Southeast Florida Coral Reef Initiative (SEFCRI)

Technical Advisory Committee (TAC)

Report of Proceedings

November 1-2, 2016

Nova Southeastern University Oceanographic Center

8000 North Ocean Drive

Dania Beach, Florida

MEETING ATTENDANCE

Technical Advisory Committee (TAC)		Day 1	Day 2
Ken Banks	Broward County	X	X
Don Berhinger	Fisheries and Aquatic Sciences UF/IFAS	X	X
James Byrne	The Nature Conservancy	X	X
Nancy Craig	Broward County		X
Dick Dodge	Nova Southeastern University - Oceanographic Center/ NCRI	X	X
Phil Dustan	COFC		
John Fauth	UCF	X	X
Piero Gardinali	FIU	X	X
Dave Gilliam	NSU-OC/NCRI	X	X
Lew Gramer	UM RSMAS/ Keys Marine Lab		X
Kurtis Gregg	NOAA	X	X
Dale Griffin	USGS		
Judy Lang	AGRRA	X	X
Diego Lirman	UM RSMAS	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	X	X

Florida Department of Environmental Protection (FDEP) Coral Reef Conservation Program (CRCP) Staff		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
Meghan Balling	FDEP CRCP	X	X
Joanna Walczak	FDEP CRCP	X	X

Additional Presenters and Observers		**Day 1**	**Day 2**
Chris Sinigalliano	NOAA AOML	X	X
Kirk Kilfoyle	NSU	X	
Joseph Pawlik	UNCW	X	X
Maribeth Gidley	NOAA AOML	X	X
Lauri MacLaughlin	NOAA/ ONMS SEGOM Region	X	X
Jane Fawcett	Vone Reasearch (NGO)	X	X
Alicia Vollmer	NSU	X	X
Stephanie Clark	Cry of the Water	X	X
Wendy Wood-Derrer	NSU	X	X
Sean Green		X	X
Ryan Hoyt	NSU	X	X
Cory Ames	NSU	X	X
Patrick Bennett	South Florida Spearfishing Club	X	
Dan Kapnis	SEFCRI	X	
Erin McDevitt	FWC	X	X
Forest Rohwer	SDSU	X	X
Chuck Collins	Marine Industry Association		X
Nick Morrell	Reef Guard		X
Josh Voss	FAU Harbor Branch		X
Danielle Dodge	FAU Harbor Branch		X
Jeff Beal	FWC		X
Sara Thanner	Miami-Dade		X
Abby Renegar	NSU		X
Cole Easson	NSU		X
Rachel Zimmerman	NSU		X
Henery Briceno	FIU		X
DD Halpern	Citizen		X
Nick Godbaig			X

Meeting Summary: Tuesday, November 2nd – Wednesday, November 3rd 2016

Meeting Guidelines

David Cox introduced himself as the Land-Based Sources of Pollution Coordinator for the FDEP Coral Reef Conservation Program. He welcomed everyone to the 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: define and plan your TAC projects and CRCP proposals, OFR outcomes. Inlet waters and coral health/reef health, outfall, comprehensive conditions are the main objectives for this meeting. We will have more presentations tomorrow.

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

Session #1: Updates/Current Events

Disease Coordination - Kristi Kerrigan, FDEP CRCP

- Southeast Florida Coral Disease Outbreak
    - Timeline of disease events beginning in summer 2014 to July 2016
    - Organized coordination calls for coral diseases
    - New disease manifestations
    - Listed corals affected by the disease
- Coordination Calls 2015
    - In 2015 coordination calls were made to coordinate response efforts among regional partners to characterize the coral disease outbreak and try to identify potential causation or correlations

    - Florida Reef Resilience Program- Disturbance Response Monitoring (FRRP DRM)
        - Modifications including bottom temp, landscape photos, list of other organisms affected
- Coordination Calls 2016
    - In 2016 promote a better understanding of the extent and severity of the ongoing coral disease outbreak across the FRT
    - Need for data, management, resources, and citizen scientists to help
    - New legislation for emergency response
    - New working groups
- Now
    - Coordination with UGS National Wildlife Health Center
    - Developing talking points for communication efforts
    - Disease data aggregation efforts
    - Exploring platforms for database storage
    - New contracted project that uses disease as an indicator for reef resilience
- Upcoming Webinar
    - Dr. Greta Aeby November 14th

<u>Questions For Kristi Kerrigan</u>

1. (Margaret Miller) *The request to USGS, what type of support are they in a position to provide? Is it sample analysis and histology and stuff like that?*

> → (Joana Walzack) *I'm gonna field that one, sure, and Esther you're gonna back me up on this terminology. Epidemology, so the broader taking the data and looking at the bigger patterns, but also Terry Burkhart from Hawaii has offered support on sample analysis. But we don't know for sure exactly what that means yet.*
>
> → (Margaret Miller) *That's what I was wondering is do they actually have capacity sitting around for that purpose?*
>
> → (Joana Walczak) *Right. That's exactly what we're wondering too.*
>
> → (Margaret Miller) *So that's to be determined?*
>
> → (Joana Walczak) *They've acknowledged the receipt and were very prompt in acknowledging that they've received our request, they'd been briefed ahead of time by Lisa that it was coming, so we hope that they've been having those internal discussions to see where that may lead.*
>
> → (Esther Peters) *The national wildlife health center (inaudible) to learn more about particular animals that are affected (inaudible).*

→ (Margaret Miller) *Yeah, that would be particularly helpful in trying to pull things together. Yeah that would be great.*

2. (Brian Walker) *I'm interested in hearing more about the resilience part of that.*

   → (Kirk Kilfoyle) *He's just now started, he's going to be using existing data, so He's not collecting any data, but using FRRP, RVC, Using, creating resilience indicators for each bioregion in the marine program. He'll be basically developing resilience indicators for each.*

   → (Brian Walker) *Does that relate to what FWC's been doing over the past three years? Working on some resilience model for over a year.*

3. (Dave Gilliam) *I think the effort is in the context of restoration, not necessarily in resilience at all.*

   → (Margaret Miller) *That's probably a big part of their struggle, it's the six dollar question. Probably because they compiled a lot of data, they spent a lot of blood sweat and tears compiling a lot of the physical data.*

   → (Dave Gilliam) *Rob van Woesik's now doing something.*

   → (Margaret Miller) *Yeah Rob's got another project.*

   → (Dave Gilliam) *I thought it might be a good time to update on, if you guys remember at the May meeting I gave a presentation on our disease observations and I dropped that bomb about the pillar coral. And if you remember we had 65 colonies that we've been monitoring for a number of years and as of May only 12 were alive, we went back in September and of those 12 only 4 were alive and all 4 have disease, so essentially all 65 colonies that we've been monitoring for years, the only 65 colonies that we know of, are essentially all dead. It's a species that I'm sure there are representatives in southeast FL somewhere, I don't know where they are, I'd love to get the information on the colonies.*

   → (Joana Walczak) *Well do we know of any from our region?*

   → (Dave Gilliam) *Six of them, and I think they're doing okay.*

   → (Joana Walczak) *Well that's something. Those become more and more important as this progresses.*

Florida Reef Resilience Program – James Byrne, TNC

- Normally we would have results by now but the hurricane came through
- Our surveys are supposed to capture peak bleaching
- Went to sites and followed protocol but ended up in sand patches

- QAQC is going on now, the database manager who does QAQC is on vacation in Australia right now
- End of this week results should be out

Questions for James Byrne

1. (Brian Walker) *I would just comment on that, I mean that's been a problem that we've brought up for years with the FRRP sampling design, for RVC we recognized it early on and adjusted points ahead of time, and for FRRP I've been doing, graciously just so that people don't struggle within our region, for the past many years. That's something we have to do upfront.*

   → (James Byrne) *It hasn't been as big of an issue with FRRP this year, coordinated with RVC sites.*

   → (Brian Walker) *Well actually all previous years (inaudible).*
   → (James Byrne) *We are going in the direction of cross tests this year (inaudible).*

Acropora Mapping – Brian Walker, NSU

- Characterize the condition of previously known large dense patches of Acropora
  - Determine the condition of the 35 known A.cerv patches
  - Spatially map patches
- Methods: Conducted four 30m transects
  - Percent live tissue, dead framework, disease and rubble within
  - Number of fragments, fireworm predation
  - Perimeter mapping-live colonies greater than 0.5 meters in diameter separated
- Results: Found 23 areas around the 35 patches, spanned between discrete dense areas
  - Total area mapped is 826609 m^2
  - Site 8 was the best, site 27 was the worst (lot of dead framework)
  - Patches 30 and 31 are close to Port Everglades
  - Site 26 had large amounts of Porites porites combined with high percentage of dead A.cerv
- Plans:
  - Analyze data for spatial pattern and understand data
  - Obtain archived satellite imagery and investigate temporal changes
  - Find funding to continue to monitor patch size and condition

Questions for Brian Walker

1. (Arthur Mariano) *Is there a big difference in site 8 and site 32 for example?*

   → (Brian Walker) *What I showed in the video.*

   → (Arthur Mariano) *Why do you think they are different?*

→ (Brian Walker) *We're not sure. This is a first assessment so we don't know what happened at these sites. We don't know how old they are, we don't know if a disease event came through last year or the year before, we're just kind of reporting how they are. And that's unfortunate that we don't have the change. In terms of disease it was kind of low in my estimation, although this was, they were collected in May, which is not a high disease time of year, so maybe it's high for May, I don't know. But of the 35 patches, this was the percent of disease within each transect at each site. So the scale here, this is 1%, 3%, site 16 had 2.5% disease, that's the most that we found, you know, not great, but lower than perhaps what people might be expecting. Now we haven't standardized it to the amount of live tissue in each site to understand the disease to live tissue ratio.*

2. (Margaret Miller) *How are these data collected?*

   → (Brian Walker) *We took a 1m quad down and estimated the percent of live and dead.*

3. (Margaret Miller) *So the diseased part is what was originally recorded as bright white skeleton?*

   → (Dave Gilliam) *Basically, you know, areas of rapid tissue loss.*

   → (Margaret Miller) *And sort of visually compiled into one meter?*

   → (Brian Walker) *It's a percent of area, so 2.5% of the quad.*

   → (Margaret Miller) *It's not percent of the coral.*

   → (Brian Walker) *This is percent of area within the sites. Like I said I didn't standardize this by the coral at each site yet so we aren't reporting that yet. Just to give an idea, it's still relevant.*

4. (Don Berhinger) *Do you have images of these quads?*

   →(Brain Walker) *We do not. We would still be down there. But one other interesting observation was, one of the patches we came across which looked like an old dead Acropora patch actually had a lot of P. porites on it, a LOT of P. porites. I thought this was worthy of showing, all of these knobs, all of this in here is all porites, just something that I hadn't observed before...I thought it was worth pointing out...all of this area in here is all live porites, and then it's mixed in with some dead and live cervicornis. So that's an impressive site, we had a lot of porites density at this site, above one per square meter, whereas most of the other sites were much lower...whole lot of porites. So that's where we are right now, we are going to continue to analyze data over spatial patterns and to understand these relationships between live cover and metrics of predation, etc. We are also going*

to look at the hard coral community data, in relation to Acroporid taxa growth percentage (inaudible). And we are going to investigate the dead patch condition data. The next step which is just part of Ryan's thesis, we haven't been running it yet, is to obtain archived satellite imagery and go back through and try to identify the cervicornis in that archived satellite imagery and look at the temporal changes. We are hoping that we can get a good understanding of how the really dense patches have changed over the last several years. We can't determine what's live and what's dead through that imagery, just try to see how they have spread out. And then obviously find funding to continue to monitor these areas for patch size and condition and to understand what's causing these changes, how are they being affected by disease.

5. (Kurtis Gregg) *The patch that is about 730 meters north of the Port Everglades. What advice do you give for the Port?*

   → (Brian Walker) *Don't dredge. That it's there, it needs to be monitored, it's going to be affected by turbidity. I've sent that map to (inaudbile).*

6. (Judy Lang) *Where are these on the reef system? Are they only on the first reef?*

   → (Brain Walker) *I think they're all in the nearshore hard bottom, nearshore pavement areas. Between the ridges and the pavement, basically what we call the nearshore ridge complex. That's an important point, it's kind of a distinct habitat that all those large corals that I pointed out last time are, it's the same habitat that's traditionally thought of as not very important.*

   → (Judy Lang) *The only other explanation (inaudible).*

   → (Brian Walker) *It appears to be just on the surface of the pavement, we don't find a lot of areas that have these built up fossilized framework of acropora that you find in other parts of the Caribbean, but you know it certainly moves around a lot, we've shown that in previous studies. Most of the cervicornis that we find is sort of in the western part of the shallow ridge offshore.*

   → (Ken Banks) *A lot of that is Anastasia formation north of port everglades. Limestone/sandstone.*

   → (Brain Walker) *But one of the questions is how ephemeral is it? Because there are patches out there that we've known about for a long time, those patches have been around for along time, so now it looks terrible, it looks dead. But we don't know how ephemeral they are. It's a 20-30 year time frame, is it just a hurricane draught, and as soon as something comes through?*

   → (Ken Banks) *There was a report in the 70s of extensive cervicornis off of Lauderdale-by-the-Sea from reputable sources.*

→ (Kurtis Gregg) *Ephemeral is a term that's been grabbed onto by folks in environmental consulting fields. It's used to explain any resources that are usually high value, the term usually gets used to refer to dynamic changes, might not be in the spotlight now but still going on out there. We need to be careful about the terminology we pick up from others, ephemeral is often dismissed.*

→ (Dave Gilliam) *I think one interesting point that we're finding, we have been monitoring 2 of these patches for several years, and what we find is that they maybe aren't ephemeral, but they don't recover. So, they are fairly healthy and have good growth, till something knocks it down. Then they maintain themselves, till something knocks it down. There is no recovery in these high density thickets.*

→ (Brian Walker) *And that's one of the reasons we feel like that site that I showed you is so nice, it's probably new.*

→ (Margaret Miller) *I think successional is maybe a better term for it. That seems to be a pattern that we see and I've thought about this quite a bit, if you look back at (name) data from the good old days in Jamaica, those thickets had 30 or 40% partial mortality issue according to them, back then. So it may be that successional nature of monotypic cervicornis is different. I don't know if you have different insights on that Judy.*

→ (Judy Lang) *Well I was just going to say that that was also a primary (inaudible) yes there was huge amounts of coral but.*

→ (Margaret Miller) *It was a ghost, it was a ghost coral because it was there, it wasn't dead yet, but once it was wiped out, it may be that that's a similar situation to what we see here, I think that that successional process is potentially a lot of what's going on.*

→ (Brian Walker) *I think it's all fair to say that this is a degraded system here, and we still can find areas like this, so why is that?*

→ (Margaret Miller) *And that seems to be a contrast between cervicornis and palmata, because in cervicornis in our region we do see the patches that do look good and do seem to be new and thriving, and the palmata on the other hand when we see those patches declining we don't see any new ones showing up cervicornis somehow colonizes and develops these thriving stands.*

→ (Esther Peters) *It was interesting about the Porites porites because I remember when the palmata was dying (inaudible) And also I wonder if you happened to mention, did you look at damselfish?*

→ (Brian Walker) *We just counted the gardens, we didn't count any of the fish, but I haven't had a chance to look at these data at all, in fact this is all I've done, just yesterday. It's not as if I've had the luxury of a month to analyze it.*

→ (Esther Peters) *It's exciting.*

→ (Brian Walker) *Yes I thought it was very eye opening to jump in at all these areas and measure the amount of cervicornis. And that porites site was really cool.*

Reef Fish Visual Census Update/Future- Kirk Kilfoyle, NSU

- Determine current status of southeast Florida reef fish populations
- Provide seamless integration with existing RVC program data from FL Keys to Dry Tortugas
- Foster partnerships among federal, state, and local partner agencies and organizations
- Methodology: stationary point count, imaginary 15m cylinder from sea floor to surface, record all species in the first 5 minutes, habitat characterizations
    - Paired site design
    - Averaged counts from two divers
- Highlights
    - Port St. Lucie to Government Cut, 0-33m depth, May-October
    - 4500 survey dives with more than 300 species identified with 26 new species not previously recorded in the FL keys
    - Recruitment pulses, reef burials, spawning aggregation sites, nursery habitats
    - Length frequency data: Red grouper, Hogfish and mutton snapper
- Many more questions to ask with this data set
    - What is the reef fish assemblage biogeography along the FRT?
    - Have parrotfish populations changed in the past decade? If so, how?
    - How do changes to specific components of the benthic community affect reef fish assemblages?
- No funding for 2017 but coming back for biannual monitoring in 2018

<u>Questions for Kirk Kilfoyle</u>

1. (Jack Stamates) *Just interested to know, have you seen much changes in density of populations around the inlets and outfalls?*

    → (Kirk Kilfoyle) *We haven't looked at that specifically yet, but that's something we could definitely do. I've had ideas about additional sampling focusing on inlets and outfalls in particular.*

    → (Brian Walker) *If you do that what buffer would you use around those things? Would you include sites within a half mile?*

    → (Jack Stamates) *1km. Yeah there are certainly fishing boats that go there.*

2. (Judy Lang) *After 5 years are you seeing any indication of more southern species move up from the Keys?*

→ (Kirk Kilfoyle) *Yeah those are temperate species that we've seen if we start to kind of increase our sampling efforts. I don't know if 5 years is long enough to see change in something like that, I think that might be something we'd pick up with a much larger dataset. I can't think of anything in particular that we've noticed that's coming up in our area except perhaps the Queen triggerfish, but there's dozens of other regions so something that we can look into.*

→ (Brain Walker) *Usually with the RVC data in the keys they don't have enough sampling to look at the annual changes, so they usually combine two or three years of data to look at blocks of time, and with a five year study we might be able to do that in two blocks, but it's tougher thing, if you have eight years then.*

→ (Judy Lang) *Somebody did some Reef Visual Fish census off Broward somewhere.*

→ (Brain Walker) *Nova did in some in 2000, it was just Broward County, they did all of Broward County quite extensively, and we're using those data to compare to these data in terms of looking at parrotfish density and things like that to see if there are any changes.*

3. (Dave Giliam) *Kirk, you may not be able to answer this, but you know, a long term monitoring designed to go every other year has a whole host of challenges associated with it, so what was the decision to go with every other year, was it funding?*

→ (Margaret Miller) *Its all funding. Nobody likes it, I guarantee you. In the Pacific they're only going every three years, to all the Pacific jurisdictions. It's a huge challenge and Kirk alluded to this, but the funding for all NCREMP is locked forever.*

→ (Dana Wusinich-Mendez) *The intent and the hope was always that it was this platform for others to build from, I mean it's 20% of our program's budget is dedicated to this, and why dedicate more?*

→ (Margaret Miller) *Yes, the intent is to use that as a platform to build more local interest, for more questions and hypotheses to be built into that through supplemental funding sources, but NCREMP is not equipped to do what needs to be done.*

→ (Brain Walker) *That's a tough sell because we have a nationwide monitoring program already in place but we need funding to do more of it. And people are going to be like, well, they're already doing that, let's look at other things. The tough part: How do you sell that to someone giving out money? Yeah we have a program that's already going on.*

→ (Margaret Miller) *But it's only sampling every other year.*

→ (Brian Walker) *Nobody's going to fund it.*

→ (Dana Wusinich-Mendez) *There are lot of questions that it's answering, you might not get flat funding from another source, to fund the off years in their entirety but.*

→ (Brian Walker) *Or are you going to supplement the years they already are sampling because they're not going to sample it enough?*

→ (Kurtis Gregg) *And that's the point, Brian, the NCREMP data are designed to answer the questions to Congress for how our reefs are doing. We all understand that it's not a very good platform but it's what that program can afford, so by providing that 30 to 40% level that we've got, we can add on to it, increase our sample size, make it better, make it applicable to the management questions here.*

→ (Brain Walker) *They're only reporting biomass, right? In the report to Congress.*

→ (Kurtis Gregg) *I think that's where we ended up, not sure if we have biomass broken down into or functional groups.*
→ (Brian Walker) *So then the sell would be, we're only getting biomass out of this data but you could fund us to get all this extra stuff.*

→ (Kurtis Gregg) *Right, and the sample size of that work would be increased by x during those NCREMP years, or we could do another 3 years by just you funding one year of work, using a three year block as a baseline. It's not good, Margaret says nobody likes it. It's more than we could do without it.*

→ (Kurtis Gregg) *You have 20% of your budget spent on something that nobody likes.*

→ (Brian Walker) *But Congress wants it.*

→ (Margaret Miller) *Brian points out, there is a huge communication problem, obviously. It's an important point. There are many things that NCREMP does not do, it is not designed to do and I think that has not been communicated well, that there are many many gaps and many many things that it is not designed to do. It is not designed, and it cannot and it never will, give us an indication about coral disease trends. It won't. It can't. I was an advocate all along saying NCREMP should not even collect coral disease data, because it's going to be misleading, automatically. So we shouldn't even do it. That's not what. There's lots of challenges like that. And a chunk of it is communication. I'll just say as well, you mentioned the report card, by the same token, huge communication problem. Obviously that is not the end all and be all of NCREMP. There are many people that are very unhappy with the report card and the report card process, how that's happened,*

but that is a product that the program and Congress demands, obviously there are many other uses to which that data is put, and report card is a fairly minor one.

→ (Joe Lopez) *It sounds like from what Brian is saying it is almost a density dependent model. If you take that data away, more people want it, and if you show the data, if it's useful, that should be an impetus to keep continuing the monitoring, like if you don't do any monitoring you'll show that there's a big gap.*

Session #2: Ocean Outfall Pilot Study- Results& Phase II Input

- Inform design of full-scale project
- Sampling Design
    - Sampled from outfall pipe or directly below it, 28m depth
    - Control station about 1.6km south, upcurrent of outfall, in region of greater predicted stress during a bleaching year
- Potential Sampling Design
    - Diffusion model predicts that pollutants decline exponentially with increasing distance from source
    - "Response at a distance" design
    - Could use out of region, cleaner control (e.g. Bahamas)
- Focal Species
    - Pilot targeted water, sediments, algae, sponges, coral mucus, bivalves—identification of algae, mussels, and non-xesto sponges was difficult
    - Did not assess reef resources
- Assays
    - Three assays suggested samples were influenced by outfall
    - SOS Toxi-Chromo, trace analysis of sucralose and atorvastatin in seawater, stable isotope analysis in sponges
- Statistical Analysis
    - Lack of replication limits usefulness of pilot

Questions for John Fauth

1. (Kurtis Gregg) *One point about the diffusion model, the assumption is simply continuous input in a homogeneous environment, and we've got a pretty good idea that the environment is not homogeneous. Is there a way to refine and account for that?*

→ (John Fauth) *Well it's more the design of having, as opposed to two points having some distances, because the whole idea is you're going to have a few points of that outfall, so you're going to need some distances, and Jack suggested a kilometer away with these kind of really expect the effects of the reach background more or less, so you want to include that point beyond it, and then include some points within it, depending on how steep those curves are, you want a lot of points really close, and then an exponential series would be a good idea, to do two km, 1km, half, a quarter, an eight, a sixteenth, a 32nd and then right below the outfall that would give you eight points in an exponential series coming down so that would cover the parameter space pretty well, but then you've got the question is that in*

one direction, both directions, how do you want to design it? So those are things to think about.

2. (Dana Wusinich-Mendez) *How many outfalls?*

→ (John Fauth) *That's the other question, how many outfalls? Okay cause we've got multiple outfalls. We also have an outfall that's been mostly shut down. We've taken advantage of that. These are all open questions.*

3. (Margaret Miller) *Do we want to look at the pilot data before we discuss the design for something new?*

→ (John Fauth) *Yeah we can do that if you want. We could be reminded of what we're controlling?*

→ (John Fauth) *Just as a reminder of when and where to sample, so Brian I think we had you beat because we looked at this morning, so this is Danny Gooding's data about coral stress effects but now broken out by the different years, so you can see if you pick almost any point on here, the outfall's right about there pretty bad, not too bad. Good, good, pretty bad not too good really bad really good really bad really bad really bad. So from year to year there's some variation, and of course there's seasonal variation too about what those stressors are.*

→ (Margaret Miller) *Is temperature the primary factor that's driving your stress impacts there?*

→ (John Fauth) *You can see the bleaching here so far...so 05, 07, 14, 15...so there's definitely a really heavy component there that the warm water.*

→ (Margaret Miller) *And then the others like 13, that big red swath, what are the parameters playing into that pattern?*

→ (John Fauth) *That's what we're trying to figure out right now.*

→ (Margaret Miller) *So it's based on coral condition is what these data are showing?*

→ (John Fauth) *Yes, coral condition, right.*

→ (Dana Wusinich-Mendez) *Sorry, so this is based on actual observed impacts, not inputs?*

→ (John Fauth) *It's based on the FRRP data, and you can create almost any point, here's another one, not bad.*

4. (Arthur Mariano) *You are assuming those measurements are independent of each other but we know they correlate, so you probably don't have that amount of degrees of freedom. You've probably overestimated degrees of freedom (inaudible).*

→ (John Fauth) *I mean yeah you could separate it out more if you want, there's nothing magic about having the perfect data, just you're trying to reduce your error. The error goes up whereas.*

→ (Arthur Mariano) *But my point is that you just can't assume that each measurement there is a complete degree of freedom, you have to calculate the interval of space scale and then divide that degree of freedom by twice that space scale.*

→ (John Fauth) *That's the whole question is to find out what that shape is that's the whole question.*

→ (Arthur Mariano) *I'm not saying anything's wrong with your approach, needing more replicates, stuff like that, I'm just saying your degrees are freedom are very rosey, you're way overestimating your true degrees of freedom.*

→ (John Fauth) *Well, I think that's the eventual analysis.*

→ (Arther Mariano) *Well yeah, you go into ecological literature and half the results are eventually wrong because people fail to estimate they (inaudible).*

→ (John Fauth) *You design things right, you can do whatever analysis you want and you're not going to have an issue, it's when you screw up, so when you don't replicate samples, you have different samples in different places, but if you set it up right you can run whatever stats you want. There are some things you can do if you're worried about your error and your estimations. See here's your error around your estimates, always tighter in the middle and gets looser around the end cause you don't have as many points. So one of the things you can do is over replicate say close to the outfall and way far away, try to pull it to scale, in the middle of the two that's where your best estimate is so there's some tricks you can play to get a better estimate. Yeah I mean the question of okay do we do this again or do we do something else. It shows you that you're not going to get hurt as bad as you think by.*

<u>How to design full-blown project:</u>

1. (Arthur Mariano) *I will make a comment about the seasonality. You showed us a plot showing interannual variability, it changed from year to year, were those all taken at the same time of year?*

   → (John Fauth) *Yes, those were taken at the same time of year, so this isn't looking at the seasonality in the pilot study.*

   → (Arthur Mariano) *So what do we know about seasonality?*

→ (John Fauth) *Well for the most part if you're really trying to look at the outfall's influence, the outfall's running all the time, so if you want to try to isolate its signal, what you don't want is a lot of things running off the land at the same time, so that says don't sample in the wet season, don't sample after they open the floodgates from Okeechobee. So you want to do dry season sampling, probably. And as late in the dry season as you dare to go. But it also probably means that when you set up a date to go, you should have a backup in case there's a big rainfall event, tropical storm coming through. We've had a couple of big rainfall events in March these last couple of years.*

→ (Don Berhinger) *Is there variability in the volume coming out of those outfalls different times of year, maybe in the spring when there's loads more people here (snowbirds)?*

→ (John Fauth) *I mean we could look at that. When they put stormwater through then we see the changes.*

→ (Dave Gilliam) *What is our bank? Where are our resources coming from?*

→ (John Fauth) *This is purely resources within this group.*

→ (Dave Gilliam) *What I recollect from the little that I've heard is they're going to be using us for the actual fieldwork but then I think funding in the past covered the lab analysis.*

→ (Lauren Waters) *It was a little bit of a mixture because I think some lab work was kind of done pro bono a bit here and there but the funds did help provide buying the supplies, maybe some fuel and things like that, but a couple of the lab analyses were funded.*

2. (Margaret Miller) *I would go back to the parameters that we feel like are going to be meaningful, and I guess I was going to ask Joana. You know the things that we to see in the best case scenarios are tracers so the water column trace substances and stable isotopes are sort of tracers to say that there is some zone of influence in a biochemical thing that we can measure either in the water or in the organisms as opposed to some sort of response to those biochemical conditions. And I guess question to how useful is to documenting tracers I feel like that's sort of a no-brainer like, is that beneficial? to exercise a big effort to say we have a gradient and a tracer or is really what we need a biological response information which my interpretation it's a little hard to find that and we haven't been able to so far to identify those responses. And that leads me to the fundamental question about what does it make sense to focus on.*

   → (Joana Walczak) *It is two-fold. The agency really does strongly need a tracer.*

   → (Margaret Miller) *So that is something that is useful to document?*

→ (Joana Walczak) *If we can definitively say it comes from that source and that's the kicker because I think I heard from a previous presentation that sucralose, you can test for it and that's a very specific human impact indicator and that's a big one that our agency uses, however, I think I heard that you can't tell if its new Sucralose or if it has been there forever because it has a long duration. So, there are nuances there but yes, a specific tie to the benthic organism is very important. If we have the ability to take it that step further, and go for showing damage to those organisms, that is ideal. But we recognize that you just have to start with baby steps.*

→ (Brain Walker) *If you can get both of those, you can get the response, basically, so it's good to get the two together in the same place at the same time.*

→ (Joana Walczak) *So for an example we're using this information in Biscayne Bay looking at septic leaking systems that we know are causing an algae bloom, so an agency specifically looking at sucralose because of that direct line of.*

→ (Brian Walker) *So you want something tied to the outfall itself specifically as well, right not just general inlet water all sources but a specific point source from the outfall, so you would need a tracer that's specific to the outfall.*

→ (Don Berhinger) *So I'm a little bit new to this so is the goal here to, if we can show impact, to be able to speed up the timetable of which these outfalls are shut down, because they are still scheduled to be shut down by 2025, that's the goal?*

→ (Joana Walczak) *Speed up would be tough, what we are trying to do is to ensure that they're won't be any push back. There are definitely some concerted efforts to push back the timeline.*

→ (John Fauth) *And going back to Margaret's point, one of our data gaps, with the FRRP data, we don't have any sampling stations close to the within a km of the outfall, so that whole distance where you'd expect to see some effect if it exists, isn't covered and I think the same is true with SECREMP correct? We don't have anything close to the outfall. Those are holes, we don't have any quantitative information there. So this has been a problem for years. I was the one who did the pilot project, okay let's get something in the water, volunteer efforts, have the resources and do it had we decided to pull back and check our methods, first.*

→ (Brian Walker) *But even if you could measure response, the signal might be masked by all the other things going on I mean in the past years we've seen it would have been a very lucky situation to actually pick a metric that could be detected over and above all the other changes happening, when comparing controls and the outfall site it's hard measuring responses.*

→ (Jack Stamates) *I'm going to take us back to a couple of years ago to when we were first discussing this, and one of the suggestions we put out is, the outfall has been running fifty years to a diver on the site with a camera, you should see in this exponential distance, you should see a gradient in bottom if there is you should see it after fifty years. A ring or a physical change, which kind of change with sampling or chemical analysis.*
→ (Kurtis Gregg) *I don't think you would due to the interactions of the habitats and the environmental variations you can get for instance algae years.*
→ (Brian Walker) *Infauna and a lot of other things that you may not be able to visualize.*

→ (Kurtis Gregg) *I was wondering, James, what would be the level of FRRP (inaudible).*

→ (Dave Gilliam) *I am struggling with just, I would suggest the SECREMP protocol since you are there anyways so might as well collect the data, but I don't know what that gives, other than to say this is what the condition is of the benthic resources. My experience is you're not going to capture differences in the data that's collected in monitoring efforts at those sites. You're not going to say, oh yeah this site is different than this site. It's not going to be there with the traditional things that we're sampling. You know, just things that pop up in my head. We have a nice long-term data set with FRRP and SECREMP and Broward County monitoring methods that show variability over years and what's happening and some trends right? Well maybe what's happening near these outfalls is not necessarily the loss of species or loss of density. It might be that these sites because of what's happening around these outfalls are prone to periodic algal blooms or greater disease prevalence or reduced reproductive capacity of these stony corals, and you're not capturing that looking at density and size classes of coral. So maybe rather than just sampling the benthic...it may be interesting to sample it more than once or over a period of time and compare that to the trends that we've been seeing with these monitoring efforts. Or maybe incorporate some tissue sampling to look at the cellular level and the tissue level to see how reproductive these guys. I'm just throwing ideas out there other than percent cover, size class, stony coral density.*

→ (James Byrne) *One thing that comes to my mind, looking at it trying to pick up on the spatial context and thinking about not just outfalls, but you also have the inlets contributing similar type of impacts. Maybe map out spheres of influence from each one and see where they start to overlap and that may be why we can't find a control that doesn't hit it because we end up seeing that they're all contributing to each other, where this one's slowing down this next one's picking it up.*

→ (Dave Gilliam) *To control for one may impact for another?*

→ (James Byrne) *Right.*

→ (Brian Walker) *There is no control.*

→ (James Byrne) *It may be just continuous across this reef tract, we're getting continuous influence from each of these different impacts.*

→ (Ken Banks) *You can see that between the two inlets, for a long time it holds that title.*
→ (Dick Dodge) *That's what the tracer study did, showed that what came out of the outfall went into the inlet it shot back up. Clear evidence that there is an interaction.*

→ (James Byrne) *If this were easy we would have done it a long time ago. Well it started out just looking at the inlet and the outfall.*

3. (Piero Gardinali) *Since we were talking about the splenda, I don't understand why it would make a difference unless you have a closed system.*

   → (Judy Lang) *What is the splenda in the outfall?*

   → (Piero Gardinali) *At the outfall the water is always super high but it dilutes very quick. The assumption of old vs new has to imply that you have a closed system that cannot recirculate, otherwise it would move away and you would have other parts of the water coming in. The advantage of the spenlda is the higher concentration because it doesn't get treated so we can trace it much farther out so It's the best shot we have at tracking something for a longer distance than anything else. So yeah, it doesn't degrade but it's always there in the.*

   → (Judy Lang) *I'm sorry I said that wrong, I meant to say in the inlet. How much sucralose is in the inlet?*

   → (Piero Gardinali) *It depends on which one but we have seen numbers that are not as high as the outfall but are different than the general region. And it's the only link to a land-based source of pollution here so.*

   → (Joana Walczak) *Yeah I guess I was thinking of it in more of the sphere of influence that we were just discussing. Can we for sure say that what we're finding is coming from that outfall. Cause we do use it as the agency for point source tracking but because we have so many influences here.*

   → (Piero Gardinali) *Yeah if you have a lake with ten houses, but that's a completely different system.*

   → (Joana Walczak) *But it's a question of our confidence of, if we do this gradient and we use sucralose as the tracker for an outfall, can we for sure say that that sucralose, regardless of how long it's been there, is from that outfall?*

→ (Ken Banks) *If the concentration is higher there then yeah.*

→ (Joana Walzcak) *Okay.*

→ (Piero Gardinali) *The problem that we ran into before, is if you take a sample right below the outfall, no it's not, so it will float out. All the pictures say that if you take it at the boil you have one number but if you take it underneath where that pipe is coming out, you may see very little. But it's still the best chance that we have to go over longer distances. That's my only argument for it. I know you can't make a difference between new and old but for this system it doesn't really matter.*

4. (Arthur Mariano) *We should really think about this system out here as a diffusive system. It also is a convective system. You probably have a ton of convection. So the thought of monitoring an inlet becomes monitoring two inlets, one on either side the outfall of Miami and Port Everglades. If you want to answer these questions, this is what you really have to do. (inaudible) If you start looking at the space and time scale of this physical system here. You have a time scale alone of 5 hours or 2 hours. A lot of things change. Spatial correlation function on scales of 1 to 5 km. Things change very quickly here. I know this replication you only have so many things you can do. You don't really understand what's going on in the km range because of all the (inaudible).*

   → (John Fauth) *Except the bio is integrated, so that's your kicker, is that integration over time of the bio.*

   → (Arthur Mariano) *But you have a very small portion.*

5. (Brian Walker) *Ken, you had a graduate student, Jessica Kraft, that did a masters thesis out here looking at gradients between benthos away from Port Everglades. Is there anything we can learn from that effort in terms of study design?*

   → (Ken Banks) *By recollection, the only thing she saw that showed a gradient was macroalgal cover away from the inlet. She didn't look at the outfall.*

   → (Brian Walker) *But would that be useful in terms of.*

   → (Ken Banks) *It wasn't my student. I don't think she ran out far enough away from the inlet to see the whole signal.*

6. (Joe Lopez) *In regards to the focal species I think those are good choices, the ones that you focused on. You have quite a few out there. You have to be careful if you are looking at the densities of the sponges if you're going to be looking at tissue biomass. Because Niphates is a very thin sponge, it could reflect more what's in the water, vs. has got a higher tissue density. But it's good that Xesto is very prevalent at the outfall,*

and also (inaudible). I don't know about Callyspongia as much, but you also have to be careful it might easier for the collectors to pick from these species, but Callyspongia, you gotta be careful with differentiating that from Niphates, they're pretty close together as well. So if you recognize, you're sticking with Xestos?

→ (Joseph Pawlik) *Well I think it's good, I wouldn't have as many as you had up there, but three species like Xesto, Niphates, and maybe one other I don't know about but yeah because those are different densities.*

→ (John Fauth) *And the other thing is Dale previously sampled sponges for human ~~no~~roviruses. I don't know how you explain those getting into sponge tissue. I guess you could argue those flushing off the land as opposed to the outfall but if you got some sort of, like Mike and Brian showed in their data, it's hard to imagine how those would come from a land-based source that isn't the outfall.*

7. (James Byrne) *Would any of those that we are seeing bioaccumulate in predators? And maybe we should come up off the bottom and think about ones that may be actually feeding in that area, that might be bioaccumulating, that might be able to give us a stronger signal?*

   → (James Byrne) *I'm thinking like in fish, up the food chain.*

   → (Ken Banks) *The goliath grouper that lives in the pipe is good.*

   → (Joe Lopez) *Maybe the stable isotopes could help you there, did that on the sponges.*

   → (Kurtis Gregg) *John, This entero virus that Dale did, were those live viruses or dead viruses, because the water is secondarily treated coming out of the outfall.*

   → (John Fauth) *No, I think those were live viruses.*

   → (Kurtis Gregg) *That would be more indicative of septic tanks into the inlet. Dale's treated water comes out of the outfall.*

   → (John Fauth) *Yeah but Dale's argument is that the treatment kills 99.997% and you've got millions of gallons of water per day, so he is less impressed by the treatment. Just force of numbers.*

   → (Brian Walker) *Are any of these tracers we are looking at have known negative effects to other organisms, other than the ones where we found them? So maybe you're finding a tracer in the sponges, but you know it has a negative effect on something else.*

→ (Piero Gardinali) *You can pick up anything you want, I mean I'm sure you have carbomazopine which is an antibiotic, it will accumulate in organisms and all that. How much of that you can pick up, I don't know.*

→ (Brian Walker) *But do we know what effect that would have on those organisms?*

→ (Piero Gardinali) *Well yeah an antibiotic would, was created with a purpose. But we go back to the same that it would have the largest effect at the lowest concentration on the hormones. Which are by nature the most difficult ones to detect. So that's the bottom of the scale. Yes we can dectect them but it's a couple of nanograms per liter in the effluent so by the time we can detect it. You need huge samples to see it. So that's at this side of the spectrum. But then you have a tracer that moves through the water which has no effect whatsoever but we can track the water. And then you have things in the middle. But the level that would produce effect is not in the concentration that are in treated, even treated wastewater. Can't use it by itself unless we go to the hormone.*

→ (Brian Walker) *But you could take one of those other tracers that links specifically to that source. And then assume that the other things coming out of that would be affecting the same region or area. Or would the break down when they get there?*

→ (Piero Gardinali) *I mean you would have to have a good handle on what the pipe itself carries all the time to be able to establish that. Each treatment facility might be different in terms of the treatment and in terms of what they get in. So we would have to characterize that specific outfall long term and know the variability to be able to track one tracer with another one.*

→ (Ken Banks) *Does splenda accumulate?*

→ (Piero Gardinali) *Not at all. I mean we did manage to, for septic systems, we did manage to get it as now it's an indicator that [we] know, near shore that you might be affected by septic or more diffuse things, we know that when we get to 55 parts per trillion there's a direct link to increased nutrients concentrations, so that we've done. But it's a different system it's not a pipe that comes out in the ocean.*

8. (Lauren Waters) *This is definitely the TAC's outfall project, so where do you guys want to go from here?*

→ (Judy Lang) *I like Jack's reminder to get in the water and look at the visual changes upstream and downstream, north and south of the water.*

→ (Piero Gardinali) *I mean there's something simpler than that.*

→ (Judy Lang) *And I recall when the Delray outfall was shut off they claimed that the cyanobacteria disappeared, and I don't know exactly (inaudible).*

→ (Dick Dodge) *Everyone's been out there has anyone ever seen a big difference in distances from the outfall? I mean I've never heard of it. Well they'd look at the same thing in the bottom and if they see a change that they can report.*

→ (Margaret Miller) *I guess the fundamental mystery if there really is no benthic data for these places, that would seem to be a gap worth filling. If there is no benthic data. It's hard to believe that there's no benthic data for these sites. If there really is no benthic data since the 70's, then that seems to be an appropriate thing to do.*

→ (Dana Wusinich-Mendez) *Well, we need to just look at the FRRP dataset , the SECREMP dataset, and just using the lens of the outfall just confirm (inaudible).*

→ (Dave Gilliam) *The SECREMP sites were purposely not placed near the outfalls.*

→ (Margaret Miller) *Well it seems like you could sample near the outfalls, do the adjacent sites. Coming back from a gradient but sample there and then use that to compare against the population of the FRRP data in that. Again, problem is it's really deep there. Benthic sampling takes time and effort. If we had a small effort that collected benthic data adjacent, you could compare that to the population of FRRP data in that strata, and that would give you a first level comparison to look at what's there at least. I mean we have a little bit of this right because there are bivalves at the outfall and there are no bivalves elsewhere. Now, FRRP is not going to tell you that so that goes back to the point*

→ (Dave Gilliam) *What bivalves?*

→ (Ken Banks) *There's a lot of oysters. In the 70s there were bivalves at every outfall that's probably why we did again.*

→ (Margaret Miller) *Well they're filter feeders anyway and we were looking for bioaccumulation so we were looking at filter feeders the same way we look at sponges. But anyway, that seems like a next preliminary step before you try to do a full spatial sampling is just to get the biggest signal data that you can. It's hard to believe that there really isn't any data from these sites, but if there really isn't then that seems like a next step.*

→ (John Fauth) *I know there is no FRRP data within a km, and my recollection is that there's zero or one within 2km.*

→ (James Byrne) *It's also the depth.*

→ (Brain Walker) *And what they're measuring, and the scale and the purpose of the project. What happens if you go there and you determine there is no difference in your dataset. Then do you try further? Do people take your data*

and say "look, these guys did a study and there's no effect, let's keep these things open"? I mean, you gotta be careful with what you look for.

→ (John Fauth) *So that goes back to having some more sensitive indicators, some things that are cellular, molecular, histological.*

→ (Dave Gilliam) *Would these samples be collected at the very eastern edge of the outer reef, that 90-100ft range? If that's the case then we don't even have any background. All the FRRP and SECREMP data is 60ft.*

→ (Margaret Miller) *It doesn't go down to 30m?*

→ (Dave Gilliam) *There isn't any general original data to compare it to? Because we don't have any data that deep. We need to have some strategy.*

→ (Joana Walczak) *To go back to Dave's original question about who's paying for the... The DEP coral program has put it into our new cooperative agreement request to the NOAA coral program for funding for the next two years. It's a very small pot of money to help with sample analysis and samples. Just so you guys know we do hope and anticipate that starting July 1 we'll have at least 10k for 2 years each to put towards this and that's why we're talking about this now. So that we can prepare to make sure that when we get to July we have something to do with that money. So we've got a little bit of time and this was just kind of a teaser, just to get the juices flowing, but we do have to come up with something.*

→ (Dave Gilliam) *Where is that money best spent then. If we have a limited pot where is it best spent: with people with tanks on their backs and slates in their hands collecting data, or people with tanks on their backs and sample bags in their hands collecting tissue that then gets sampled up in the lab. I mean being in the water with slates and collecting data and cameras is expensive. That same group of people collecting a hell of a lot of tissue to take it to the lab and analyze it...that might be more efficient. I think the three stony coral species were good. I think if you're going to collect some, cavernosa, Porites astreoides, and Siderastrea siderea (inaudible) and all three of those species are at all depths so they're approximating directions (inaudible) it's nice that PAST is a brooder vs the others being broadcast spawners.*

→ (John Fauth) *It's a hard one because when you have limited resources you can't cover all your bases. I would think fewer species sampled more intensively.*

→ (Dave Gilliam) *Is there a downside to in terms of sponges, having Xesto be in here? It seems like the easiest...easy to collect and most people can identify it.*

→ (Judy Lang) *If it's only going to be one coral what about one sponge and one coral? Which of the three corals if it had to be one coral, Dave?*

→ (Dave Gilliam) *If I were to choose one it would be cavernosa.*

→ (John Fauth) *What would be your second?*

→ (Dave Gilliam) *Probably astreoides, but they're a little less abundant that deep.*

→ (Margaret Miller) *I feel like it was hard to find one of those, I can't remember if it was two years ago, I was swimming around looking.*

→ (Dave Gilliam) *You also need a big enough sample, generally your cavernosas are abundant and a decent size.*

→ (Margaret Miller) *Well we're doing mucus, right? We're not talking about taking tissue samples?*

→ (John Fauth) *Well that's one of the other decisions, for the pilot project it was just mucus.*

→ (Margaret Miller) *From what I remember most of the colonies were small, tissue samples become more problematic.*

→ (Brain Walker) *That seems to be continuing the pilot in a way. We want to inform the next step with the pilot we've already conducted.*

→ (Don Berhinger) *I guess it would make some sense too, I mean, by the time we start multiplying out all of these replicates that we are talking about and all of these different assays, I mean in the end are we going to end up, even though it sounds like a lot less effort to go out and collect a bunch of samples, if you need to reach a certain level of replication and you start multiplying that out, if you do stable isotopes, if you're doing carbon and nitrogen it's at least, if you get a good deal $10 a sample, are you going to have enough replication or in the end, might it be more worthwhile to put people in the water, perhaps some folks are already funded, you know Broward County and places like that, to collect some of this benthic data, get an idea of what the sponge community is like, maybe get a gradient away from these sites. I mean we have no idea what the sponge community is to start out with, and perhaps there's totally different community distributions as you move away from these outfalls. And I'm not talking long term data but you'd have control data vs outfall data. I don't know I guess it's probably worth doing some of those calculations before committing to one direction or another.*

→ (Dave Gilliam) *Well, not at that depth. I mean we're talking 30m. We don't have a lot of data on anything at 30m. None of these ongoing monitoring projects.*

→ (Margaret Miller) *That doesn't seem like the place we'd want to start.*

→ (Joe Lopez) *Ken would you say the habitat a little bit shallower, say 20m, would be reflective of what's going on at 30m?*

→ (Ken Banks) *Its different.*

→ (Dave Gilliam) *It's like a bald head, right.. You get a lot more rugosity and complexity at either edge your data can pick that up.*

→ (Judy Lang) *Would recreational diver have any knowledge that would be useful?*

→ (Margaret Miller) *Yeah that's a good point. He did take tissue samples I recall, we did not exclude that area, if you are doing community sampling you obviously need to incorporate some buffers outside of that visible disturbance area. But you're not going to see a spatial gradient, in once sense yeah but I don't think that's what we're looking for.*

→ (Joana Walczak) *And we could ask them to do things, that would help. They are a bunch of tech divers that have the ability to get down here, and they are very very willing to work with us. So if there are specific questions or things like this video of habitat that would be helpful for us then we can make that happen. But they aren't coral biologists, they are tech divers who have the ability (inaudible).*

→ (Brian Walker) *We did try some video surveys on deep wrecks using a similar team of Project Baseline guys and the first go at it wasn't very good, so we'd have to calibrate them ahead of time.*

→ (Joana Walczak) *This particular outfall, the Hollywood outfall, they are very focused on it, they are trying to get a lot of attention on it, and they are willing to take decision makers and politic[icians] down in their submarine and things like that to look at it, so they would be very much in favor of supporting this effort.*

→ (Dave Gilliam) *Could they provide boat time and tank fills?*

→ (Joana Walczak) *Potentially. We haven't ever asked. If there were to be an ask what would it be?*

→ (Margaret Miller) *Not scenery but down-looking video preferably with some sort of scale in it that with adequate lighting and things like that where things could be identified, that would be the most likely beneficial.*

→ (Dave Gilliam) *Like I said if you look at the video the question is what's the benthic community like here vs here...you can't sample in the trench, you can't sample adjacent to the trench, that's disturbed habitat. Something where at least the structure of the reef is going to be similar, they need to be aware of that.*

→ (Joana Walczak) *There could be some coaching.*

→ (Margaret Miller) *Close coaching, I would say.*

→ (Brian Walker) *Actually what they do have the capability of is putting a scientist in a submarine and going down and communicating with the divers to tell them exactly what to do.*

Session #3: Coral Disease Data Mining- Results & Phase II Input

- Coral Disease Outbreak Timeline
    - Reports of coral bleaching and tissue loss in summer/fall 2014
    - April-July 2015—widespread reports of diseased coral
    - August-October 2015—bleaching along northern FRT
    - November-December 2015—beginning recovery
- Disease Diagnosis Program
    - Surveillance
    - Study ecological factors as well as victims
    - Preliminary diagnosis
    - Evaluate and summarize to form final diagnosis
- Hypothesis: certain environmental conditions recently changed on the northern FRT, causing disease outbreak.
- Data Collection Plan
    - Parameters: chemical, biological, hydrological, and physical
    - Years: 2012-2013 minimal disease reports, 2014-2015 high disease and bleaching reports
    - 62 owners of data contacted: no response from 12, more than 50 useful data sets
    - Develop conceptual model about what is in the study area
    - Need to decide how to analyze data and identify data gaps
    - Disease investigation models: epidemiology, ecological risk assessment, CADDIS, conservation medicine/ecohealth
- Phase II Study Team
    - Input from TAC (write answers to questions on paper)
    - Data crunchers to be determined

Questions for Esther Peters

1. (John Fauth) *I can give you an answer for items 1 and 2 right now if you want me to.*

    → (Esther Peters) *We want you to write it down. And we also want to know what other people might think about questions 1, 2 and 3.*

    20 Questions for the TAC (discussion about protocol for answering questions, led by David Cox)

2. (Joana Walczak) *The whole intent here is that we have an event going on that is different from natural variation in disease prevalence. We want to focus on the management questions that will help us define this event, then we want to look at the data that we have to see what datasets can answer these questions, and if we don't have the datasets, we need to focus on what data we need to collect. The first question is: are*

these the right questions. The second question is do we have data to answer these questions. Third is, if we don't have the data what is the data that we need to collect?

→ (Margaret Miller) *I mean, according to the published paper, the ground zero was off Virginia Key, out of Port Miami, it spread rapidly north and more slowly south, so currently there is much more activity in the upper Keys right now, and I don't know what the current activity is in the northern region. But certainly there is much more recent, virulent disease going on it the upper Keys, it seems like.*

→ (Esther Peters) *The dataset that would tell us that is SECREMP, CREMP, FRRP.*

→ (Margaret Miller) *And there's the data that Precht has published already. Typically not, they'll spend a lot of time running around in the water to try to demonstrate that it wasn't that. He spent a lot of time running all over the county and looking at things, so the data intensity isn't as great as it was at the sites around the port, but there was a lot of effort there in terms of documenting the spread in the 2016 scientific reports.*

→ (Esther Peters) *And, of course, the concern always is that yes, we are targeting Science because some of some rescue that's going and some issue that's going on, and yes we don't know (inaudible), so hopefully we can get that information.*

→ (Brian Walker) *I was diving out here in August and disease coral still around. I don't know how someone identified that one area of the reef tract is more prevalent than another unless they're sampling the entire reef tract. I'm a little bit cautious about thinking about one person's interpretation. I also think that we can't ignore the obvious that there might be a conflict of interest with that paper and the Port of Miami dredging, which is what it spawned from, and I think it would better for another group to look at it as well.*

→ (Esther Peters) *Well we did have all the FRRP and SECREMP samples.*

→ (Brian Walker) *And I think that what John's student is doing, it's kind of an offshoot of what I had presented at the 10 year FRRP event, looking at year to year hotspot analyses and how they compiled throughout the years to give additive effect to a region, not just it's happening now, it's not happening. I think, in that sense the FRRP data are pretty strong.*

→ (Margaret Miller) *They don't provide temporal, they are much less useful in terms of those sort of temporal.*

→ (Esther Peters) *I personally think that our first step is going to have to be, where do those diseases come from? What are the (inaudible) of these corals? For each year. Wherever they collected them from. And then, in order to show causality, match need locality of coral diseases with all the other datasets, and*

then pull out the numbers and then match the distance with the data collected within a certain distance of those spots. So there's going to have to be a break (inaudible) to get at exactly what this disease, and where, and were there any other data collected from those spots.

→ (Dave Gilliam) *I think that, for number one, what has always struck me about the where, is this is an event that is mostly based on observational data, unfortunately, but it has been observed along the entire Florida Reef Tract. That seems unprecedented to me. And then in terms of each region, for example the SEFCRI region, it's on all of our habitats as well. So it's unprecedented in terms of the FRT but also in terms of its distribution within the reef. In terms of its where, I don't know, we have the data, certainly not the quantitative monitoring data that can tell you that it started here or it's more prevalent here, I don't know if the data can show that. Spread's another challenging thing to show because that requires a lot of samples to show that it wasn't here before time A and now its here before time B.*

→ (James Byrne) *The FRRP data would just be able to tell you in the fall, you can pick up some of those changes but as we know disease prevalence is actually more in the time frame.*

→ (Esther Peters) *Fall is the time to pick up disease.*

→ (Judy Lang) *There have been diseases that have extended. What is unprecedented is the number.*

→ (Margaret Miller) *Another pattern that I note which is my impression and I think something that everyone needs to weigh in on, but it seems like there has been a progression from more classical white plague signs that have been reported on a certain species, whereas later on, especially I'm more familiar with the observations from the upper Keys, but these novel signs and manifestions on Siderastrea siderea seems new, and some of the recent reports from Bill Precht on cavernosa, really looks more like a yellow band type manifestation to me than white plague, as it was manifest earlier on, so my perception is a progression of condition from morphs of the white plague to a greater diversity of conditions later on, and again that's a little bit confounded by space maybe because more of the high prevalence may be south of here, although the cavernosa is very widespread, current, prevalent, so that's one point. A second point, according to Precht's paper, he cites Porites porites, astreoides, Siderastrea siderea, and Stephanocoenia intersepta, as being completely unaffected during that earlier white plague phase of that outbreak. So he cites those four species as completely unaffected. Clearly at this point in time at least S. siderea is highly affected. My impression is that astreoides is also affected in certain areas. So my observation is we've kind of got two different events going on, potentially, in terms of signs and species being affected, at least from a hodgepodge set of observations.*

→ (Brian Walker) *Is it two different events, or is it just progressing through species that are more likely to be affected vs species that are.*

→ (Margaret Miler) *That's the question. The signs certainly seem different to me. In terms of photos that I've seen. And I don't know, I'm sure you've seen more photos than I have. But what I was looking at early on was pretty classical white plague, rapid progression on that set of susceptible species. The stuff on S. siderea is totally different. I would not call that white plague at all. And I don't know if those patterns are coming out in the FRRP data but I would be really interested to look at those specific questions in terms of what's identified in that dataset and the species prevalence that might be different between 14, 15, and 16.*

→ (Esther Peters) *We've not done this before...the earliest report that I can find in my survey list is in Biscayne National Park, Siderastrea lesions. I don't know if anyone's seen anything sooner. As you said, maybe the conditions are such that other species that may have been just fine.*

→ (Margaret Miller) *Is it one event or is it really more than one phenomenon that's going on?*

→ (Esther Peters) *We're going to have to get at it with sampling. There's still classical white plague. And we have to get at it with histology, and examination of the disease for each of these. Vanessa Brinkhuis at FWRI is going to be leading sampling going on from the Keys as well as from Broward. And some of these other Siderastrea and.*

→ (Brain Walker) *With the large coral study we did, we had initial observations in 2014 with images, we did assessments in 2015 and the siderastrea that we noted then did not visibly look diseased in 2014, and then in 2015 it looked like it started with a dark spot type morphology.*

→ (Esther Peters) *Although it does not always seem to be initiated with the dark spot (inaudible).*
→ (Brian Walker) *I'm saying between 2014 and 2015 is what we saw. But that's only on two corals.*

→ (Judy Lang) *It might be worth looking through old photos to see if any disease looked like this.*

→ (Esther Peters) *There is a whole lot of other things that need to be done. So this is our data gap discussion, and we would appreciate people to enlighten and comment on our data gap. I do think that besides the histo, there are bacteria, whether they are primary pathogens or secondary, we're going to be collecting for that as well, we're also going to be getting samples for scanning electron microscopy. There could be viruses involved and you can't see that with microscopy.*

→ (Margaret Miller) *Are there samples in hand for the Siderastrea siderea syndrome or is that still a need in terms of collecting. Again, to me that's the maybe novel thing that's going on and very troubling because that has been a resistant species in the past. Are there samples in hand from the FWRI effort?*

→ (Esther Peters) *We've gotten samples for that. They also got MCAV samples in 2015.*

→ (Dave Gilliam) *The way some of the cavs look, some of them are kind of novel to me too, that whole scalloped edge with bright swollen polyps.*

→ (Margaret Miller) *Some have a yellow band and some of them don't, but what I've seen is much slower than the white plague that I was seeing a lot more of it in '14. So I would agree with you, I think that is potentially more of a novel condition.*

→ (James Byrne) *You're saying that the siderastrea one is unique? Because I've seen that throughout the Caribbean going back to 2005. It is very common in St. Vincent and the Grenadines. I actually have some photos from 2005.*

→ (Esther Peters) *Well we need to look at those and see what might be affecting them. And I have a potential student that would like to work on that.*

→ (Judy Lang) *Well I wasn't going to say anything, but since you said that I heard there might be some photos from the Bahamas, something with the same signs. I was going to wait until we had the photos and got a chance to look at them making any bold comments, didn't want to raise expectations.*

→ (Esther Peters) *But that's good because one observations is there have been lesions in the past but the corals healed. What's going on now?*
→ (Dave Gilliam) *Well that's another unfortunate observation of this entire disease event or events is that you see so many 100% mortality colonies now. So, so much of this once big coral has become diseased. In years past it didn't seem so severe, but again that's purely observation.*

→ (Esther Peters) *Brian you have pointed out the Colpophyllia tissue loss.*

→ (Brian Walker) *Yeah, we had some of that for sure, just in a couple months, or a month. But I think Dave probably saw that too with the Dendrogyra.*

→ (Dave Gilliam) *I don't think we had any disease in April 2014 and by April 2016 we only had 8 that didn't have disease, and from April 2014 to September 2016 the all died.*

→ (Esther Peters) *Some of you have brought up some great points about other data or data analyses that are currently being done. Certainly, if you could drop that data off and get back in touch with me, or I could get in touch with you about what's going on with that, the amount that would be available in the future, that type of thing?*

→ (David Cox) *There are two questions that I think are important, 15 and 16. Well maybe pass on 15. But how fast is disease spreading? Is that something we can answer? We've touched on it. About when we've seen it, and the rate at which it spreads in colonies. Can we address 16 about how fast the disease or diseases have spread?*

→ (Margaret Miller) *It's hard to get that retroactively, and that's a little bit related to the comment that I was going to make. And that is certainly for a lot of different geographies and a lot of different datasets looking at disease, storms are often a trigger for increased prevalence as well. And particularly for the areas that did have an impact from Matthew, and I kind of doubt we've been able to get in the water yet, but that would be something that would seem like it would be worth some targeted looks, because we might have an expectation of disease spikes following storm impacts regardless of what the baseline level was.*

→ (Dave Gilliam) *We saw that with our Acropora monitoring following Sandy, certainly.*

→ (Margaret Miller) *We did likewise, it's evident with a lot of different geographies.*

→ (Dave Gilliam) *I'm actually somewhat, this optimist part of me, is thinking okay we just had this event, what are [sic] we call this, the October 2016 event, maybe I'm naïve, I'm hoping it really shakes up the system and allows this to, like the Lyngbya outbreak we had in 2003 and 2004, those hurricanes came through and we never got it back.*

→ (Margaret Miller) *But I guess we still have something to look for now, because that event has sort of been ongoing with disturbance, it's been a little continuous over the past four weeks or so.*

→ (Esther Peters) *The only program that has gone out after events we've had before was FRRP, right? (inaudible) and then go out in winter?*

→ (James Byrne) *We did follow up in 2014 and 2015. So it would have been January 15 and January 16.*

→ (Esther Peters) *Is it possible to do one upcoming?*

→ (James Byrne) *It's something we really need to look at and see what makes sense. The way we were doing the follow up site selection I don't necessarily think was appropriate to capture the information that we're looking at. Because what we were doing was using the CREMP and SECREMP sites to go in and do fate tracking of areas that were hit hardest by bleaching within those zones. I don't think that's necessarily going to get us what we're talking about here. It would take us a little bit of a different design to get us the right information to follow up on disease.*

→ (Judy Lang) *What is the coldest month? January or February?*

→ (Margaret Miller) *April...it's late in the spring. Or March anyway.*

→ (Judy Lang) *So we should wait until then.*

→ (James Byrne) *Well that was following up on the bleaching, looking at trying to capture properties of bleaching because that's what we were looking at. It wasn't designed to learn anything about disease. If we're looking at disease it might be a different time frame, a different strategy. That's, I think our biggest issue and what we're talking about today. We've got all these great designs and surveys, and we can use them for so much but not for what the actual intended purpose is. And that's when we run into a lot of problems, when we start going after these other purposes, you know what—no. We're really going to use that? We really need to go back and tweak the design to answer the question we want to get at.*

→ (Judy Lang) *Are you amenable to addressing the disease?*

→ (James Byrne) *I'd be happy to bring it up to the FRRP steering committee and see what they think and how they would like us to go forward and work with all of our partners.*

→ (Joana Walczak) *The answer is yes, we're amenable, we just need someone to figure out what it is we need to do to change the protocol if it can be a small modification. If it needs to be a large modification we need to have a larger discussion.*

→ (Dave Gilliam) *I think John already suggested, what about more sites with one transect vs. fewer sites with more transects. That might help us with this disease case to cover more area. It's all about what effort gives you the most colonies.*

→ (Margaret Miller) *Yeah the colony density seems to be going down the past year, so the amount of area you have to cover has just tripled or quadrupled or gone up by an order of magnitude in the past two years.*

→ (John Fauth) *You know Esther has 20 questions targeting she wants to address, and by my count the FRRP dataset has got 8: 40%, that's pretty darn good. And some of the others.*

→ (David Cox) *Let's take a quick look at the 20 questions: which 1 or 2 really stand out as needing to be answered.*

→ (Lauren Waters) *Are there one or two that are really jumping out at you as really important questions that we don't have the data to answer yet.*

→ (Dave Gilliam) *13 through 18.*

→ (David Cox) *We have 13 through 18, anyone want to add anything else?*

Session #4: SEFCRI Updates & Future Efforts

- August 2016 Meeting Summary
  - New members listed
  - SEFCRI Local Action Strategies/Initiatives
  - Reviewing past SEFCRI project ideas
  - FDOU Project 26-Recommendation Review
  - Discussing regional efforts and issues
- Regional initiative and emerging topics
  - Coastal Ocean Forum Update
  - NOAA Best Practices
  - Discussed emerging topics such as disease, algal blooms, etc.

Questions for Lauren Waters

1. (Judy Lang) *Is the NOAA best practices document available?*

→ (Kurtis Gregg) *We actually prepared an article and Margaret, do you want to talk about it?*

→ (Margaret Miller) *I don't know if that's what you are talking about. There is a little bit of post-mortem data analysis that we are in the process of publishing in PeerJ. So that information should be coming out within the next couple of weeks. The pre-print version was published back in June so that's available. (Joselyn talked about best practices for monitoring). I mean I was informed about this and I think there's an ongoing dialogue between this and DEP and the CORPS and some of the other folks involved in terms of trying to develop a better plan for the upcoming project. I don't know that there's a document.*

→ (Dave Gilliam) *I don't know that that actually exists right now, that discussion.*

→ (Dana Wusinich-Mendez) *I would assume that sprinkled in some of that was also the US Coral Reef Task Force mitigation guidelines that are being developed...Joana can speak to this, she's been highly engaged in that, but across the 12 federal states and territories, I'm sure some of the best practices they've included in this voluntary guide the task force is putting out is a best practices model for mitigation of project impact in coral reef ecosystems.*

→ (Kurtis Gregg) *Some of the best practice I'm pretty sure Joselynn touched on in that presentation is related to the practice of chopping where they turn off the suction from the secondary where they just have the cutter head turning, pounding the rock to break it up and then turn the suction back on. Apparently that was something that the Army Corps reported in their work was contributing to potentially to turbidity and (inaudible) reef framework and other issues with (inaudible).*

→ (Judy Lang) *Is any of that written down?*

→ (Kurtis Gregg) *It hasn't manifested in a document yet. But I'm pretty sure I could get that information.*

→ (Margaret Miller) *Several people might have interest, maybe we could ask her.*

→ (Dana Wusinich-Mendez) *I have that one, I would ask her for an update I'm going to make sure I have the most recent one before I send anything out.*

→ (Lauren Waters) *Real quick, I want to ask you all a question and then you guys can think about it for a little bit: the SEFCRI team vice chairs have a question for you all. There's one vacant seat on the TAC, there's actually been a vacant seat for a few years, it rotates in and out, so they started to think about what expertise is sort of a gap. So they're asking, as you see these conversations going on, think about if you say "oh golly I wish we had this person in the room".*

→ (Dana Wusinich-Mendez) *Yeah, fish/fisheries expert. Kirk isn't on the TAC but there are several times today where I was thinking we could use him in here.*

→ (Lauren Waters) *If you could also be specific, because they had that conversation about if you just say "fisheries" or specifically fisheries management people, that'll be translating it more to regulation, or is it the fisheries biologist? If there's a nuance within that genre, also let us know that.*

→ (Brian Walker) *Can we just nominate someone?*

→ (Lauren Waters) *When the application comes out, you can absolutely, as it will say at the top, please forward to all the people you think will be the best to fill this position.*

Public Comment: Stephanie Clark & John Fauth & Joe Lopez

- State and Territorial Coral Reef Conservation Cooperative Agreement
  - Management Priorities
    - SECREMP
    - US Coral Reef Task Force
    - Outreach Efforts
    - Land Based Sources of Pollution
    - Reef Injury Prevention & Response
    - Fishing, Diving & Other Uses
    - Reef Resilience
  - Learning Exchange

<u>Questions for Francisco Pagan</u>

1. (Esther Peters) *On the learning exchange, so we hope to have an audience of who?*

   → (Francisco Pagan) *Stakeholders, students, people that are looking to be further involved in the world of research and communications, or people that are really interested in what's going on out there, [the] general public.*

   → (Joana Walczak) *The audience is marine managers. We need a better mechanism to get the information that's being done locally to us, so we decided to host it, and bring everyone to present out on local information on a regular basis. There are scads of studies being done in the universities and in our agencies and we just don't hear about them regularly to be able to incorporate them into our management positions.*

DAY 2 FALL 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.

Session #1: New and Emerging Research on Coral Reef Ecosystem Stressors

- Nutrients, Sponges & Reef Resiliency- Joseph Pawlik (UNCW)

- Caribbean reefs experience different trajectory than Indo-Pacific (low recruitment, decreased growth rates)
- Overfished reefs had slightly less macroalgae than the MPA reefs
- In the 1990's barrel sponges were understudied, began studying them on Conch Reef to figure out growth rate and age
    - X. muta is a dominant competitor, particularly compared with stony coral
    - Abundance increased by 122% and increased in volume by 40%
- Sponges are very selective in feeding habits but 70% of their diet is dissolved organic carbon
    - The "sponge-loop" says carbon is retained on the reef
    - Select for high N particles, eat mostly DOC
    - Excrete lots of N and turn over high volumes of water
- Sponges cover 16% of benthos in the Caribbean versus <1% in Indo-Pacific
    - Caribbean sponges have mound, branch, tube or barrel morphology; Indo-Pacific sponges have foliose encrusting morphologgy
    - Sponges of the Caribbean are heterotrophic whereas Indo-Pacific sponges are phototrophic

- The Caribbean is a closed mixing bowl of water and has 4 major rivers ways flowing into it
    - DOC sources from seaweed feeds sponges and they produce nutrients that feed the seaweeds creating the vicious circle hypothesis
- Testing hypothesis by measuring IN-EX flux, flow cytometry, nutrient analysis, DOC analysis

Questions for Joseph Pawlik

1. (Ken Banks) *So a couple of us in here work for the local government and we are trying to coherce the higher levels of our food chain to adding DOC levels in food chain. The argument is, what are you going to do with the information? Well what do we do with any of the information? What kind of levels of DOC should we be expecting to see in these urban waters?*

    →(Joseph Pawlik) *That's a great question. Forest, go ahead and chime in here too. DOC is a black box. We really don't know what it is and how to manage your samples for what your concentrations are going to be. DOC concentrations in the literature range by at least three fold and 100μmol per liter is a fairly standard concentration that people come up with very often.*

    → (Ken Banks) *In what condition?*

    →(Joseph Pawlik) *Data in the literature show higher levels in the Caribbean that the oligotrophic reefs in the Indo-Pacific. Forest just had a paper that he is going to talk about, I'm sure, where the levels are all quite similar although they are all significantly lower than what is out there. Again it depends on how you prep your samples to do your analysis. So the thing to do with DOC, generally, is to use the same technique and then do comparisons rather than try to come up with absolute values to establish the concentrations.*

    →(Jack Stamates) *I'd like to chime in on that. The most recent water quality work we are doing we did measure the DOC and we found it was noticeable elevated in the inlets.*

    → (Ken Banks) *Can you track the plume?*

    →(Jack Stamates) *We were not sampling at that kind of resolution.*

    →(Joseph Pawlik) *Maybe Forest will talk about this but for the Morayin reefs they actually find more DOC on the reef flats where the algae are and they are the ones making the DOC. Microbes are picking it up faster. There are a lot of interesting data coming in and a lot of them are quite confusable.*

2. (Jack Stamates) *It turns the water column over?*

→(Joseph Pawlik) *Right. If the water column were static, it would turn it over in that amount of time. That volume of water would be completely turned over. That gives you a feeling for the huge volume these animals are pumping. Relative to the Indo-Pacific we don't have that going on for the oligotrophic reefs. Here we have that going on. They aren't playing a big role in water quality.*

3. (Don Berhinger) *Considering the age of some of those massive Xesto's, thinking that some of them have been around since pre-Colombian times if you might be able to see a pattern around the Caribbean where you have some of those massive sponges that were in close proximity to areas that have high load of DOC like maybe the Florida Keys which has DOC coming out of the Florida Bay with a massive algal production or other places where there is a reef lagoon relative to atolls and offshore locations that aren't in close proximity to that king of offshore loading it might support that hypothesis.*

→(Joseph Pawlik) *There are several things here. First of all, frequently people think that sponges like pollution. They don't. There is no evidence to show that polluted waters grow more sponges. There aren't particularly good at handling anthropogenic sources of pollution. The sites that we have seen that have unbelievable populations of X. muta are like Tobago where that Amazon River water is coming across and the bottom there is just unbelievably loaded with X. muta. The other places where you find the X. muta equivalent, X. testudinaria is the kind that grows in the Indo- Pacific. You don't see that kind on oligotrophic reefs but you do see it in the Coral Triangle where there is a lot more river water hitting the system. The difference there is the volumes of freshwater input are huge, sediment loads are gigantic but the rivers are very short run so they don't pick up a lot of organic material. They are not meandering through forests and carrying along a lot of stuff with them. So there is that difference but sure enough that is where you see X. testudinaria in larger abundances so there are these indicators that perhaps there is a connection there.*

4. (John Fauth) *I've worked a fair bit on black water systems. Has anybody tried to hind cast the inputs to the system?*

→ (Joseph Pawlik) *This just came out this spring so it is all new.*

→ (John Fauth) *It seems to be a prime element to your hypothesis.*

→ (Joseph Pawlik) *Unless the real black water DOC was some new kind of DOC that is coming from farmland or forested areas where stuff was run off the land, it was previously held on land. Again it is easy to make these conjectures because DOC is a black box. Until we start actually identifying components it is a reach.*

5. (Ken Banks) *So the reefs in the Gulf of Mexico that get blasted by the Mississippi River discharge would be a nice location to study?*

→ (Joseph Pawlik) *Well yeah potentially. The Gulf of Mexico has a lot of other problems. First there is a lack of hard bottom overall. The amount of freshwater*

inputs may be enough to keep the sponges out. I've seen pictures of the Flower Gardens and there are lots of X. muta there.

→ (Brain Walker) *We just did some mapping off Tampa Bay in the nearshore. We mapped more pavement. We have mapped twice as much hard bottom over there than we have on this entire system on the East Coast. It is quite considerable coverage in some areas. I don't think an absence of data means there is a lack of hard bottom, at least on the Western Florida shelf. We have seen a lot of gorgonians in our videos but not X. muta.*

- Microbial Communities & Corals- Forest Rohwer (SDSU)

- Overfishing reduces grazing.
- Any sort of OC kills corals. Coral associated microbes grow faster with additional energy sources.
    - All stressors increase the relative proportion of pathogenic microbes and the number or virulence factors
    - Each stressor changes the relative proportion of different virulence factors and specific pathogenic groups
    - Energy enrichments kill corals. Nutrients do not.
- DDAM leads to alternate stable states…
- Microbes on healthy reefs are starving. Microbes on degraded reef are fat and happy
    - Large microbes on degraded reefs are more virulent
    - Microbes on degraded reefs carry prophage
- Overfished reefs result in positive feedback loop that increases space for algae
- Methods
    - 99 sites, 29 islands
    - Fish surveys using belt transects
    - Microbe samples taken from 1m above the reef
- One gram of microbes is roughly equal to 500g fish
- DOC on degraded reefs is a global phenomenon

<u>Questions for Forest Rowher</u>

1. (John Fauth) *Take your model and now add the inlets and the ocean outfalls we have here with the secondary treated wastewater with all of the human pathogens. What is the prediction there?*

→ (Forest Rohwer) *A lot of the early horizontal gene transfer (inaudible) there are people who know more about this. There are cases where either you have the human pathogen which I would call the pathogen is explicitly in the ocean or you have genes from that pathogen showing directly up on the reef system. They are identical. The only problem with that is you often see those genes all over the world. So you don't know for sure if their point source is here. You start adding DOC and nutrification step that the filter feeders are doing; you make the DOC stuff worse.*

There is also this weird thing that is happening, what we see is a chewing into of the horrible world, remember the DOC is semi-labile, we see things chew way down into the refractory DOC. The only other real place we know that happens where the river water hits the oceanic water. I think there is a chemical explanation but lots of people think it is a biological explanation. That is happening all over this place. It might not be food for something coming out of the runoff but it will be food.

2. (Margaret Miller) *So is the solution just more grazing? Is it really just the Diadema problem then in places like Florida where we have parrotfishes grazing on things because we still have a lot of turf?*

→ (Forest Rohwer) *The fish don't do you as much good as everybody would like. The fish aren't primary grazers. The Diadema gets you there; well it would hold it there. The turfs are the main problem, we actually know the physical reason why that is a problem going on. To graze down those turfs again you have to get back most of the food web. You need the top predators. You could probably go for the top predators if you protected those and not worry so much about what they are eating. The faster that turnover is the better off. Standing stock messes with the brain. Strongly believe that it is mostly keeping big macro organisms in the system.*

→ (Margaret Miller) *Here in Florida you get big turfs but you get sediment bound in that. Even when you have a lot of fish, you have sediments in there and it prevents them from being grazed. Would you agree with that?*

→ (Forest Rohwer) *Yes, that seems to be all over even in the Pacific. If you get a turf algae patch that grows and gets big they know how to graze it until it gets to a mat. That is why it looks so white. That is true with the macroalgae as well. They will hammer on those things without a problem.*

- Coral Health& Land-Based Sources of Pollution- Abby Renegar (NSU)

- Objectives:
    - Examine linkage between LBSP nutrient level and coral health
    - Utilize multiple complimentary metrics to examine sub-lethal impacts
    - Identify thresholds of response to chronic nitrate exposure
    - Ultimately: reduce impacts to coral reef communities by enabling and supporting management actions
- Research Approach
    - Identify target nutrient concentrations
    - Six-month dose-response experiment
        - Four coral species at 6 dosing levels over a 6 month period
    - Link coral response to nitrate exposure over time
- Coral Assessment
    - Physical effects
    - Growth rate
    - Photosynthetic efficiency

    - Histological assessment
- No significant differences in mortality between nitrate concentrations after six months
- High concentration of nitrate caused a reduction of photosynthetic efficiency
- In *S. siderea* there was a significant decrease in growth rate at higher concentrations

Questions for Abby Renegar

1. (Dana Wusinich- Mendez) *The higher concentrations that you used were from pulse events, correct? They were actually measured concentrations from?*

> → (Abby Renegar) *Yes, we looked at the mean for all of the data. That is a high, that is a pulse. So you are not wrong.*

2. (Judy Lang) *What time of year were you running these experiments?*

> → (Abby Renegar) *They are temperature controlled. The temperature was probably a bit higher when we started. We started in July and it ran through January.*

3. (Esther Peters) *The 0.3 micromolar, what sort of habitat out there would you find that?*

> → (Abby Renegar) *That is from the reef. The data for that came from Jack so he can verify this.*
>
> → (Jack Stamates) *It has been a few years but I think around the 2nd reef. I would have to get back about the specific locations.*

4. (John Fauth) *You have replication of this right? So you could count not just the mean of the EC50 but the error of it as well.*

> → (Abby Renegar) *Yes. It was variable. To get a good tight confidence interval; this is going to be a sigmoidal curve so you need to accurately define your top and your bottom but to do that you need to have a good fit. To really get the base, at the top of that (inaudible). What we are capturing here is the middle part of that curve. It is easier to do with the concentrations that cause mortality. You can ask these questions about the graded response but you are not really getting the outer edges.*
>
> → (John Fauth) *Those means are inside your data set. The most informative question I ask for myself "Are those confidence intervals that overlap the mean around 0?".*
>
> → (Abby Renegar) *Not for all of them, some of these fits are better than others. That is why I look at the average and can look at other species. If you take it lower than it is now that speaks to the N:P ratio where coastal environments are not phosphate limited. I think that is the case here. If the average nitrate is 0.3 and the average phosphate is 0.03 then the ratio is 10. Anyway that is an entirely different*

question, "At what concentration is that effect seen?". The PAM data is far more sensitive than you would expect.

- Coral Metagenomics & Microbial Source Tracking- Chris Sinigalliano (NOAA)

- What are the spatial and temporal trends in temperature, OA, and LBSP on US coral reefs?
- What are the ecosystem impacts of temperature, OA, and LBSP on US coral reefs?
- What are the genomics of corals and their holobiont communities under stress
- Taxonomic sequencing
- Preliminary Coral Genomic
    - In the tissue samples there were increased abundance in Bacillius
    - Significant population changes for what is in the pipe to what reaches the surface
    - Percent of bacterial/fungal community composition attribute to source communities determined by SourceTracker.
    - Detection and quantification of PMMoV and HPyV human source viruses are highest in southern outfalls.
    - When you move toward southern reefs you see more human makers in polyps and tissues. Anecdotally the southern reefs had higher impacts from mortality and legions.
- Evidence of coral tissue/coral mucus exposure to LBSP microbial contaminants was found by both qPCR microbial source tracking and by Source Tracker Sequence Analysis

<u>Questions for Chris Sinigalliano</u>

1. (John Fauth) *Flip back to the slide that shows source tracking. Is the outfall at the surface boil? So you are getting a wastewater signal as a significant source rather than one from that outfall so what does that suggest here?*

    → (Chris Sinigalliano) *One of the things that we have noticed is that generally it dilutes very rapidly away from the point source but it doesn't always do that. Sometimes you get that phenomena when they get constrained and tapped in freshwater packets or eddies. If you run a gradient through the outfall you can see a really rapid sharp decline to back our concentrations but every once in a while you will see these packet of really high concentrations that carry much higher contaminants much farther downfield than they normally do. Rather than spraying out of a hose you get globs and bubbles that are variable and periodic rather than a constant stream.*

    → (John Fauth) *I am more interested in the source tracking in identifying the wastewater treatment plant and how what goes into the pipe is different from what comes out of the pipe.*

    → (Chris Sinigalliano) *What goes into the outfall has already been treated.*

→ (John Fauth) *But it is identifying it as two different sources so it has to be separating it somehow.*

→ (Margaret Miller) *But you define it as separate sources don't you? That's the way this analysis is done. You designate potential source details.*

→ (John Fauth) *I understand that but I would expect. I'm just trying to figure out how that would happen.*

→ (Jack Stamates) *If I might interject here, when you measure the outfalls in many cases you can miss. When you put the side of the boat next to the boil you are not getting it. The odds of hitting it.*

→ (Chris Sinigaliano) *There are certain days that you are almost certain that you do miss it. If you look at the salinity and other data there are days that appear after the fact that the expression boil at the surface was probably missed.*

2. (Brain Walker) *When were the data collected? The tissue samples collected?*

→ (Chris Sinigalliano) *The tissue samples were collected quarterly from 2014 and 2015. All of this took place across 2014 and 2015.*

→ (Brain Walker) *So one of the things with all of my mapping projects is that generally the communities in the south are in better shape than the ones in the north. Your interpretation shows that the southern regions are more degraded because of this outfall situation. I hesitate to believe the outfall is responsible for the coral disease that was measured.*

→ (Chris Sinigalliano) *We are not implying that the outfalls were responsible for that at all. If you look at this again, the greatest influence by source is background oceanic source. What we are saying is that the microbiota in the south are experiencing a greater influence from the outfalls than are the reefs in the northern areas. We are not implying causality.*

3. (Jack Stamates) *I just want to reiterate what you said Chris; you need to weight the outfalls by their volume. The Miami Central Outfall by far puts out more than any other outfall combine. Emerald Reef is getting directly hit by the water from Port Miami and the boats.*

→ (Chris Sinigalliano) *In the Port of Miami we have seen detection of source markers. The wastewater is treated and presumably a majority of the things are dead. Even if it is dead you have to recognize that it is a very large contribution of genetic information. We were just talking about in some of the previous presentations about horizontal gene transfer and potential for virulence genes and antibiotic resistant genes. There is a large potential for a lot of undesirable genes being exported even if that's not viable cells. That is not to in any way lessen the impact of inlets. When we are looking at the microbiotic structure we are saying there appears to be a significant influence of outfalls to the reefs*

microbiotic structure but we know there is a fairly high output of pathogens and live deleterious genes from the inlets. Something else we do that is independent of this is we do a lot of looking at floodwaters, king tides, coastal urban flooding, and things like that. There are a lot of sources that are picking up non-source things and bringing them back out into the environment so outfalls and inlets are very significant factors in the loading of pathogens with fecal indicators to this environment. If you are going to take some kind of remediation approach it is going to have to be holistic; you are going to have to look at runoff, storm water, tidal flooding.

4. (Lew Gramer) *This is a total flyer but I happen to be looking at some papers on the Mississippi plumes reaching the Southeast Florida shelf. Your oceanic source, to what extent does that distinguish? Is it unlikely that you sampled anything from the Mississippi, viable or otherwise?*

   → (Chris Sinigalliano) *Probably unlikely with what we have done so far but we probably could not tease apart a Mississippi signal. One of the things to keep in mind is this is based on taxonomic sequencing and there are sequencing approaches that give you far higher resolution but they are more expensive. Now all of these are archived and could potential be re-analyzed with other technologies and as we move forward with other funding we are going to try and use more shotgun sequencing but with the sequence data we have in hand we could probably not determine if there is some short of Mississippi signal. There is such a large pollution factor that it is unlikely that we could source any of this to a specific source.*

   → (Lew Gramer) *Just to clarify, the paper suggests there are episodic pulses that can be detected from sources from Mississippi.*

   → (Chris Sinigalliano) *I think you will find that is true of a lot of river inputs is that it is highly variable. Over time it is very large loading but you have to take any one-grab sample with a lot of caution. From sample to sample it can be so variable.*

   → (Joe Lopez) *Is this metagenomic or is this 16S?*

   → (Chris Sinigalliano) *This is all 16S. These DNA's are all available and moving forward we are going to be doing more pulse shotgun sequencing. Right now with everything we have done we can only report 16S.*

5. (Piero Gardinali) *We detect, once in a while, salinity declines outside on the reef that you do not expect to happen. They are associated with entrainment of water masses. There is one right at the Tortugas; it is more or less permanent. We see more of these eddies moving around the Gulf Current in tropical waters. I don't know how much that influences your data.*

→ (Chris Sinigalliano) *It is likely these transport mechanisms are complex. Even on a small scale that happens. When you mix in eddies and other transport vectors that is why a lot of this exposure occurs in a very patchy nature. To know what the absolute frequency is you have to sample more frequently but clearly there are exposure routes to the reef.*

→ (Joe Lopez) *Yeah we are characterizing the microbiota of the water column for the Gulf of Mexico project. We have a loop current in the Gulf is highly complex. We are trying to link up with the oceanographic models.*

6. (James Byrne) *One thing I was thinking about, looking at the difference in the one that was different over time and you went and did the coral samples did you actually capture the overall condition of the reef at that time? The reefs' stress level? The southern reefs may have been more stressed so they are more susceptible to be influenced by it.*

   → (Chris Sinigalliano) *The sampling was done, again this was kind of a low budget project, we were piggy backing this on other cruises and there were two aspects to that. Bimonthly they were sampling the water column and quarterly with the benthic coral surveys to collect the physical coral tissue for us. The primary goal of that diving was to report the coral benthic surveys that are required and I believe that has already been published in a technical report, right Jack? So those larger details of the coral disease state are already available.*

   → (James Byrne) *I just think it might be interesting to see if there is a correlation. It might explain the southern reefs. I'm thinking from a management standpoint there are a lot of implications there that we can look at from nutrient control at different times when reefs are more susceptible to being influenced.*

   → (Chris Sinigalliano) *So all of these samples have benthic data available and associated nutrient data. At least for the water column a whole suite of nutrients were analyzed. That is available in that report that was given to the DEP.*

Session #2: SE FL Inlet WQ Connection to Corals & Reef Ecosystems- David Cox (FDEP CRCP)

- Goal: Obtain info on how best to show detrimental impact of inlet waters on coral reef habitat
  - Best metrics
  - Minimum effort needed to show a connection
- What methods/tests could be used to achieve the goal?
  - Tissue sampling
  - Microbial communities
  - Turbidity
  - Nutrients
  - Etc.

1. (Dave Gilliam) *Wait so what are we doing? You have this big broad question, "Inlet water is bad and how can we show it?".*

→ (David Cox) *How to link inlet waters to the reef biota. There may be direct impact, say we look at a microbial community that is perhaps linked to viruses or if you want to go with a more direct impact you measure something that is increasing macroalgal cover. Some kind of linkage of water quality in inlets to detrimental impact on the reef. It is a broad question so we want to get some details of very specific ways to find that signal. Much like with the outfalls, what do we sample for to find that signal around the outfalls?*

→ (Erin McDevitt) *From a management perspective what question are you trying to answer? Why are you trying to prove that and then maybe we could design a question.*

→ (DavidCox) *It is basically looking at what is in inlet waters that is harming the reefs. There may be nothing but that is the question, can we come up with something that is in the waters.*

→ (Don Berhinger) *So what is the end goal? Say we pick a sponge and it does not exist near the inlets. How is that going to be used? Does it limit or put some kind regulation on?*

→ (David Cox) *That would be to be determined. Part of the stipulation of us doing this project was to have a biological link, a component. Water quality sampling with a purpose. Showing that that water does have a detrimental impact.*

→ (Joana Walczak) *So here is how this went down. We went to the Deputy Secretary and said we need funding for the regional offshore water quality monitoring program that we are kicking off with NOAA. He said "Wow, that's great but what information does that give us as a regulatory agency to do anything." We said, "Well it is going to tell us what the offshore conditions are on the reefs and the episodic conditions around the inlet and outfalls." He said, "What does that mean for the reefs?" He directed us to instead choose a point source and make a connection first before asking a bigger boarder suite of information. I argued that we need both but presumably the number one reason for reef degradation is water quality. It ultimately goes to the management question that our stakeholders believe that the number one reason for reef degradation is water quality and can we in any way address that because we don't have a way in addressing that right now.*

→ (Dana Wusinich- Mendez) *One of the big problems and I think it was a challenge in the outfall discussion yesterday as well was its not that's simply because there is too much stuff going on out there to be able to link it to and have this clear case of A, B, and C are coming out the inlet and we are observing impacts on the organisms and it is because of A, B, and C. Abby's presentation that she just gave us showed a scenario where if you remove the environmental noise of the*

fieldwork and you bring it into the laboratory and look specifically at one thing you know is contributing to the natural environment in the laboratory you can say what are the impacts happening to the organism. You can say we know we are measuring this coming out of the inlet at these levels and we are measuring offshore at these levels and here is the effect it has on the organisms we care about. Could there be some type of laboratory component here where yes we are doing the water quality monitoring program and we collecting the samples in the field but we are looking for things and trying to replicate those conditions in the laboratory setting and look at those impacts on selected species? Could we think of this as an extension to Abby's work?

→ (John Fauth) *Can I interject here? We don't even have to think about this. It is already been developed it is called TIE/TRE (toxicity identification/ reduction evaluation). It is exactly what Abby has done and people do. You can piggyback it off your water quality monitoring and you can test it for toxicity. Then you can identify what the components are and what levels cause an effect. There are different assays or treatments that could be done. You can do an assay where you bring artificial saltwater back up to the proper salinity and test the toxicity. If you do the problem you know is just freshwater. This has been developed for decades. It is easy, it is a little bit time intensive, you have to do the diving and then choose an organism and one of the easy ones to do is a sea urchin fertilization assay. Sea urchins are readily available and very sensitive and you could go beyond fertilization and look at development. The point is, I wish Abby were here and I'm glad she just spoke, you have to do this in the lab. If you want to identify cause and effect you have to do it in the lab. That's the big R word, you have to start doing research.*

2. (David Cox) *Before we continue on I would like to ask the coral program managers if they think that fits in the framework of the proposal we have already yielded?*

→ (Joana Walczak) *We are not afraid of research. Don't worry. It has to be the targeted research that gives us a management action. I like this path.*

→ (John Fauth) *This is really straightforward. Environmental companies do this as a service.*

→ (Brain Walker) *I understand the gist of what you are saying and look for an effect on the reef and looking for a response to some condition but what if you aren't measuring those conditions? What if your levels aren't high enough to elicit an LC50 or whatever? Maybe it is something much more benign and harder to read. I think part of this isn't just running experiments on how much organisms can handle but it has to be linked to actual values it is experiencing. What if it shows nothing?*

→ (John Fauth) *Oh it will show stuff. We have some toxicity that we saw in the sea urchins.*

→ (Brain Walker) *That is what we are trying to get out of you guys. Not start from scratch but to find what we know about, all the experiments that Abby has run plus all the research she has done that goes behind that and the knowledge behind that to help inform this process instead of starting from scratch.*

→ (John Fauth) *I think it's a simple way to go. We have done the projects independently but we don't have the pieces put together to make those strong inferences that we want. If folks are going to be going out and collecting water samples we have to use the samples for this process and now you have the two things tied together. Then you can start to go back to ok you have these conditions on the reef and this is the sort of analysis you will start to see.*

→ (Joe Lopez) *That is what we are missing yesterday. The more meta data you have attached to the communities there it is a lot more informative. It is about the coordination.*

3. (Kurtis Gregg) *Is there a better test than sea urchins? I could see going to a higher up and them saying why sea urchins?*

→ (Margaret Miller) *I think there are exposure tests to corals that would be appropriate in concert.*

→ (John Fauth) *You could do coral planula.*

→ (Esther Peters) *In the biomarker study you did it on coral.*

→ (John Fauth) *We sampled coral but the assays were done on sea urchins because they are sensitive and can be fertilized throughout the year.*

→ (Dana Wusinich- Mendez) *I agree with Kurtis. Going back to originally what was called for in this project and hearing what Joana provided with the request from leadership I think we have to look at directly to the corals.*

→ (Forest Rohwer) *I would argue strongly against that. (inaudible)*

→ (Dana Wusinich- Mendez) *That is the purpose of taking the water samples and then basing the laboratory conditions on the really observed levels of whatever toxin or pollutant you want to look at from the actual water sample of what is really happening.*

4. (Piero Gardinali) *The problem with that is when you sample water you get a snapshot. When you sample tissue you are having the community effect with whatever has been happening since that tissue was developed. If you were thinking what causes an event maybe its no. Or the other way around, you need significant amount of samples to make that link, you cannot do it with one sample of tissue and one sample of water. That doesn't make any sense. I can tell you that I have sampled water for many years and working*

together with people like the coral program, when you compare what you have in tissue and in the water in many instances it does not match. It is not just one event.

→ (Forest Rohwer) *Boundary water makes a lot of difference. If you get below the boundary layer you get a different signal. If you keep sampling in the water column it is almost impossible to really test things. We probably have the biggest data set in the world for the differences we see between these two things. The boundary layers are pretty stable for long periods of time and they reflect what they conditions of the greater oceanography.*

→ (John Fauth) *Or port water?*

5. (Brain Walker) *So, ideally you would have some metric that you could sample tissue for or coral skeleton or something. You would already know the effect of that on the organism and you tie that to a source say inlet or outfall. That is what they want, I think. This stuff is coming out of the inlet, building up in the tissue and is having this effect and that effect is negative. So is there anything like that? Do we know of anything like that? All of the things we have discussed yesterday and today seem kind of related and the biomarker stuff. Is there something there where you can go out and learn from something you have done to inform this as well?*

→ (John Fauth) *The problem is without an experiment you still have no correlation. You have to move the corals around. You get the corals and lay them out in a transect and you have a bunch of clones that are split up and then you put them by an inlet and you can measure whatever you want. They all started at one set area so any change is attributable to that area.*

→ (Dave Gilliam) *We could do that. We have a number of same genotypes growing.*

→ (Kurtis Gregg) *From looking at the cervicornis at the inlet and saying why they are dying, that would be a great finding. That would be an effect you could take to the decision makers in Tallahassee and say this is what we did and this is what happened.*

→ (Dick Dodge) *Is there a gradient that you could show?*

→ (Dana Wusinich- Mendez) But how do you isolate to just look at the impacts of the inlet.

→ (Dick Dodge) *I guess the case is that if you don't see a gradient in abundance of happy corals north or south of the inlet than maybe there is no problem from the inlet but if you see a gradient of smaller corals, sicker corals.*

→ (Brain Walker) *Maybe it is not visible. Maybe it is histology or growth rate.*

→ (Don Berhinger) *If we are not talking about money at all maybe you want to do all of those things. In those gradients you wouldn't necessarily know there is any genetic component or resistance in some of those thickets but if you use the corals you have of a known genotype and they are all otherwise the same, that helps you out with that. In the laboratory experiments you can look at the components and see if there are direct impacts. There maybe be something that is not a direct impact but maybe it is encouraging algal growth and it is driving that vicious circle and that's why the corals are dying, you don't know. Potentially doing all of those things is the sky is the limit.*

→ (James Byrne) *Right now we are just focused on corals and we have heard about other components that affect this system and we have heard about them constantly. Maybe there are bigger impacts on other components. It is the increase in algae growth, going beyond the turf algae that the herbivores we have can keep up with and it is turning into macroalgae and sedimentation hits it so it is not being grazed. Or is it affecting fish populations and the fecundity of fish and that is a bigger impact on the whole system than what we see in the coral. Step off the bottom for a little bit and corals are par of a bigger system. We keep saying things we want to manage but it is bigger than that. We keep showing things we want to show impact and we go straight back down to the bottom.*

→ (Dana Wusinich- Mendez) *But money is an issue and we can't look at the entire system right now.*

6. (Brain Walker) *We are trying to bring the expert knowledge together to get ahead of the curve in terms of starting from scratch. We have been looking at outfall impacts to the reefs or trying to. We have been looking at inlet water and where it is going and trying to make those links.*

→ (Ken Banks) *But they are all correlations. We don't have a cause and effect.*

→ (Brain Walker) *Right, we don't have an effect but maybe use a tracer to show that the inlet water is getting somewhere and maybe use experimental data, perhaps it has already been done, to show different levels of other things that cause an effect. It doesn't have to be a direct effect but it has to be a direct link to the water source.*

→ (Dana Wusinich- Mendez) *They want to be able to take management actions with the results, right?*

→ (Brain Walker) *That is the intent. If you said surcalose is only coming out of the outfall and we find surcalose here, here, and here and we measured the nitrogen and phosphate coming out as well and they have a direct effect on the reef organisms, you could build that case right. You should limit nitrogen and phosphorus coming out, I think.*

→ (Kurtis Gregg) *That is what we are trying to make, the foundation. Right now all we have is a pile of bricks, nothing put together that shows a link that is coming out of the outfalls and is having an effect on the coral reef ecosystems. James is right that we might need to consider octocorals and sponges or the turf algae and macroalgae.*

→ (Brain Walker) *Any reef organism should be open but there could be work that has been done throughout the Caribbean and all the lab work that has been done to date that you could reference without having to go out and do it right here.*

→ (Kurtis Gregg) *That gives us a direct link that is understood to be under pressure at all levels.*

→ (Judy Lang) *I think they need something concrete. We need something as sensitive as John's sea urchins or Dave's corals.*

7. (Brain Walker) *What do you measure? Do you just measure their survival, amount of tissue mortality?*

→ (Abby Renegar) *I think it would be easy to do effluent type Port water (inaudible).*

8. (Kurtis Gregg) *I have a question for Josh. The coral stress genetic response work that you have been doing, is that something that could be translatable to other areas?*

→ (Josh Voss) *Completely. In a nutshell when we did the two-factor experiment looking at effects of temp on gene expression trumped the effects of discharged water type expression on Montastraea cavernosa. The one limitation you are going to have is there is no annotated transcriptome for Acropora cervicornis. There is a building database of that but it is not there yet. You could reference to M. cav and I think there would be some overlap that you would see in both of those species. Gene expression could be one response you could look at. Microbial community is another response. The key is to look at a combination of lethal and sub-lethal responses.*

9. (Margaret Miller) *Josh, do you feel like there is enough to be able to distinguish what is beneficial transcriptome changes. You can show a response of a differently expressed gene. The differentially expressed genes are enabling the coral to deal with it or indicative that the coral is under severe stress. Do we have enough tools to distinguish those scenarios?*

→ (Josh Voss) *The key is to make sure you have reference samples at the beginning of the experiment before you put the corals into the experiment and then before you ramp up the experiment before the experimental conditions.*

→ (James Byrne) *Andy Baker is doing something similar to that. He is actually looking at temperature exposure to gene expression. He is doing that with corals from Florida and most of the Caribbean.*

10. (Dana Wusinich- Mendez) *You said water type but what do you mean by water type?*

→ (Josh Voss) *So we did just a simple two level two-factor design where we had ambient temperature at 28C and elevated temperature at 32C and the second factor was offshore water or discharge water from St. Lucie Inlet. So we had two factors combine. We looked at both the combined and individual effects. Temperature was a stronger predictor of the expression that water type as well as changes in the zooxanthellae density and chlorophyll concentration. We did not look at microbes.*

11. (Jack Stamates) *I just want to take an opportunity to throw another major wrench in the works. Inlets are just simply a structure by which the water flows out. The inlets are very different and have to be taken uniquely.*

→ (Brain Walker) *I think this group wanted to focus on one or two. Not necessarily all of the inlets.*

→ (James Byrne) *I kind of like the idea of what Josh did but adding in what John was suggesting. Taking it from a management point we could start regulating it from when we have elevated temperatures, is it a bigger stress than normal? And we could look at some very strategic kind of management actions instead of trying to clean up all the discharge that is coming out. If you do it on a temporal basis it is not a signal bullet.*

→ (Jack Stamates) *Highest temperatures are in rainy season when inlets are biggest.*

→ (Josh Voss) *There is an issue with power. I think the temperature threshold is something that will be different with species. The other consideration with that is the timing of discharge and looking at tidal cycling. In St. Lucie Inlet the tide isn't as much of a constraint to the environmental conditions as much as the volume of discharge.*

→ (Brain Walker) *I guess one of the arguments might be is that goes out is that the water is diluted. Have you heard any sort of argument? You are sampling from inside, right?*

→ (Josh Voss) *We sample water inside and then dilute it with offshore waters to the salinities we have observed.*

→ (Brain Walker) *In your experiment is salinity the main contributor to that response?*

→ (Josh Voss) *I think that until you add a third treatment you would not be able to tell. We could not achieve that third treatment factor with the number of corals we had.*

12. (Lew Gramer) *Did you see robust evidence of a potential effect from inlet waters versus offshore and temperature?*

→ (Josh Voss) *Within the coral zooxanthellae data, no. But we have not analyzed all the gene expression data.*

13. (Joana Walczak) *Let me throw out another idea that I heard floating. DOC contributions for the inlets are showing increased coastal acidification is actually really detrimental to the structure offshore. Is that anyone knows enough about the work to talk about it? Surpassing hundred year models that DOC is exiting the inlets, which presumably is degrading the offshore reef structurally. We might have to follow up and get some more information on that.*

→ (Margaret Miller) *It is a good idea but how would you get that measured?*

→ (Dana Wusinich- Mendez) *What is the management response to decreasing the DOC? Something with a clear management response that needs to be done, to reduce a stressor.*

→ (Erin McDevitt) *Just from the management perspective, you are trying to find an effect. Link something to the coral disease. We need to know what is causing the coral disease.*

14. (David Cox) *Does that mean we focus on the microbial work?*

→ (Forest Rowher) *Go into a system, get transcriptomes and metagenomes with the metablomes and you can pick apart what happened. You have a strong power. It won't let you go immediately to management because you don't know what you are looking at. Everything is so conserved that you could pick it apart. You could do it on a reef. The chemistry is more satisfying to most people because it is more direct.*

→ (Dave Gilliam) *Could that type of sampling and analysis be tied back to stress on the reef?*

→ (Forest Rowher) *Yes, whenever you stress the system there are directions that they go. The cost now is so cheap. It is probably $10 per sample.*

→ (Arthur Mariano) *Isn't there coral disease in other parts of the world where there are no water quality issues? There are cheaper technologies to learn more about physics. We need to learn more about the physics of the water.*

→ (Brain Walker) *We would want to know about the residence time of the water that is here.*

→ (Arthur Mariano) *There is very little velocity of water in the reef system. Just put some drifters in the bay and get the trajectories. Measure temperature and velocity of things that matter.*

→ (Brain Walker) *I think it is relevant because it is not just things flowing out of inlets. You need stratified sampling design.*

→ (Jack Samates) *Low cost current measurements are available. I just want to add on with the physical thing, it depends what day you are looking at it. It flips within hours, it is highly variable.*

→ (Arthur Maiano) *These eddies come through.*

→ (Forest Rohwer) *It is almost impossible to tell you the biology at the bottom with the currents at the top.*

15. (Joana Walczak) *At lunch a group of us were talking and essentially, we already have an identified an area of concern so that narrows it down to the inlet.*

→ (Dana Wusinich- Mendez) *The group of us just couldn't stop talking after all the great ideas were put up on the screen. We can talk about not having limits to our resources but given that we have really important questions to answer but given that we do. We need to know where we might go with this. One of the different angles we were talking about was where does it make sense to focus this? I think John you made the point perfectly where we could all do these things in the same place we would have really valuable important information that is actionable. Judy you had some good insights there.*

→ (Judy Lang) *We know what increased levels of nitrogen have on 4 species of coral from Abby's talk earlier and the output of the research is extremely actionable.*

→ (Dana Wusinich- Mendez) *Joana talked about what makes sense opportunistically. Now Kurtis can kick in.*

→ (Kurtis Gregg) *Earlier this summer we received funding from the NOAA Coral Reef Conservation Program to move forward with the watershed management plan for the Boyton Inlet contributing area. Most of the folks on the TAC probably remember we did the inlet contributing area work for contactors. We brought NOAA's coral center watershed management plan to south Florida and did the delineation that highlighted what water quality data needs to be used in a watershed management plan that meets the EPA's 9 elements. The benefit of having a watershed management plan is that it is a requirement to access funding for the state and EPA. We had a kick-off meeting last spring and made connections*

with those people at a municipal level in the city of Boynton Beach and the city of Lake Worth. In that watershed there are two canals that empty to the southern end of Lake Worth lagoon after it goes out. When you see black water out of a lagoon it is Boynton Inlet. Some of the work the planning group did was highlight where the septic tanks are. We have got a lot of the foundational information to what the. Let me back that up. If we spend hundreds of millions of dollars to build an infrastructure what is the link to the ecosystem? Some of the recent work may be able to provide that link to what is going on landside and how it would affect the ecosystem. We have a priority watershed and we have work going on already and it wouldn't be a bad time to plug into that.

→ (Dave Gilliam) *So plug this into the Boynton Inlet?*

→ (Don Berhinger) *Is Boynton Inlet then as what you described there is less potential variability in oceanographic variability based on the way Boynton Inlet is structured? So some of the things we talked about doing would be less subject to that variability? Is there evidence for that?*

→ (Kurtis Gregg) *The flow is high and pretty dynamic but I don't think it is stratified like you see in Port Everglades.*

→ (Don Berhinger) *So you are hedging bets a little bit there.*

→ (Kurtis Gregg) *You have reefs a half mile from the inlet.*

→ (Dave Gilliam) *You have the outer reef, which is dominated by significant north flow. And then turn around and try to tie this into it. It adds another challenge. Personally I just don't get it.*

→ (Joana Walczak) *But in terms of management it gives us a better opportunity to show success in certain aspects. I'm not necessarily saying tying it into organisms offshore on the outer reef but success in steps that we could replicate later. In terms of choosing Boynton Inlet we know we are spreading ourselves too thin by looking at all of the inlets, it is too complicated. This is a location that all of the stakeholders at this group chose to provide us incremental steps for success that we can tie directly back to management decisions.*

→ (Don Berhinger) *If one of the elements we discussed was the idea of putting out these corals as sentinels.*

→ (Dave Gilliam) *Not there. There is no cervicornis there. I would not outplant A. cerv off of Boynton, it is too deep and they are not there, they are not there for a reason. If we did Bonyton, which is completely fine, you have to think about something different. You would have to outplant M.cav which you could certainly do, we would have to do some genotyping first. All of it is doable but it changes because it is too deep.*

→ (Joana Walczak) *The ultimate endpoint of our discussion was we need to stop thinking like scientists and think like managers. Define the issue and reverse engineer a study that will give us an answer to that issue. I know that is tough to ask of you guys but it is ultimately the only way to make an actual change. If we can define what it is. And I as a manger will do my part to figure out what it is that. I think that is where we need to go.*

→ (Dick Dodge) *Is there a gradient of decreasing coral abundance or coral size north and south of the inlet?*

→ (Brain Walker) *That area is close to where the whole system kind of turns temperate. From a tropical system to a temperate system.*

→ (James Byrne) *What is the time frame of this?*

→ (Joana Walczak) *We get our funding, we get limited funding starting July 1st of next year and we have 2 years of funding that we can out towards this.*

Session #3: SEFCRI Local Action Strategy Review- Lauren Waters (FDEP CRCP)

- Looking back at local recommendations there were 14 in April and 1 new strategy
- August SEFCRI team gave feedback
- Identify precursory steps to determine if that is need for these recommended actions

Report Out

→ (Lauren Waters) *For my group, we did make it through all of them. For the first one, the review of the turbidity standard there was suggestion that you might need a study to suggest on the deleterious effects it has on the corals before you talk about revamping that rule. In general, the group was talking about not revamping the turbidity rule but that the state should start looking at a sedimentation rule and a water clarity rule rather than turbidity because turbidity is just a proxy for those two things. Genetic evidence of wastewater pollutants said this could be a small study like the ones we have been talking about for the past couple of days. There was also a question as to whether the prokaryotic community was the most important one to be looking at. Profiles of inlet waters we have that they already exist at several inlets. Assessment of toxicity is not a stand-alone project, it is a literature review and the group was confused by this project. Pier monitoring, as long as you knew what data you wanted to collect and what the monitoring station was out there for you do not need a precursory research project. For the lobster trap project, a precursory would be to have a better understand of where all the lobster traps are before you go out and see what they damage they did is. Mitigation, in general that is a review but add the current mitigation success material the state has for this and the information needed in order to change that. Regarding that last project, about protected species demographics the data gap would be that right now while we know where*

are Acropora species are there is no information on other species and where those colonies are in order to move on with monitoring them.

→ (Brian Walker) *Number one, the turbidity standard stuff there was good reference that Dick Dodge pointed out and it would be a good starting point for this and they just wanted to point out that this study should be conducting a toxicology study for the turbidity as part of the evaluation. For the wastewater associated with microbial communities, just one comment to include collection for archived samples. If you are going to go out there and collect these samples, archive some for future use because other funding might come along. The profiles of inlet water two comment hers, one was to include a turbidity measurement and sediment samples along with this project. Another comment was to make sure it was a systematic sampling design. No comments on most of the other ones. Let's see, number seven none. The protected species they said if you are going to go out and assess these corals you should collect tissue or mucus samples and preserve them for future studies as well.*

→ (Chris Sinigalliano) *I think that was piggybacking field programs of opportunity. If you have an ongoing program with a little extra effort you could collect samples and use them for future work.*

→ (Margaret Miller) *We talked for bit about the turbidity standard one emphasizing that what we are try to understand in terms of reefs is light attenuation one the one hand and sedimentation on the other. We need to recognize that turbidity is about the water quality standard. To the extent that NTU's are used they need to be calibrated for specific sediments because there isn't a one to one type of relationship. It needs to be done for each type of sediment. Wastewater associated pollutant stress is relatively straight forward assays, the linkage to reefs and management implications are sort of an additional step that still needs to be taken on them. The inlet water project we were speculating if it was the water chemistry that was being added on and looking at the relationship of the communities with the water chemistry. The coral toxicity studies our group thought were important and really useful at this point. I think there is some literature about these substances and what substances may be worth targeting and look up the water quality data that is available and look up what substances are in the local water. The type of experiments Abby described this morning on thresholds could be very useful to the extent that ESA species could be called out is in the Acropora recovery act as well. The pier project Jack was going to describe because it is underway.*

→ (Jack Stamates) *We are developing a prototype system at AOML now. The original concept was to put stuff on a pier but we realized a pier was kind of shallow water so we are looking at a data transmission system where we can put stuff on the bottom at the reef and get that data back to the pier in the most cost effective way.*

→ (Margaret Miller) *The lobster trap project there was talk about using aerial surveys or drones to document what the distribution of traps is, which would be*

the first piece of that project. We didn't have much time to talk about the mitigation strategies but Dana thought she had the task force was doing something like this. We had some discussion on the protected species monitoring. It is important to do this but it is also important to have other types of monitoring data that needs to go with that as well.

Session #4: Our Florida Reefs Recommendation Review- Lauren Waters (FDEP CRCP)

Report Out

→ (Lauren Waters) *The first one that my group tackled was N146. They identified that there seems to be throughout the process there seemed to be a disagreement between the connection of fisheries health and ecosystem health. From some of the presentations you saw this morning, that that kind of information and dialogue needs to be had with the folks in southeast Florida. They also identified that you need to show if large fish are absent what does that mean for reef condition? It might to be a primary research type project, the data might exist but it needs to be analyzed. Also a need to link human health to reef condition and if the folks landward understood how their human health would might be impacted they would understand how that link might be useful. S104 said see notes and discussion from earlier today regarding session 3. N70 the group said these types of restoration project are pretty expensive so if your purpose was to maximize the connectivity to reefs then you need to do a study on here you want to prioritize these habitats and where they occur. Comment about which type of mitigation was most cost effective. The data might already exist so we have to bring the right people in to discuss and prioritize. N68 discussion that some exist like best practices for homeowners and best practices for golf courses and a lot could be implemented without a lot of additional research. You would still need to formulate and evaluate those existing to know which ones you want to target. Research need to understand what are the current loads of nutrients. Reducing nutrient loads could be tacked onto the inlet work we talked about earlier. N38 it was identified that this is a portion of what the Boynton Inlet Watershed Management Plan is doing however if you are talking about SEFCRI wide then you need to identify where those hotspots are. That is how far our group got. Thank you guys.*

→ (James Byrne) *So we went through all of them. We had a common theme throughout all of them, channeling Nike "Just Do It." With N68 we need research to tell us what the thresholds should be but go ahead and do it while you are working on that. For N97 we said see Kurtis because the inlet project would be the pilot for doing that and then from there looking at the whole region. Mooring buoys, another one, go put them out. Fund it and get them out there. It would be important for where to put them but the working groups did that already with the marine planner. National marine sanctuary going through the nomination process there was no research needed to nominate it. The main thing there is stakeholder support is critical for it to go through. Enforcement officers the link could be needed and efficiency of officers, how many are actually needed. It is important to*

get them out there and recruit officers that are conservation minded may help with retention. The rest we said just do it. N146 basically just do it and use existing science on the design of MPA systems and use existing data to go do it. The one thing we highlighted up front there was spawning aggregations are well identified. 104 lots of research useful right now coming out of Australia with projects that are impacting the coral reefs.

→ (Brian Walker) *Very little comments regarding the law enforcement stuff. N25 for the educational component is are there education resources in place? S65 the sanctuary nomination our comment was how supportive are the local communities and state on that effort or it's not going to go very far unless you gain that support. S2 we had some questions about the cost effectiveness about why change the current set up and take on that cost. N97 is the one Kurtis has started and one comment is need to define the performance measures because it seems vague in the wording. N68 we had one comment, which was to include a performance measure on the educational component on why choose one fertilizer over another. S104 see previous work.*

→ (David Cox) *The group focused on stakeholder input and public support, looking at the socioeconomic studies going on and the need for people to understand the spatial areas selected. The group focused on the need to provide the public with knowledge.*

Public Comment

Stephanie Clark & John Fauth

Adjourn