before Dave Gilliam's talk and there was a title correction to a presentation in the afternoon regarding emerging technologies to study normal and abnormal sediment plumes in SE Florida.*

Session #1: State of Corals & Recent Disease Outbreak in SE Florida

Update on Coral Disease Outbreak - Kristi Kerrigan, FDEP CRCP

- Southeast Florida Coral Disease Outbreak
 - Numerous types of diseases impacting multiple species of coral
 - Disease has been confirmed from Biscayne National Park to Pompano Beach
 - Timeline of disease events
- Florida Reef Resilience Program- Disturbance Response Monitoring (FRRP DRM)
- Need for data, management, resources, and citizen scientists to help

SECREMP Update - Dave Gilliam, NSU

- Southeast Florida Coral Reef Evaluation and Monitoring Project (SECREMP)
 - 22 sites monitored for stony coral, octocorals, and barrel sponges
 - Disease prevalence increased since 2014
 - White disease prevalence has increased in all four counties: Martin, Palm Beach, Broward, and Miami-Dade
- Staghorn coral (*Acropora cervicornis*) Monitoring
 - Disease prevalence peaks in July-September every year
 - Highest prevalence in Broward County noted in summer 2015
- Pillar coral (*Dendrogyra cylindrus*) Monitoring
 - 58 colonies total in May 2014, as of April 2016 only 8 colonies surviving
 - Disease has increased leading to a decrease of 94% live tissue

Questions for Dave Gilliam

1. (Joe Lopez) *Does some of the data include some of the barrel sponges?*

-(Dave Gilliam) *No this is just for stony corals, larger than 4 centimeters.*

2. (Phil Dustan) *Dave, this parallels with what we found in the Florida Keys when white plague was discovered. The summer of 1975 there was a massive die off with multiple species. In the earlier 90's, there was a release of water from the Everglades that caused the water to be*

hypersaline and caused a huge nitrogen slug. The coral reef monitoring program we had started in 1996 chronicled a 38% loss over the next 4 years. Which a large part of that was disease driven, exactly like you are talking about here. The corals that survive one episode of selection get hit with another episode of selection and there is really no such thing as resilience against this.

-(Dave Gilliam) This is quite depressing. Some of these corals were several meters by several meters and they died from September.

-(Phil Dustan) This is exactly what happened in the Florida Keys in the 90's. Then Montastrea annularis bigger than that table dead in 30 days, just like that. The white plague has become much more virulent and fast acting in the summertime. What happens with a lot of species is that it starts on the edges where you have algae buildup and without the herbivory the system just gets killed. In my mind it's as though the water column is becoming more heterotrophic and favoring the more heterotrophic microbiota that live on the surfaces of the corals. The question I have though is what seemed to have triggered it in the Keys in the 90's was this massive release of water, and I'm wondering if you go back to 2012 or 2011, do you see something like that occurring in South Florida that would drive that?

-(Dave Gilliam) I think it is a combination of a series of unfortunate events if you will. I think in southeast Florida in the winter of 2010 and 2011, we could visually see the impact of cold water then. We have ongoing water quality issues in south Florida and of course the double whammy of 2014 and 2015. Maybe the corals got bleached in 2014, they were stressed and got nailed again in 2015 and just couldn't recover. I don't know if it is necessarily an introduction of something new. I think it is more likely something present and now the corals are stressed and they can't deal with it.

-(Jack Stamates) I've got some data that I will be showing tomorrow that in September 2014 the whole Broward area experienced significantly lower salinities and significantly higher temperatures and higher nutrient loading through the whole area. There was a lot of rain that occurred just prior to that so I remember the bottom water one was just incredibly high so I'll talk about that tomorrow.

3. (Margaret Miller) *I want to make sure that we emphasize that the most direct proximate trigger seems to be heat stress. Right? We had dramatic heat stress in the summer of '14 when this kicked off and we know from a lot of different place and reports that disease outbreaks closely follow heat stress events. That seems to be the most obvious proximate trigger. Yeah you've got a disturbed system and that makes it more potent perhaps but the heat stress has been extreme and persistent.*

-(Phil Dustan) In other words, it's the same sort of event just moving north?

-(Margaret Miller) I don't know what you mean by that?

-(Phil Dustan) Like the Florida Keys.

-(Margaret Miller) Yes, fair enough. In '96, like you were talking about, there may have been some events like that, but in '98 the bleaching and heat stress was extreme. It serves as a proximate trigger for a lot.

4. (Brian Walker) *If I can comment on that Dave on the large corals, we have reconned some in 2014 and revisited some in 2015 which I will show later.*

-(Dave Gilliam) That's what we thought with our pillar coral, we thought they were recovering. We came up from our winter dives and thought they are getting their color back. Then next summer they get bleached again and almost never recover.

5. (Josh Voss) *Can I make a brief suggestion? We are starting to talk very broadly about disease across the entire range. We are going to have 2 more talks about these same issues as well as some*

additional data. So if we have specific questions to Dave's data let's try and address them now but this broader discussion is what we will follow up with.

6. (Jack Stamates) *When you are saying bleaching that is normalized by the corals, that number is?*

-(Dave Gilliam) I also forgot to mention that 2 of those colonies were in Palm Beach and are both dead now. So this is Miami-Dade, Broward, Palm Beach.

-(David Cox) There were a few questions and we should have some time after the next presentations. Please keep those in mind.

-(Josh Voss) I saw people cueing up to tell their stories about disease and co-factors that they had so there will also be time for that.

Florida Reef Resilience Program's Disturbance Response Monitoring (Update on bleaching) - James Byrne, TNC

- FRRP began in 2004 to develop a resilience based management concept
- Four main chapters to the bleaching response plan (early warning system, impact assessment, communications and management actions)
 - Impact assessments use random sites from 2005-2015
 - Severe bleaching found in 2014 (20% is considered mild bleaching)
 - Fate-tracking with individual corals from CREMP and SECREMP sites
 - Corals did recover from the bleaching
 - High levels of recent mortality on some sites
 - More severity in 2014 but more widespread bleaching in 2015

Questions for James Byrne

1. (Phil Dustan) *I have a question about how you find your sites, you said it is at random?*

-(James Byrne) Yes. It is based on that spatial framework.

-(Phil Dustan) Ok. So now you are in the boat and you are going out to sample X area. How do you find your site? And then find it again next year?

-(James Byre) We don't repeat sites. Every year it's a new draw. We do the draw beforehand and it's based on data.

-(Phil Dustan) So now you are in a boat and you drop on the GPS Coordinate?

-(James Byrne) Yes, now sometimes you go down and there is not coral there then you enter that that site was not good and you keep modifying the database every year based on the data that comes back in.

-(Phil Dustan) So as the resource decreases you keep the same kind of sampling, the same number of samples and size of samples. So suppose you went to a place one year and sampled it, went there the next year or 5 years later, and there is no coral there, do you move the site?

-(Margaret Miller) It's very well documented in the Smith et al. paper is the best reference. I can talk to you a little about it but that paper is the best reference which goes through the whole sampling theory. It's based on fisheries sampling approach in terms of population estimates from stock assessments. The sampling effort versus the variance, you can tell where that improves and that is the number of samples you target for each strata.

-(Phil Dustan) It just seems like gross undersampling.

2. (Francisco Pagan) *I have some quick things. The first one is observing your data. There seems to be a higher disease prevalence in Miami-Dade and Broward counties than the rest of the tract. Is that something that you have seen throughout the years? Second, it is something we might want*

to put on the agenda for the rest of the day. It's important to share results, it's important to tell the whole story. When you look at the whole story, you can look at management positions that can help us deal with the different threats that we are observing out there.

-(Dale Griffin) I don't know there was a lot of occurrence throughout the Tortugas. It just wasn't Broward, it was the whole reef system.

-(James Byrne) The only time besides these that we have had a 2-3 year time frame that we really noticed anything significant like that mortality was after the 2010 cold water event. Where we actually went out and did the same random samples and added in a strata of the cold water and that resulted in hugely significant mortality in Biscayne and the Keys primarily. Disease really we haven't seen it stand out in any point in time until these last couple of years.

-(Dale Griffin) If you have ever seen Gene's African dust chart, a lot of the disease outbreaks occurs during the El Niño years. We have been in a pretty severe one but supposedly we are moving out of it. That might be the good news.

3. (Dave Gilliam) We kind of moved on but I was going to address your original question. Back when we first started FRRP I was skeptical a little bit but I think there is a lot of value in it the way you present it now. I think when you start going down to the details it is more changing and if it is going to continue down the road, there does need to be some discussion on how to modify the program to meet those needs. I think it is really challenging here in southeast Florida when you start breaking it down into outer, middle, inner, it kind of breaks apart. With those random stratified sites you could have 15 outer reef sites but you could have 5 down south and 10 up north and you are saying that that is all outer reef. I have always been challenged by that. It has its place but it doesn't address all the questions

-(Josh Voss) We know that the FRRP limitation is that we cannot look at all of this reef. So modifying FRRP would mean looking into CREMP and SECREMP.

-(Dave Gilliam) We are not there yet.

4. (Phil Dustan) If you are truly interested in populations you could do a pretty swift survey of the area and gather a whole lot more data for that reef. So you could get population level data.

-(James Byrne) Our biggest challenge is doing it across the whole reef tract and trying to have everyone do the exact same thing across the whole region. That is why we went with this methodology for 200 sites a year with 35 different surveyors out there to make sure that is all standardized.

-(Dale Griffin) There is value to what Phil is suggesting.

-(John Fauth) I just wanted to point out that I've looked at this data. It is 550 some odd data points and I have looked at the sources of variation. Unfortunately, that gains you the least by dropping it. Statistically you could go to one transect per site.

-(Ken Banks) There is no real effort in doing so with divers.

-(John Fauth) It also speaks for a robustness of the dataset; that it is ok and you would still be fine. So it's a really robust data set.

5. (Judy Lang) Can I ask how many corals are on that dataset?

-(James Byrne) It varies a lot. It typically ranges from 0-20 in this region.

6. (Kurtis Gregg) I have a question going back to the methods. Coral smaller than 4 cm. are they at least counted?

7. (Margaret Miller) In terms of the follow-up evaluation I assume you guys have talked about, what is the reason for revisiting the same random sites that were done for the bleaching assessment? What was the thinking on that strategy?

-(James Byrne) *The main thinking when we first had that discussion was that the fixed sites we know the corals better there. Because it is a fixed transect. Even if we revisited a random site you would not get the same transect.*

-(Josh Voss) *That's the case when having the 2 transects.*

-(Margaret Miller) *Well, that is an interesting point because you would have better coverage in that point as opposed to one.*

-(James Byrne) *I know one thing that what we tried to do was when we did the first selection of those, CREMP and SECREMP sites was pick ones that were within those spatial areas that actually experienced bleaching.*

2015 SEFL Large Coral Assessment & Upcoming Acropora Assessment - Brian Walker, NSU

- Assessment of large corals from aerial photography and LiDAR in 2013
 - Initially 200 points to visit from photography
 - 110 were corals of which 50 of them were alive and 60 were dead
 - Corals were predominately *O. faveolata*
- Statistics on large corals
 - 115 greater than 2 meters
 - 50% were diseased, paling, and bleaching
 - Only 5% of the colonies still healthy with no tissue loss
 - Noted some bleaching recovery
- Recommendations
 - Perform spatial analysis of these large corals
 - Regular assessment of these large corals

Panel Discussion from Session #1

1. (Josh Voss) *I think we should pick up on these two things: disease and co-factors. What we don't want is just, "I saw this." let's try to be a bit more systematic about it and if you have data published let's share that or if you have data you are willing to share do that.*

2. (Dale Griffin) *So has there been an expansion? Range expansion? Is there any evidence that it is moving further north, creeping further north?*

-(Dave Gilliam) *No, we don't have any evidence that they are moving forward. We see a colony here or there in Palm Beach.*

-(Brian Walker) *I can speak to that. Part of my research is looking at organisms along the coast and the biogeography and all that stuff. North of Lake Worth inlet there is significantly increased intensity and frequency of upwelling that is keeping the system further south. The tropical species aren't progressing further along the coast.*

-(Dale Griffin) *We see some evidence with certain micro-organisms. We have historical data outbreak basis and there has been a steady creep north of about 2 degrees in latitude since the 1960's. I was just curious because Acroporids seem to do so poorly in the Keys and you have some little groups doing well up here so I was wondering if there was any evidence of a creep north?*

-(Brian Walker) *Well we have [been] doing work on the large patches of coral and Dave has been doing a lot of work on Acropora in general. Looking at the large dense patches, we are going to assess them this year and understand their state and maybe get some information on how long they have been around. We have been rummaging around through old aerial photography and satellite imagery to try and ID when these things came about. If we can identify a patch now and go back 10-20 years from now and it's not there, then*

we have some kind of time frame about that. Moving forward I think we need to document those to understand if they are expanding or contracting. One way to do that would be periodic aerial assessments like we did previously and identify new patches. To speak more about the range expansion, in Martin County the temperature data are showing that between 2010-2012 there were 420 hours where the reefs up there were below 16°C. So it's just not conducive for long-term establishment of tropical species. As long as that upwelling mechanism is in place I don't think you are going to see the range expansion.

-(James Byrne) Oceanographically speaking the Gulf Stream, where it goes in and comes back out, that is kind of at that same range as well. When you get farther north the Gulf Stream goes out and you get the colder temperate water coming in. So that is also a barrier for upward northern expansion.

→(Josh Voss) But in terms of the disease outbreak, it is generally south for more observations. For example, Palm Beach wasn't strongly hit until March of this year.

3. (Kurtis Gregg) *I was curious if you guys had any insights on disease cofactors?*

4. (Josh Voss) *Have there have been any efforts to look at collation with sea surface temperature data and FRRP data?*

-(James Byrne) Yes, University of South Florida has been focusing on that. Trying to really look at a finer scale sea surface temperature model and hone in on that. They have had some results but it's still not at the same scale.

-(Arthur Mariano) I was a co PI on that, that's a good product. It's the only product that does it smooth at a few kilometer scale.

-(Esther Peters) Who at USF is doing that?

→(James Byrne) Frank and Brian Barnes.

5. (John Fauth) *This may be a question for someone else moving forward here. When looking at our coastlines and all of our problems here we don't have any control so when these outbreaks happen we don't have a spot that we can say "ok, has it happened here too?" So what about the Bahamas?*

-(Judy Lang) I can speak to that. There was massive bleaching there last year. It's actually sitting in many different waters because the Bahamas archipelago is so huge.

-(Ken Banks) There is brand new research facility in Abaco. Its \$30 a night and its beautiful.

-(Jose Lopez) I was in Andros last September, just to support Judy's claim, and it was bad. We were there and we collected some water samples. We have done some preliminary microbiome analysis. We actually had some differences between providences. You see differences even locally. To add on to the cofactors, we have some published data from Campbell 2014 looking at the microbial communities in the reef, in the inlets and the outfalls. We have some data that hasn't been published yet for the dynamics of the water column on a weekly basis. So this could be a look at the possible factors there.

-(Judy Lang) I would be really happy to act as a liaison for that because there is increased funding for that.

6. (James Byrne) *I was talking to colleagues from the Pacific atoll and they were having massive bleaching. So we can't just blame our water because we are seeing it in other places.*

-(Josh Voss) I think an important part of that message is the global factors as well as local factors that are still present.

-(Brian Walker) We cannot ignore that we did a huge dredging project in that time frame. And this is an extremely sensitive, delicate time that could have led to that.

Session #2: Global and Local Events

Projecting Coral Bleaching on Multiple Scales - Ruben van Hooidonk, AOML

- Project coral bleaching using temperatures
 - Average all of the models together in an ensemble
 - Massive bleaching events occur at least twice per decade
 - Reefs around the equator predicted to see bleaching sooner than reefs further from

Questions for Ruben van Hooidonk

1. (Dave Gilliam) *I'm looking at FL and I'm looking at your scale bar and as you go towards blue you get annual bleaching?*

-(Ruben van Hooidonk) *Yeah, right around 2040 you will have annual bleaching.*

2. (John Fauth) *I hate to bring another complication in. With that earlier onset we will get solar light intensity. The light and the temperature will increase multiplicatively, it's not additive. Do you have a way to address that?*

-(Ruben van Hooidonk) *Yeah there should be climatology for that. I have not addressed that yet but that is a good point. For the FRT that could enhance the quality of this project there.*

-(Phil Dustan) *I believe there is expansion of the downwelling shifted up.*

-(Brian Barnes) *Just a comment on that, it is not straightforward to propagate light at the surface of the water to determine the light reaching the corals.*

Water quality Impacts of St. Lucie River Plume on the northern end of the Florida Reef Tract - Mingshun Jiang, HBOI

- Understand the potential stress land-based pollution may impose on corals
 - Measure and model water quality parameters
 - Quantify relative contributions of various sources of water properties
- Field surveys
 - Collect water samples at 20 stations at both surface and bottom waters
 - Acrobat tow package
 - Low pH and aragonite saturation state in estuary

Questions for Mingshun Jiang

1. (Dave Gilliam) *Josh, have you been up there lately? How is the visibility?*

-(Josh Voss) *Not good.*

-(Dave Gilliam) *At all the sites we do up there we worry about sea state. It is just very different up there.*

Normal and Abnormal Sediment Plumes in Southeast Florida: Analysis and interpretation using satellite data - Brian Barnes, USF

- Turbidity plumes in shallow coral reef ecosystems can be studied through history and through major dredging events with satellites
 - Turbidity plume prior to dredging is small
 - Turbidity during dredging covered 4 times more area and occurred 3 times more often
 - Turbidity during dredging is like a hurricane but lasts for a year

Panel Discussion for Session #2

1. (Ken Banks) *How often is the satellite overhead?*
 -(Brian Barnes) *For LANDSAT there is a 16 day repeat cycle and then MODIS is essentially every day but there is the big factor of clouds and if the clouds are in the way you have nothing.*
2. (Dale Griffin) *Have you looked at picking up whittings?*
 -(Brian Barnes) *There is someone in my lab who does that exclusively for her master's project. So I can give you her contact info but yeah she can pick them up.*
3. (Brian Walker) *Just 2 points as I recall after Wilma and Hurricane Sandy both of those had maintenance dredging after those hurricanes so I'm not sure how that lines up with your timing but there are a lot of things going on in the inter-coastal that would produce plumes going out. Another point, what is the reason for MODIS stopping?*
 -(Brian Walker) *MODIS is global so we stop it at the FL Keys station. We don't have virtual buoys up there but given the right funding anything is possible.*
4. (Jack Stamates) *I did a study for the Army Corp. prior to the dredging inside the bay so I am looking at waters that are being advected outside the inlet. The zooplankton population modulated the average turbidity levels significantly throughout the year which was a function of the nutrient input. I swim on Emerald reef down there and you saw it, it was just a thick layer of sediment down there. It was very, very obvious.*
 -(Ken Banks) *Was that the predicted impact area?*
 -(Brian Barnes) *That was way outside the projected area. I think the projected impact area was 150 meters from the channel and the plumes you saw here were several hundreds of meters.*
5. (James Byrne) *Looking at multipliable effects of stressors, were some of those sediment plumes coinciding with elevated sea surface temperatures?*
 -(Ruben van Hooidonk) *SST is at a coarser resolution of those plumes. I think it's a signal to noise ratio here where if you put sediment on a coral it doesn't matter if it's hot.*
6. (Brian Walker) *With respect to in water turbidity there have been some discussions that if you have 2 reefs in nearby areas and both of them are very hot, and one of them has a turbidity plume overtop it may reduce light stress and save the coral from bleaching. Trying to decouple everything is a pretty big task.*
 -(Margaret Miller) *To that point, I have looked at a lot of the A. cervicornis photos and there was in fact less bleaching in the immediate vicinity there than there was in other places in the county.*
 -(John Fauth) *The first biomarker study we did, we got this weird signal from the bottom up. We got some weird enzymes in the coral that we called hypoxia in which the corals got smothered and then re-oxygenated. We dove on the same sites later on, and we couldn't find our colonies. We knew we were there because of our sediment traps but we came out the next time and they were clear. We were clearly picking up a signal of burial and it was not a good signal. A lot of it is timing, if it hits at just the right time and attenuates the light and doesn't add to the thermal stress it could save it from bleaching but if it hits at an off time, like a recovery period, now they are not recovering as much as they should be. I think we have to make some recommendations as to when these projects are done.*
 -(Judy Lang) *What are you doing with this information?*
 -(Brian Barnes) *I think what we would like to do is, for the Port Everglades expansion if it ever goes through, is do this in a more real time scenario.*

7. (Dale Griffin) *Has anyone looked at the frequency annually of these inlet plumes and the occurrence and frequency of disease on the reefs in the area?*

-(Margaret Miller) I think to that point and Judy's point we have the tools to be able to do that. It provides an opportunity to get historically through time. With the NMFS we have talked about being able to do that but there is an opportunity to pursue that hypothesis so that there is a very careful spatial resolution that has been established.

-(Mingshun Jiang) One way we can help is with a very fine scale model, that way you can combine all of your effects.

8. (John Fauth) *I'm going to throw out an idea just for the TAC to have, I think that one thing that would be really useful is to have a workshop for the bright young folks that are doing these things and know a lot about environmental factors. Get these folks in the same room for 2 weeks with a bunch of computers and buy their time. Put them to work on a bunch of answers to these questions. I have seen this done on a smaller scale and at the end of 10 days a bunch of papers came out. I think we can have that.*

Session # 3: Existing Data & Data Gaps

Using Spatial Analyses of FRRP Data to estimate Anthropogenic Impacts On SE Florida Reefs - Danny Gooding, UCF

- Using FRRP data to develop a coral stress index and model spatial patterns of coral stress as well as identify possible sources of stress
 - Bleaching hotspots exist in high traffic area
 - Disease hotspots north of Hollywood and Miami outfalls
 - Areas south of Port Everglades are hotspots for disease and death
 - The relationship with outfall distance is opposite of expected

Questions for Danny Gooding

1. (Judy Lang) *Well so sometimes you get disease outbreaks after a bleaching event and I was wondering if you saw any lag effects?*

-(Danny Gooding) So that would be the follow up to split the disease dataset into bleaching and non-bleaching which I actually have on my computer.

2. (Brian Barnes) *If your r^2 is .03 then 97% of your data is explained by something else that is not in your model. Can you speculate what that might be?*

-(Ruben van Hoodonk) Temperature is going to be a driver of a lot of this.

-(Danny Gooding) As a way to sort of get around temperature was the bleaching and non-bleaching years.

-(John Fauth) If you just look at the raw overall dataset it spans 11 years. Most of the variation is a true variation between the years. When you want to figure out the spatial factors, to figure out hotspots and coldspots, those are correlated with space. What Danny has done is that he has taken out the year effect so he is only looking at what are the bad spots in a bad year, what are the bad spots in a good year. Those are the residual things that are going in the same direction. So all that variation between years is taken out and you only look at sites.

-(Arthur Mariano) But you still have 97% that is inter-year variability.

A Reef Resilience Assessment for the Florida Reef Tract - James Byrne, TNC

- Brief history of resilience assessments
- Prioritizing key resilience indicators to support coral reef management

- Assess resilience potential where management has already been implemented
- Identify targets for different types of management actions
- Prior study showed: resilience potential varied greatly within and among islands and majority of site warranted management attention for at least one reason
- Taking the first step of assessment in Florida but still need to select indicators and collect data

Questions for James Byrne

1. (Ken Banks) *What is the time frame for all of this?*
 -(James Byrne) *I am working on that right now with Jeff, we are doing the scope of work for it. We are doing this in conjunction with DEP. Jeff is going to start working. Actually he is compiling datasets now. The idea is to have this completed by next December.*
2. (Margaret Miller) *What is the thinking on indicators that are going to be applied locally?*
 -(Phil Dustan) *Why aren't the predators, the carnivores that are present on the reef listed?*
 -(James Byrne) *That is what we are trying to figure out right now. He is datamining what is out there right now.*
3. (Dale Griffin) *You said the Keys were dead earlier, what is the resilience?*
 -(Phil Dustan) *I personally think that one of the things that accounts for a lot of it is the lack of Diadema. Until that gets restored there is no place for the corals to go, no place for them to settle.*
4. (James Byrne) *One last thing, what I would like to do is at the fall meeting I am inviting Jeff down to present on this project. It should be well underway by then and we could show you what is happening and get direct feedback back from you.*

Comprehensive Conditions Study - Ester Peters, GMU

- Collect data from diverse sources that can contribute to the northern FRT coral disease outbreak during 2015
- Looking at both abiotic and biotic factors that may have contributed
 - Parameters include: physical, chemical, biological, and hydrological
 - Study period is 2012-2015: get a picture before bleaching event and then during bleaching and disease outbreaks

Questions for the TAC

1. Do you know of any other sources of data pertinent to the hypothesis that may have been collected during this study period that the study team should try to obtain?
2. Are there any gaps that should be investigated?

Discussion for Comprehensive Conditions Study

1. (Mingshun Jiang) *As we look at disease are we looking at previous stress?*
 -(Esther Peters) *Yes, and another thing I forgot to mention is that we have bleaching and some people think that isn't a disease but it is.*
2. (Brain Walker) *Are you planning to do any spatial analysis with the data that you collect?*
 -(Esther Peters) *Well certainly, but we still don't know what phase 2 is at this point.*
3. (James Byrne) *Do you want data on stressors as well?*
4. (Joanna Walczak) *Just a reminder bringing it back. Why are we doing this? We don't want this to happen again so we need to be able to communicate it back to those higher up. We want to frame telling a story about what happened out there as far as we can tell with data. So ultimately we can try and prevent this from happening.*
5. (Phil Dustan) *How far back in time do you want to go?*

-(Joanna Walczak) *The time frame we have in your reports is the time frame we came up with based on anecdotal reports. This project has limited funds so we are going to try and start with 2012-2015 to keep the boundary with the relative timescale to this event.*

-(Phil Dustan) *So the system starts at 3% coral cover and goes down? Basically?*

SEFCRI's Our Florida Reefs Update - Francisco Pagan, FDEP CRCP

- Started with 300 recommended management actions and have narrowed them down to 68 RMAs
 - Received feedback from public and changed some titles
- June is the next meeting
 - Prioritize the final list based on costs and benefits
 - Then take steps towards adaptive management

Questions for Francisco Pagan

1. (Dan Clark) *At that last meeting, some of us were shocked how the RMAs fell out based on cost. One of the things that got archived was the RMA to look at disease and I was livid, I was mad and about ready to walk out. If the TAC suggests to put the disease stuff back in, can it be put back in there?*

-(James Byrne) *I think if I remember correctly was that the disease got archived because it was based on research.*

-(Francisco Pagan) *All of the RMAs will be presented to them and sorted by the benefits.*

-(John Fauth) *So one of the recommendations was for the TAC to be involved in the adaptive management strategy at the end.*

2. (John Fauth) *What is the protocol for closing that loop and making adaptive management?*

-(Lauren Waters) *June is scheduled to be the last meeting. After we finalize that the members can decide to meet again with everyone to fill in any possible gaps.*

Diseases and the Future of southeast Florida reefs - Francisco Pagan & Kristi Kerrigan - FDEP CRCP

1. (Francisco Pagan) *What should we be looking into? That will definitely help us to take management actions with enough time to make a positive impact?*

-(Dale Griffin) *I'm sure this already exists but I just have to bring it up. Are there GIS layers for the various coral species along the coast?*

-(Josh Voss) *I put that on my list but the sample data over time is in relatively small areas.*

-(Dave Gilliam) *We have pretty good estimates of density even by size class. The reality is our resources are great, you can throw me anywhere and lay a transect down and I can probably get 70% of the corals without even swimming that transect because we only have 5 or so that dominate our species diversity. We have a lot of points with species that can be identified but I don't think you will see a lot of diversity.*

-(Phil Dustan) *In the Florida Keys we have a much better handle on it.*

2. (Brian Walker) *What we can do is summarize data by strata and then use those strata locations as a proxy for what is in that area. That is what we have been doing with the mapping work. We are able to quantify what is in those polygons as a general proxy for what's there in that region. We can't tell you the density of coral here versus there or the species composition as you go anywhere along the reef tract. It's summarized by a broader scale.*

-(Dale Griffin) *I would just recommend that you do something like that. It would be a very useful investigative tool. Take the datasets that are available and create some layers.*

-(Brain Walker) One of the data gaps we do have is the randomization data off the middle and outer reefs. We have it on the nearshore but not on the offshore. The NCREMP has made so many cost saving decisions that it may compromise the data.

-(Dave Gilliam) The one area that we are limited is anything east of the out reef crest, anything 25 meters or deeper.

3. (Phil Dustan) *I want to take us on a left turn. I have been doing a lot of work in the Caribbean and the biggest thing that has happened is when the spiny sea urchin died. If you go to places in the Caribbean where they have come back, no matter how nutrified, overfished, or how destroyed the environment is, where there is Diadema, the reef is actually growing. Corals are a lot more robust than you think they are. I think we need to start investigating how to bring back Diadema into these waters. It has been a huge effort at Mote and nobody has really been able to do it. The inactivity of sea urchins here is probably one of the driving forces for a lot of what we are seeing. We really haven't done anything to see if 1) what would happen if we brought them back and 2) how do we do that? That is a way we can do something positive and amplify the forces of biology.*

-(Josh Voss) There is a lot of anecdotal evidence but we need to test what is the threshold of Diadema that we would need to go to the positive side of that.

-(Dave Gilliam) I think the first question is that I don't know of any info or historical Diadema data up here to begin with. I mean I saw 12 yesterday, was that good or was that bad?

-(James Byrne) And if there are places where the Diadema are starting to rejuvenate, what do those areas look like? What happens when you start to concentrate them?

-(Dave Gilliam) It reminds me of your suggestion last time where we have a coral garden and put a lot of effort to see what we can grow.

-(Dale Griffin) You go to the Tortugas it's the same system and there are a lot of Diadema and there are a lot of healthy reefs out there.

4. (Esther Peters) *What is the biodiversity that we need on these reefs that would maintain corals?*

-(Manoj Shrivani) There is an opportunity to try to set up an experiment and see how much we can get out of a system.

-(Phil Dustan) If you go into a regular community your lawnmowers and weed whackers. So you need both of them, the Diadema and parrotfishes.

5. (Joanna Walczak) *I'm going to throw out a boundary for you. We have just completed the largest reef restoration, it's an old ship-grounding site, not a natural reef. We took the initiative after they secured it to go out and do additional restoration to that site. It's kind of a blank slate right now. There are two separate sites right off of Port Everglades that are very easy to get to.*

6. (Josh Voss) *We have very limited info on the potential of synergistic thermal stress so I think experimental studies to address and inform timing. You can do it in microcosms.*

-(Dave Gilliam) Is Nikki still here? She has couple of students right now that are evaluating that type of question.

7. (Dan Clark) *I want to raise the issue of parrotfish. Parrotfish have become a world issue. Here we get more and more of a Caribbean community, parrotfish are in the for sale ads of the newspaper. Only bycatch parrotfish under a foot long that come out of lobster traps are supposed to be taken, but they claim most of the parrotfish that we see in the markets are being speared. Parrotfish are becoming more consumed.*

-(Brian Walker) I have a student who is going to look at that data. We have data from Broward fish surveys in 2010. We can look at a 10 year comparison. Talking about relief, these large corals are a huge asset to our system. They are arguably the most resilient

organisms out there. They have been growing for a couple hundred of years. Understanding why those corals are there, how they are related to one another. Understanding what happens to them on a yearly basis under heat stress or disease. I think those recommendations I put up there are very important for moving forward and possibly being able to use those for restoration.

-(Esther Peters) *If you did chop them up and start putting them in other places, those corals are used to those conditions where they are. If you put them in a new place you have no idea.*

-(Brian Walker) *Well I wouldn't suggest a new location but perhaps like what Dave Vaughn does at Mote. He has a very high success rate at taking smaller plugs and having them re-sheet areas because they grow at a much higher rate. Those are options that are out there, I'm not saying we need to chop them up and place them all over the place but under controlled settings they have good potential.*

-(John Fauth) *I want to expand on an opportunity those large corals present. One of our frustrations with biomarkers and other studies is that we are being asked to determine why corals are getting diseases, when did they die, how they died. We would like to have a past history, the places you get those are the long-term monitoring sites but they won't let us touch those. They let you take the ones next to it. It's like saying I'm sick but you want to sample Esther, not me. I would like to have the opportunity to sample those, do the genomics and ecological measures that we can't do on the CREMP sites. That would allow us to figure out what the mechanisms are. Clearly some corals are doing better.*

8. (Francisco Pagan) *There are other projects going around, all of you are involved in other projects. We find ourselves with a need to take management actions to be able to answer some very basic questions you have brought up on the floor. We know resources are limited. Limited to the point where it is difficult to find resources to answer everything. With the research we are doing now, is there something that needs to be modified, something that needs to be added. Something that needs to be modified that would allow us to get some of the answers we need to be able to manage and take action.*

-(Phil Dustan) *I would say that the herbivory project would be a good one. Brian, the work at Mote is really unique because they take a small piece of coral so maybe some of your large corals that have maybe 5% of their tissue left to do this.*

-(Brian Walker) *We are going to propose something like this because that large coral that died and we watched it, we want to ask them about the permitting but there was just not enough time in the day to get it moving.*

-(Margaret Miller) *I want to play devil's advocate here. The fact is that the world is changing so what did well there in the past is not necessarily going to help us in the future. This gets into a much more difficult research agenda. It has to do with the fact that we are in a worst-case scenario and headed towards a high CO₂ world and the corals that we have now don't work in a high CO₂ world. So that means in the medium to long term.*

-(Josh Voss) *I have huge contention with that. There are basically 2 species that have demonstrated that they cannot cope with altering their sub-calicoblastic space. There is also a ton of evidence showing that corals can and do modify that space to calcify.*

-(Phil Dustan) *If you have a coral now that is alive, maybe use some of that tissue to grow, it might survive for 10 more years.*

-(Esther Peters) We also have to look at what is in the coral holobiont. Fungal hyphae that live in the coral and interact with the coral may be being favored. We are seeing more fungal diseases globally in the plight of the amphibians.

-(James Byrne) I agree with the comments that Josh makes that there will be survivors. Can we figure out who those survivors are going to be? Which species or genetic strains could be there? What effect that would have on the community composition and what would that look like? Let's manage towards that. Some are not going to make it.

-(Phil Dustan) The way nature does that is through genetic variability. You want to set it up so that you have the greatest genetic variability.

-(James Byrne) In the lab we can test what is going to survive. Let's use that knowledge and try to work towards that.

-(Phil Dustan) I really think you have to let nature sort that out.

-(Josh Voss) Relative to that point is that one of the big limitations is that we have little genetic studies on the populations of corals through the FRT and how they are connected.

-(Dan Clark) What Esther said about the fungus after Andrew we had a fungus outbreak and saw the Aspergilla. The other thing is that you are talking about taking plugs of the big corals, I don't want to see what is reef enhancement turn into a reef mitigation project.

-(Brian Walker) So if we had this coral that was almost dying we might be able to go ahead and sacrifice that.

-(Josh Voss) We have looked at differences in gene expression and genotyped those corals but we do not have sufficient replicates to draw any correlations between genotype and expression between diseased and non-diseased corals. We need to scale it up pretty dramatically or take the experimental approach where you have known genotype lines and expose them to disease.

-(Margaret Miller) There are several efforts for that now. Nikki Fogarty has a student working on that and my group will also be working on that in the upper Keys and middle Keys' nurseries. We are going to work out some protocols that can be used in the Keys to screen nursery stock. If we can identify those resistance traits and how they cross correlate with each other but I'm not expecting to find those traits because I see everything getting disease. The other point is that if you identify those that are resistant to disease, you have to worry about how that trait correlates with growth rate, fecundity, etc. And that's another real big question we need to look at because if they are all traded-off there is no good answer there. So if I want to go with the disease resistant genet and it has zero fecundity it is not really healthy in the longer term. You have to cross correlate the traits to understand if there is a better one.

-(Brian Walker) But unlike cervicornis, with faveolata we can use age as a proxy, right? I mean these things have been around a couple hundred of years versus all the ones that have died. There are still 50% that are healthy, we know they are resistant and have been here as long as they have. With cervicornis and palamata they are so dynamic.

-(Josh Voss) With your questions about which traits correspond to fitness and disease, the first step would be to take the genome of a coral. Then you could say these genes correlated with this trait.

-(Esther Peters) We must be doing histology too on the different genotypes and that is what I am doing with Nikki and Margaret on the genotypes.

-(James Byrne) Which populations are going to be the survivors? What is the reef of the future going to look like?

9. (Dave Gilliam) *We have been talking about all of these unknown. A very powerful management action already exists. We need areas offshore where we don't extract resources. We need areas where you can't remove fishes or beach renourishment.*

-(Brian Walker) Something I didn't get to talk about and I totally agree with Dave. The presentation I presented at the FRRP 10 year thing, I think a lot of you were there, we identified areas along the reef tract that had persistent clustering of disease and bleaching, I think if we start to understand possible areas or sources, we could focus our efforts on management in areas that need it.

-(Kurtis Gregg) Just to flip that, given what we don't know about the large corals perhaps prioritizing areas in which the large corals are doing ok to protect them. That is direct management action right now based on that.

-(Brian Walker) There is a reason that we haven't divulged our coordinates [which] is because there is a lot of fish.

-(Arthur Mariano) Since I am in the minority being a physical oceanographer you all have a lot of great ideas that you put out. We do have technology that we could put out to help track and answer some of these questions.

Adjourn

DAY 2 SPRING 2016 TAC MEETING

Introduction

David Cox introduced himself as the FDEP LBSP coordinator, welcomed all in attendance to the Southeast Florida Coral Reef Initiative (SEFCRI) Technical Advisory Committee (TAC) meeting, and reviewed meeting participation guidelines for TAC members and observers, which included the facilitators' role, guidelines for discussion, consensus rules, comment card procedures, and the use of meeting evaluation forms. David then reviewed the day's agenda.

Outfall Study Results - John Fauth, UCF

- Tested sediment and organisms and water samples on the outfall site and at a control site
 - Three assays were conducted: microtox assay, chromo assay, mass spectrum analysis
- Microtox assay resulted in levels higher at the control site than the outfall site
- Chromo assay tested for mutations in the DNA
- In the mass spectrum caffeine had the highest concentrations and then deet had highest values at the Port
- Sucralose is highest at the outfall pipe and can be used as a tracer for human impacts

Questions for John Fauth

1. (Arthur Mariano) *One way to interpret those results is that the convergence zone is collecting water.*

- (John Fauth) *One of the things I wanted to point out is that Danny Gooding's data samples were collected during a bleaching year.*

- (Jack Stamates) *Arthur, are you talking about a consistent convergence zone? Because this would have been something that has accumulated over time right?*

2. (Dale Griffin) *It is also possible that the ecology of the sediments can be completely different from the outfall. Joe, have you looked at the diversity in these sediments?*

- (Jose Lopez) *No we haven't.*

3. (Esther Peters) *We may just not know what has gone on at that control site over the years. I remember in Long Island Sound when they were testing sediment toxicity. Sediment samples were loaded with oils and all kinds of things, it turns out many years ago it was a site for dumping. Even though it wasn't current, you just don't know what has gone on there.*

- (John Fauth) *That's one of the problems with sampling like this when there is no replication or history to show a pattern. It's just 2 samples in isolation.*

- (Jack Stamates) *I think when we were conceiving this idea we envisioned a transect or multiple transects to be measured.*

4. (Margaret Miller) *Can you explain more about what this means? Test the viability? What is this telling us in contrast to the previous slide?*

- (Dale Griffin) *One tests DNA damage and the others tests for a state of viability. You can have DNA damage and still be viable or you can have DNA damage and be dead. Overall, there was not a big difference between sites, with the slight exception of sponges.*

- (Jose Lopez) *So sucralose has a half-life of about a million years or so. How about the other compounds?*

- (Piero Gardinali) They vary. They are so diverse. Deet is very stable but we all use it all over the place. The antibiotics there are some that are stable and some that go pretty quick.*
- (Dale Griffin) Just as on the side, what I did was take sediment samples and you get a little disk and plated a community on a petri dish. There were more zones of inhibition in the control zones than the outfall, which makes sense. In the soils near creeks we can pick up these antibiotic resistant genes. It would be nice if we could show an influence genetically at the outfall. Next time someone is collecting near the outfall if they can get me a tube of sediment I would like to run them. It would be nice if we could show an influence genetically with the antibiotic resistance.*
- (Margaret Miller) Could you run the same test for microbes on the coral mucus samples? That would be a much more direct linkage if we are trying to look at coral health impacts?*
- (Dale Griffin) I would be happy to test that.*
5. *(John Fauth) There are some lessons that we have learned from this. We need some more control sites, if we could get the heck out of southeast Florida that would be really smart. The SOS chromotest is certainly feasible for sponges and coral mucus so that seems pretty viable. I don't know, Piero if you had to choose something to use as an anthropogenic tracer would you stick with sucralose?*
- (Piero Gardinali) A couple of things. We were surprised how low the numbers were in the samples because we had done the outfall before and we did see stuff. Sucralose is great but the only drawback is that it does not age so if you have a body of water that moves around forever in the same sites, the sucralose would stay there. So we would end up with a combination of sucralose and something else that degrades quickly. We have used caffeine in the past only because one of the things is of high concentrations but some people have argued for many other things like ibuprofen.*
6. *(John Fauth) We are still down to this problem where we don't have the zone of influence defined. That is one of the data gaps that we still have. The other thing is that our institutional membrane is starting to break up on this project.*
- (Jack Stamates) We were out doing water sampling on the same days.*
- (Phil Dustan) It's kind of some sort of amorphous result we got when we did the buoy experiments. It was on the edge of whether it is significant or not.*
7. *(John Fauth) Yesterday we had a discussion on what management actions would you recommend. We need to start putting the pieces together and we've got the tools to do it I think. It's just a matter of executing it.*

Session #1: Water Quality in Southeast Florida

Background, earlier work - David Cox, FDEP CRCP

- In 2006 the groundwork was laid for a water quality monitoring program
- 2011 there was an annual report of the water quality monitoring project
- In 2016-2017 we will sample 100 sites and do one year's worth of monthly sampling

Coastal Water Quality in Miami-Dade/ Broward Counties & Measuring Chemical Loadings Through Tidal Inlets - Jack Stamates, AOML

- Water quality cruises conducted bi-monthly from Nov. 2013- Sept. 2015
 - 27 locations sampled
 - Measured 13 different analytes
 - Heavy rainfall during this time cause nutrient runoff and very high chlorophyll levels
- Outfall plumes & Reef Data
 - The Miami Central outfall is certainly the largest
 - Significant decline in coral cover and an increase in cyanobacteria
 - Bovine fecal contamination markers were found on the reef

Questions for Jack Stamates

1. (Phil Dustan) *The warm water, was it reduced in salinity?*
 - (Jack Stamates) *Yes.*
 - (Margaret Miller) *I'm curious how rare those salinity excursions are in those areas?*
 - (Jack Stamates) *I can't say. We could look at the rainfall during this period.*
2. (James Byrne) *The last set of data, what is that?*
 - (Jack Stamates) *September 2015.*
3. (Chris Sinigalliano) *The one thing I would also point out is that we were starting to see human, cow, and dog markers out at the Emerald reef area.*
 - (John Fauth) *How is bovine found way down south?*
 - (Chris Sinigalliano) *We don't know that. One of the questions we are asking is if the Miami River carries the bovine marker. On days we have seen some of the elevations at Emerald reef we have also seen some elevations at the Port of Miami. We also had another coincidental cow marker out at Barracuda reef and at that same time we had detected it at Port Everglades.*
 - (Dale Griffin) *There are issues with specificity though. It doesn't mean that you find a cattle marker that came from a cow.*
 - (Arthur Mariano) *Probably just ensure this, but there are people doing trapping for the stone crabs and they use pigs' feet, deer, and animal parts to attract the crabs. I know people with 500 traps because it is cheaper and the crabs actually like it.*
4. (Dale Griffin) *I would like to say that the nitrogen data is really important. The city of Tallahassee traced nitrogen from their wastewater plant penetrating through the ground and traveling 10 miles to the coast in Wakulla Springs. The city spent millions of dollars to upgrade to the new wastewater treatment so they can reduce those levels and [so] what they were releasing into the environment wouldn't cause the proliferation of algae that shouldn't have been there and that is 10 miles away. The extent and risk of health on the reef system, I think it is there. We need to use the data to change that.*

Florida Keys National Marine Sanctuary Water Quality Protection Program Overview - Henry Briceno, FIU

- There are 112 water quality monitoring stations that are sampled quarterly since 1995
 - Chlorophyll a concentrations are ok
 - K concentrations have remained constant
 - TOC has been declining since the 90's

- Analyze it on a spatial scale using biogeochemical classification of water types
- Working with counties in the Keys to test quality in canals

Questions for Henry Briceno

1. (Phil Dustan) *How deep is the water column?*
-(Henry Briceno) *15 feet.*
2. (Kurtis Gregg) *When was this paper published?*
-(Henry) *2013.*
3. (Dale Griffin) *How does that relate to the sewer system?*
-(Henry Briceno) *It's good because we have very low resolution.*
4. (Phil Dustan) *Do you ever take oceanic levels from the Gulf Stream?*
-(Ken Banks) *It is very difficult to take samples logistically.*

Overview of South Florida Hydrology & East Coast Discharges - Wossenu Abteu, SFWMD

- Historical flow of water out of the Everglades was south
 - Now there are reservoirs that move water east and west
- Rainfall is much higher than historical averages
 - Lake Okeechobee have very large fluctuations though droughts and floods
 - Need plan to restore water flow to the south
- Kissimmee River restoration
 - Acquire 102,000 acres of historic river floodplain and backfill canals
 - Recarve 9 miles of river channels
 - Final completion in 2019-2020

Watershed-scale Management Planning Boynton ICA - Kurtis Gregg, NOAA

- Nine coastal inlets along the 105 mile SEFCRI reef tract
- Inlet contributing areas (ICA) were mapped in normal operating conditions
 - Boynton ICA is 144 square miles and is part of the Lake Worth Lagoon watershed
 - Focus on the southern end due to the proximity to the reef tract
 - Focus on analytes that may affect coral reef systems

Florida Northern Reef Tract Water Quality Monitoring - Dave Whitall, NOAA

- Testing water quality along the northern FRT with a reef perspective
 - Sites at outfalls, inlets, and random sites along the reef tract
 - 4 point source sites and 8 random sites coordinating with the point source
 - Sample at both surface and bottom waters
- Will ultimately be handed over to SEFCRI partners

Discussion of Water Quality Monitoring Project - Sites

1. (Kurtis Gregg) *Where did we land on whether or not we are going to pick the SECRMP sites or not? You have long-term benthic data at those sites. There are 22 sites.*

-(Dave Whitall) *I thought we had decided not to do that but were those non-random sites? We could reopen it for discussion but my concern is having all targeted sites or mostly targeted sites is then you can get into questions about how statistical those sites are. We wanted sites that are representative of coral reef so we wanted a more randomized design.*

- (Kurtis Gregg) They are non-random sites.*
2. *(Judy Lang) Are the RVC sites not stratified by reef reach?*
- (Brian Walker) Yes, they are stratified by biogeographic region and then habitat type.*
- (Judy Lang) That might reflect [inaudible].*
- (Dave Whittall) We had talked about doing an outer, middle, and inner stratification but as you get further north you don't have that same design across the entire 107 miles. It would be difficult to do.*
3. *(Phil Dustan) Are you going to do an offshore site?*
- (Jack Stamates) Are you going to do that?*
- (Dave Whittall) We haven't talked about that specifically.*
- (Phil Dustan) This is the same problem that went on in the Florida Keys water quality monitoring because they just said we are going to sample the reef tract but we are never going to know what the ocean is because we don't go out there and it's not in our contract. That's the other N member. If you don't sample that you have no idea where you are.*
- (Dale Griffin) That's true. We used to get arguments that viruses we were finding in canals were coming from cruise ships out in the Gulf Stream because no one had sampled that offshore.*
- (Phil Dustan) For me it's crazy. From a scientific standpoint is needed. Nobody ever says this is what it is like in the ocean.*
- (Josh Voss) If one of our potential strategies is to engage volunteer and partner organizations, I think of off the top of my head about 60 fisherman who are quite happy to go out 10 miles in their 21 foot boat. I don't think we are as boat limited as we think we are.*
- (David Cox) I would beg to argue or differ, just to play devil's advocate for a little bit, relying on volunteers and weather conditions that are difficult at best we are kind of straying away from the plan that we need here which is to target this right now. I think it's a valid point about the ocean water and it's something to bear in mind but we are straying away from what we need to be talking about.*
- (Phil Dustan) I just want to go on record saying it is irresponsible to try and sample to coastal region and not get a sample from offshore.*
- (Ken Banks) We do that regularly for Nancy because it looks like you are in clear water a couple of miles out. My point was that you have asked us to go out further. We have gone out to where it looks nice and it looks like the clear water but it's not. If you listen to the NOAA forecast, sometimes the edge of the stream is way offshore.*
- (Dale Griffin) There should be physical models that tell you where to sample.*
- (Joanna Walczak) Are you still doing that sampling? And if so, can we piggy back on that?*
- (Nancy Craig) We do that very regularly because that is our baseline. We go out and collect 3 carboys every couple of months. It just takes time to get that far offshore, you have an hour or an hour and a half travel time to get out there.*
- (Margaret Miller) If that is happening even on an irregular basis, it does provide some boundary. Over time it should give you that value which is kind of what you are after.*

- (Dave Whitall) *So we will follow up with Ken.*
- (Dale Griffin) *You will always get challenges with your data. If you take those samples you will have something to show.*
4. (Dave Gilliam) *What does it mean that after next year it goes to the SEFCRI partners? That's what I'm confused about.*
- (Joanna Walczak) *He meant the DEP.*
- (Dave Whitall) *So the leadership will probably go to the DEP. But one of the things with this that I have alluded to is because we have such a large area, the field logistics are going to be a team effort. As it moves in the future it is going to continue to be a team effort with the leadership role assumed by the DEP.*
- (Dave Gilliam) *So the on the water collection of data is going to be done by multiple groups and some data collection of opportunity?*
- (Joanna Walczak) *Just like our FRRP people across the region trained for the same protocols. What we have to figure out is who is available to do what and when on a regular basis.*
- (Dave Whitall) *Realistically in year one we are not going to hit all of the sites. Year one is going to be a subset of this to get things up and running. Depending on what happens next year, we will attempt to ramp it up again.*
5. (Dale Griffin) *So if these 16 sites get done is that a subset of the big study? Because I remember originally we were talking about needing more sites. So you are talking 16 samples right here?*
- (Josh Voss) *That is just where David happened to zoom.*
- (Dave Whitall) *If you zoom all the way out, that is the 100. We had had an initial plan that the DEP's lab was going to do the analyses but for a variety of reasons that didn't work out for this year. For this year, we have analytical monies that we are going to use for a contract lab. What that means is when you do the math for the list of core analytes that we are using, the numbers suggest that we do 12 months of sampling for surface and bottom waters then we can afford can 18 sites but we probably have to round down for 17 sites. What that means really is that we can do 2 ICAs really. Those are sort of the rough numbers we are talking about. A subset of this group decided how to strategically select which of the ICAs to do. In my mind it doesn't make any sense to spread them across the entire region, just focus on 2 ICAs so you have concrete data for 2 units rather than scatter.*
- (Diego Lirman) *When you say site is that set of symbols a site or each of them a site?*
- (Dave Whitall) *Each of these symbols is a site.*
- (Diego Lirman) *So you have all 100 shown. So you are just going to do a fraction of these?*
- (Dave Whitall) *In year one. Ideally we would ramp it up to have all of them done every year but that obviously is a big undertaking with a lot of partnerships and a lot of resources. So we know it is a big effort but we wanted to design something that made sense so that if the political wills ever do it then it will be done.*
- (Josh Voss) *Dave, I think Diego is confused based on the acronym you use. So when he says ICA he means Inlet Contribution Area. So if you spread those 18 sites you could potentially target 2 inlet areas.*
- (David Cox) *That is the Miami main outfall right there.*

- (Diego Lirman) What is the point of doing 18 sites? Just to get things going?*
- (Dave Whitall) Yeah. Some data is better than no data.*
- (Diego Lirman) Well yes and no.*
- (Josh Voss) All right, let's go home.*
- (Diego Lirman) I understand that but then how do you select which of the points?*
- (Josh Voss) That's why we are here right now.*
6. *(Jack Stamates) Indian River is having a lot of issues so that could be a hotspot.*
7. *(Kurtis Gregg) So I'm going to come back to the questions I had earlier. With the 9 ICAs and the spread we have of the sites, how many do we need to make a clear picture? Do you need one for each of the ICAs to make a full sweep?*
- (Phil Dustan) That depends what your question is. I want to throw out another hand grenade. We just heard a 20-year study that has stations and we really can't say anything from those data. The stations in some respect are great in outfalls or inlets but obsolete when you want to know how process works. Why don't you set up a high speed boat, you can do a lot of that on a long tract and record a lot of this stuff on transects in and out a get real time data that you can subtract water masses and upload that into a remote sensing perspective and get a real idea about what is happening here. That's very easy to do technology and you can do it on a boat and it would take a lot less time. There are a lot of auto-analyzers and stuff that work. It is going to get a surface signal, it wouldn't give you the depth but you could also do it at depth with an AUV. There are a lot better ways that could make your sampling obsolete.*
- (Jack Stamates) I somewhat agree. We have some outfall studies where we have done some in water sampling like that. Getting the resolution of the nutrient samples from a land based laboratory takes forever.*
- (Phil Dustan) We are trying to figure out the process, not the absolute number.*
- (Dave Whitall) I don't disagree with what you are saying, I think it is excellent point but I also think we have a relatively limited budget. There are a lot of excellent ideas that we have brought up here.*
- (Phil Dustan) This is a massive project.*
- (Joanna Walczak) But why is it massive? The implementation is so the design is based on a comprehensive level but the current budget is a tiny shadow.*
8. *(Dale Griffin) My vote would be for the project we showed earlier with the hotspots in Miami where you propose to start. I think it's nice that you have it already as a starting area of concern. I think it's a good start.*
9. *(Brian Walker) I'm a little confused about what the question is you are trying to answer with this. Are you looking for what the differences are spatially along the coast in terms of water quality and how it changes over time? Would the idea be to re-randomize the random sites each period?*
- (Dave Whitall) No because then you lose your time period. What we had discussed was using the random sites to leverage data sites but then continue to visit those sites.*
- (Brian Walker) I would disagree with that because coming from a spatial background, you would want to systematically lay out your sampling points in more of a grid fashion so then you could analyze them without having spatial correlation issues. I'm not sure that if you are going 4 sites around a target that those should*

be considered 4 sites or perhaps that should be combine into one sample when you are comparing them to the entire region. There are some issues with this design in my view. I understand the randomized asset of it if you were going to randomize each year but I don't understand the random points and why you would come back to them.

-(Dave Whitall) So the grid is sort of a guide way around the ICA?

-(Brian Walker) It's better than having 5 points here and then 1 over there, and 1 over there. At least you would have the ability to analyze it spatially.

-(Arthur Mariano) I would agree with Brian you need a spatial correlation design with a grid and you cannot do that with your design. You need to calculate that with this particular sampling you have done.

-(Brian Walker) If you are doing this with a systematic grid and are doing it monthly you have these randomized sites that are spread out I don't think it's as good of a design.

-(Dave Whitall) I think that's a great point and I would love to talk to you about that over lunch. Our question is not necessarily tracking nutrient plumes up the coast. Our question is what is the water quality stressor to the reef system themselves? So you could obviously have a grid in the nearshore environment that would allow you to track currents. When we study coral reefs normally we randomized the samples.

-(Brian Walker) But you repeat that randomization every period, you don't randomize it once. If your question was, I want to know what's going on in this ICA then you can just randomize sites in that ICA each sampling period. But if you are looking at within strata variability you really need to come up with a more systematic approach I think, especially in the case where you have targeted sites within multiple sampling sites.

-(John Fauth) I agree with Brian. Imagine if you have a cluster of 4 above them and a cluster down below, those are obviously on some feature you are interested in, the outfall and inlet right?

-(Dave Whitall) So this is an inlet, this is a random site, this is the outfall. So sometimes the random sites cluster.

-(Brian Walker) You can easily take an ICA and maps of the reef and figure out randomized points for each area.

-(Dale Griffin) Well you could float your random sites each time right?

→(Brian Walker) If you are just trying to figure out what is happening in the ICA then if you want a time series.

-(Arthur Mariano) If you have a place with a very strong seasonal signal you are going to have a hard time determining that in the randomized spatial design. You need to have the time series data.

-(Josh Voss) You could do a combination. You could do a box of 9 points in a grid design and 9 random points overlaid in that box as well.

-(Piero Gardinali) I would like to be obsolete, in Jack's presentation it gave us a lot of good points and that was based on the obsolete concept. Now the next argument we are going to have in randomizing things is the size of the box. So we are carrying on this argument. We understand the value of randomized sampling but we are also

- trying to figure out where the problems are so we need to figure out what we want to do.*
10. (Dale Griffin) *When this all first started these were the hotspots so the compromise was random and targeted.*
- (Arthur Mariano) I think this hotspot is important.*
11. (Joanna Walczak) *To bring it back as to why we designed this whole concept was to see if we could find a way to answer the perception of our community that says water quality is the primary reason for reef degradation. Can we say that with this design? That is what we are trying to ask.*
- (David Cox) If I might interject with Kurtis' work in Boynton perhaps demonstrates that if you set up one of these options around the inlet.*
- (John Fauth) You have to have your y axis which is your biological and things that are responding and your x axis which is your water quality, once you get those 2 things together with the spatial dynamics.*
12. (Francisco Pagan) *I have 2 very distinct questions about the sites for the TAC: 1) Do we have a direct area that are of higher priority than others? 2) We have the random and targeted sites, which will lead us to answer the questions we want?*
- (Diego Lirman) There is another way to slice the pie sampling quarterly.*
- (Dave Whitall) You could but my concern with that is that the work that Joe Boyer did sampling quarterly was that the consensus was not sufficient in terms of what was going on. So you could sacrifice temporal resolution for spatial resolution but it might not be a prudent choice.*
- (Josh Voss) As alternative you go to quarterly plus a combination of event sampling.*
- (Diego Lirman) A number of people use spatial patterns and, look at the long-term dataset very successfully. I have a problem with 16 sites for a huge area. I think having too few data points is worse than having no data.*
- (Dave Whitall) For year one that is what we are proposing to do but not after that.*
- (Phil Dustan) So Joe Boyer's work did not detect any signal at all from nutrients with the loss of 40% of the coral cover. It gave 0 support. That kind of sampling just doesn't work.*
- (Josh Voss) Or maybe it does work and the driver is not water quality.*
- (Margaret Miller) I think that that is an important point. Diego to your point quarterly versus monthly, is that it is going to take you more years of sampling to build a dataset that is useful. In the Keys program they have 21 years of data and that is really useful but the first few years is not so much. So if the intent here is to jumpstart that it seems to me that the more frequent sampling is an appropriate trade off in terms of getting a dataset that is going to provide us something for a small area as opposed to waiting 5 or 10 years to get enough data from quarterly sampling.*
- (Phil Dustan) Number 2 there is not enough coral out here to do the kind of correlations out there that because the main event is over. I think you would learn a lot more doing things experimentally.*
- (Josh Voss) I agree with you but to decide what conditions you need this data first.*
- (Esther Peters) They (FDEP) are looking to find out what the public thinks of it, if there is a water quality data or not.*

13. (Dave Gilliam) *So we have a commitment for 16 sites that appears to be sampled monthly. Then year 2 is a hope and a prayer that we can do another 16 sites or the same 16 sites or ramp to 32? What is our honest expectation about what is going to happen in the future?*

-(Dave Whitall) We have a finite amount of money to spend on laboratory analysis this year, that is how I am back calculating to the 16 sites. Given that dollar amount you can play games with the money but it all comes back to that number. Looking forward NOAA will transition the project to DEP and then it becomes your tool and program. I cannot speak to the funding situation at the DEP or the counties. Joanna and I might talk and say we want to go after funding again in '17 but I don't know how that will be received. What I would love to see happen is to keep the momentum going and it grows over time to become a sustainable long-term monitoring program.

-(Dave Gilliam) Maybe a hotspot should be defined then as the greatest likelihood that there is going to be a partner to continue the dataset so the appropriate time series continues. In '17 if there is no partner to continue it tells you nothing but at site B there would be a greater likelihood that a partner would continue that dataset. I'm just throwing that out there as another variable to think about in terms of selecting sites.

-(Dave Whitall) I agree completely.

-(Jack Stamates) Dade County Utilities funded the project I talked about earlier however the project is finite and completed.

14. (Kurtis Gregg) *Just a point to Joanna's comment about the question the public is asking, what is the water quality status on this portion of the FRT? We are just trying to say this is what we've got. If you do take actions to improve we have data. This project is where we are at. We've got to get the ball rolling.*

-(Kathy Fitzpatrick) I just want to mention since I got rid of all of my counterparts is that Martin County is a great partner. Our commission is very motivated on water quality issues and is also very politically active and may throw in some of their own funding.

-(Brian Walker) Given that there is such a small amount of money this year and the intention is that all of these partners in the future, why not utilize the money as a training exercise for all of the partners on board with every single aspect of the data, that way when you do go off and get a pot of money that you can implement something at a broader scale, you have it set up for that?

-(Joanna Walczak) We would have no product to show at the end of the year. Ok so, where would you focus your sample? South with Jack or North with a lack of data?

-(Josh Voss) It's that we don't have data offshore.

15. (Brian Walker) *To me it seems like a similar question to how we set up the SECREMP sites. You have some people doing work here, you have some people doing work here, you have this one continuous project with people collecting data in a consistent way. My suggestion would be to spread out throughout the whole area. Then you are going to be able to connect the dots with one consistent survey design. Then having to worry about team logistical issues.*

- (Josh Voss) SECRMP was born out of another monitoring program that had already been revised and established over a few years. If you are developing a de novo sampling design and de novo analytes there may be an iteration. We need to do it somewhere well once to decide what that optimal sampling along the coast is.*
- (Diego Lirman) The variance is so huge that you can't say much about the whole area.*
- (Dale Griffin) I think you could take that data and extrapolate that and possibly determine where you want your sites.*
- (Kurtis Gregg) In my collaboration with colleagues at SFWMD monthly sampling was the minimum sampling number, when it comes to which area to focus on. We have to focus on areas with gaps. And look into wet versus dry season sampling.*
16. *(Josh Voss) Relative to Martin County with Dave's question about picking out partnerships we could collect the samples and then pass them off to the park or either Martin County.*
- (Dave Gilliam) That area is part of the SEFCRI region but it does not represent the area well. So is that important?*
- (Judy Lang) I can imagine the arguments with the fishing with water quality as well.*
- (Josh Voss) Weather windows are more challenging in Martin County than they would be in Miami or Port Everglades.*
- (Brian Walker) Hollywood would be more representative of the Broward to Miami-Dade.*
17. *(Piero Gardinali) This is a water quality monitoring program that we are trying to develop and sell to other programs, we should look at the partnerships as a priority, characterize the n members as boxes. We really need to address this.*
- Discussion of Water Quality Monitoring Project - Analytes
1. *(Phil Dustan) Why is chlorophyll so expensive if it's easy to measure?*
- (Dave Whitall) They do chlorophyll with sonification in the dark method.*
- (Phil Dustan) But you could do it fluorometrically in situ and use an in situ probe for much cheaper.*
- (Josh Voss) In terms of logistics you don't want to send in situ samples everywhere else.*
- (Esther Peters) Plus you have to consider the quality of the data that you get out of the lab. If you contract it out you have third party validation.*
2. *(Kurtis Gregg) For the TAC's consideration would caffeine or something else be better than sucralose?*
- (Jose Lopez) I don't know if your list reaches to the bottom but for microbiomes what are you testing?*
- (Piero Gardinali) We developed the sucralose method so people are more inclined.*
3. *(Margaret Miller) If we are investing money into other nutrients, is chlorophyll that important?*
- (Kurtis Gregg) I think there was correlation between chlorophyll and other nutrients.*
- (Diego Lirman) The more I think about it is fine scale [inaudible] and do it all out this year with all of the analytes at one site.*
4. *(Josh Voss) What is the justification as to why you have dropped them?*

- (Diego Lirman) Yeah, what are the science based suggestions for moving up?*
 - (Phil Dustan) Sooner or later you want to scale up and you can link chlorophyll to remotely sensed signals.*
 - (Dave Whittall) The money can't go to anywhere else, it has to go to this third party lab because it is in the contract.*
 - (Margaret Miller) Then maybe target the biggest signal for your project.*
 - (Phil Dustan) The boats are all here so why would you have to limit it.*
5. *(Jose Lopez) When we did a quick microbiome study, we covered sampling from the inlets outfalls and reefs the greatest we saw was in the inlets.*
- (Chris Sinigalliano) It's the same pattern we saw at the outfall and reefs and the inlets stand out.*
 - (Kurtis Gregg) But we still need to answer what is the water quality on the reef system.*

Public Comment

Directions for public comment:

- Please fill in a Comment Card and give it to the floating facilitators or registration staff if you wish to speak.
- Public comment is limited to 3 minutes for each person speaking unless there are less than 5 comments; Then up to a maximum of 5 minutes will be allotted.
- Only comments submitted in writing on a comment card will be included in the meeting minutes.
- If you have materials you wish to give to the SEFCRI TAC, please provide copies and leave them at the Registration Table.

Dan Clark – Cry of the Water

Video of reef damage from Tortuga festival. Disease outbreaks have been bad. Is there a direct correlation between truck haul and dredge and fill projects and coral disease outbreaks. Coastal meeting is right down the hall, how do we get the word out to Washington and local politicians and the public about how bad our reefs are and the need for more money to study the problem?

Stephanie Clark – Cry of the Water

The maps I have up on the screen show a section of Hollywood Beach after 4 beach projects. The hard bottom edge has moved offshore with each project. In Ft. Lauderdale area there has never been a major beach project. The hard bottom edge has remained steady, in the same place, so when we get the hard bottom edge after the truck haul project that is going on right now, how much of the hard bottom and reef will we have lost?

Anonymous

1. When choosing a location for the pilot WQ project also consider proposed land use changes e.g. port Everglades was mentioned as a good control location, they have proposed projects and yesterday discussion pointed to studying that area remotely.

2. There is a danger with planning the rest of the future. The future is not a fixed moment in time, it is ever evolving so if we plan for our future what happens to the future's future.

SEFCRI Future Needs, Laruen Waters, FDEP CRCP

- What projects would you like to see go through for potential funding?

Project Title	Number of Votes
Evidence of wastewater associated pollutant stress in marine prokaryote communities	11
Incentive based fishing license education program	1
Reducing LBSP in stormwater runoff	7
Pier water monitoring stations	7
Lobster Trap Damage to SEFCRI coral reefs	7
Profiles of inlet waters and their effects on nearshore reefs	0
Map atlas of the Northern Florida Reef Tract	0
Friends of SEFCRI	0
Coral reefs mitigation success criteria and application of best practices	7
Update 2000 economic valuation of SEFCRI reefs	12
Coral toxicity studies of LBSP	11
Re-evaluation of existing state turbidity standard for coral reef habitats	12
Review synthesis data gaps, synthesize knowledge of reef status	0
Acropora dense patch mapping and assessment	13
Protected species demographic monitoring and large corals	13

Discussion about SEFCRI Needs

1. (Esther Peters) *FWC has samples that need to be analyzed for microbiology and histopathology from the disease outbreak.*
2. (Kurtis Gregg) *Rule making for prohibited anchoring to prohibit anchoring at a distance from the shore.*
 - (Dave Gilliam) *The immediate action is to get the DEP and Army Corp. to say no to that.*
3. (Dale Griffin) *DEP in Tallahassee to be willing for an education thing for the wastewater treatment facilities to improve practices.*
 - (Jack Stamates) *The outfalls will be turned off by 2025.*
4. (Margaret Miller) *Bottom line you need a focal disease program to do this.*
 - (Brian Walker) *But from the FRRP data you could get estimates of corals by species and compare then by year to see what we've lost.*
 - (Dave Gilliam) *Our densities our too low right now to capture anything.*
 - (James Byrne) *It's per strata so it should be sensitive enough to pick up a 10% change in the different metrics.*
5. (Esther Peters) *For what Francisco is asking, why did this happen, we have to have disease diagnosis going on and have the background to do this and feed that back into the system. I took a lot of time to rewrite the RMA. We don't know why that is happening.*

-(Dale Griffin) *If there is a limit to the number of organisms on a system you can use foraminifera?*

-(John Fauth) *You could like Danny is doing.*

-(Kurtis Gregg) *But getting back to Dave and James, looking at the ratio of macroalgae to coral cover, because our coral cover is so low.*

Adjourn – Lauren Waters

Lauren reviews meeting achievements and states that the next meeting will be held over the summer. Email Francisco or David with any further thoughts or comments.