

**Ecological Functions of Nearshore Hardbottom in Southeastern Florida: Field Study
Technical Advisory Committee Meeting Notes
30 October 2012**

Participants

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Summary

CM: Brief history, overview of project to date. Year 1 TAC Meeting to review the nearshore HB study. PowerPoint presentation.

DS: Overview of the field study and literature synthesis, condensed PowerPoint presentation previously presented at October BMA meeting in Palm Beach. Summary of epibiota – PowerPoint presentation. Overview of flora/fauna using NHB.

VK: what is the percent cover of abiotic substrate? What does it mean?

DS: portion of the quadrat composed of sand, rock, sand over rock, those sort of things. Will show a picture that might help.

CM: Substrate categories.

VK: do you have biotic substrate too?

DS: Yes. Sediment over HB most prevalent category that comes up. Sediment over HB where algae protruding through a sand veneer.

VK: Is this category of abiotic substrate, are they making up 100%?

DS: Yes.

VK: OK, fine.

DS: Has biota in it, but called it abiotic substrate. Artificial reef, boulders have a lot of sand and also a lot of turf impacted by sand, but a lot of bare because buried and scoured pretty clean over several cycles.

RT: Diatom films and basal holdfasts that to naked eye might look barren but might be covered. Were they scraped with razor blades or something?

VK: Bare limestone not covered by sediment.

MS: Could be diatoms, bacteria, etc.

DS: No question, there could be a film covering this stuff, and have noticed that depending on the duration of the burial, the sand could be buried the boulders one week and uncovered the next. Hydroids, sponges and other things that did just fine as long as sand wasn't too hard-packed and water movement.

JK: Clarify terminology in report.

DS: This is how it comes right off the data sheets, will revise, this is preliminary. Summary of major taxonomic groups (presentation)

VK: Category Cnidaria should be renamed because corals are cnidarians, as well as hydroids. Rename the category.

DS: Dan and I were discussing that. Again, this is how they come off the data sheets. Will revise these categories before it gets posted to the public. Corals are mostly hydrozoans, and should have been changed in the data analysis, not many stony corals within the study areas. Some *Oculina* on Ocean Ridge, but none within quadrats, and lots of *Millepora* on Singer Island reef, also not within quadrats. No patterns jump out regarding algal cover. Survey 1 – *Dictyota* in deeper water during that survey, similar to sites surveying now, algae comes and goes. Expectation that less algae in deeper water than what we saw. Dan will talk about kinds of algae across depth strata. Diversity of algae higher on natural HB (~10 spp), number of little guys can't distinguish in situ analysis, brown alga *Dictyota* was prevalent in number of samples and dominant on natural HB. Comes and goes, but can be very lush. Reds in kind of clumps on the artificial reefs, green algae very low in cover. Sponges – survey 1 had lots more sponges because looking at older reefs. Generally, not much difference between the two types, no trends discernable.

RT: Older reefs deeper?

DS: One at Phipps called Stratum 1, another at Boca borderline far enough south had corals and sponges. Can certainly add age as a factor in final analyses. Age may have a lot to do with it. We had whole suite of strata, just not paired, deep one off Phipps built 5-6 years ago. Can talk about later – use info from survey 1 with the other sites. No stony corals on artificial reefs, *Siderastrea* on natural HB. Area with *Dictyota* get scoured down and then *Siderastrea*, seems to withstand scouring. Octocorals had depth-related pattern re: numbers, none within shallow stratum.

MS: Assumption no transplantation at any of these sites?

DS: No transplantation at any sites.

DM: Dave and crew collected WR and algae samples for us and we analyzed at Jacksonville University. Summary of smaller biota associated with WR. No surprise found high number of crustaceans, number of crab families, snapping shrimp. Roughly 45 species encountered, mostly invertebrates, some vertebrates. Data currently in process, this is preliminary analysis and will reconcile terminology across presentations (Strata versus Depth). Decapods pretty well represented. Intertidal area number of mollusks surprising because a high number encountered in shallow depths, surprised at abundance because not as highly studied as decapod association. Peanut worms also a surprise because widespread throughout samples and range of sizes, potential food source for inverts and fish, sent samples to Smithsonian for further analysis, may be 2 species. Recruits of echinoids, number of brittle stars impressive. Student looking at them, possibly 8-10 species and possibly a few more. Working on that to get as many specific IDs as possible. General trends for Depth 3 mollusks prevalent, natural Depth 3 high number of decapods. Generally lower abundances at deeper depths. Artificial substratum lot of same groups; decapods well-represented and generally lower abundances in deeper strata, but roughly same proportions of organisms. First sampling 2009, started to work on 2012, but still have good way to go on that. Sipunculids very abundant in Depth 1 (natural). Higher numbers of individuals in ARs. Side items interesting re: population ecology of WR. Collected worm mounds, pull out individual *Phragmatopoma* and measure sizes, resulting in size distribution over depths. Nothing 1 and 4, mounds collected were vacant of worms. Preliminary analysis, shallower depths had somewhat smaller individuals. Artificial substrates, larger individuals shallower. Independent study comparing intertidal populations along east coast, percent coverage of intertidal habitats and looked at WR, limestone, sand, algae, starlet coral, clionid sponges. Satellite Beach northernmost site, Bathtub Beach, Coral Cove, Shark near WPB inlet. High % limestone and sand. Significantly more WR in middle counties of east coast. Latitudinal difference, maybe slightly more to the north. Sizes similar across all locations. Fecundity higher to the north than to the south sites. Egg sizes similar across locations. Photographs to make estimates of individuals in given reef area, under analysis right now to compare populations at molecular level. Will provide more info in the future.

VK: Interesting data, but our main question that if looking at fecundity, do you have a gradient across depth? Do you have cover in nearshore vs. offshore? Different size of the worms across strata? Very main question is cross-shore versus longshore.

DM: Published paper of study at Boynton, found populations at 12' depth range more fecund than those in intertidal zone. Some of that info available and would like to do larger project.

VK: Question how fauna changing? Different populations within the WR at different strata? Something specific about WR in nearshore vs offshore.

DM: Trying to approach that as much as possible. Students looking at and can also look at crab species across gradients.

VK: Very important to look at the difference in the relief, because I believe that relief plays one of the key roles. Compare high relief in nearshore vs low relief in offshore would be helpful.

MS: Very surprising that fecundity in nearshore less than offshore, because stressors require that reproduction must be more rapid to make up for that.

DM: Found sig correlation with wave activity, periods of high wave activity, worms in nearshore lower fecundity. Frequency of spawning rather than food intake.

RT: sample size bigger than 1?

DM: Shooting for 10 replicates, but lost some samples. Boynton Beach not comparable because only had one worm. All the others based on 5.

DS: SR is actually one of our study sites (PB 1, Singer Island natural reference Stratum 1) that Dave samples at.

TJS: Couldn't find comparable AR in shallow water, should note because of constructability issues. Most modules deployed from barges by crane and may not be able to get into 1m water depths, so have limitation.

RT: Whole other conversation because they can build jetties from shore/shallow water.

TJS: If wanted to build ARs like that could do it, but not sure people would agree. ARs are deployed from barges with cranes. It needs to be noted in the report as a limitation when saying don't have an intertidal sample for comparison.

CM: Noted and we'll continue later.

MS: Not just constructability, also liability because don't want people swimming and diving while construction. Also concerns about ARs getting buried by sand. These are also considerations.

DM: Note taken, any final version will need to be specific and clear on these things. See today's meeting from data standpoint to show you where we're at and what we're finding, and certainly we have a long way to go. Looking at macroalgae samples and organisms found within. In some cases, no data collected, other cases still processing data. Have total of about 30 perceived species encountered in this part of the study in 2009. Means vary between 4 and <10. Tried to break down into functional groups. Dictyota falls under sheet category and one of the more abundant species found in intertidal samples. Also branched species common which can include Caulerpa spp. By and large seeing turf algae classification, so trying to identify some of the larger species and perceive trends. Only comparison between natural/AR is the deepest depths (2009). Looked at average numbers of inverts, pretty broad groups, natural areas amphipods, decapods, isopods, polychaetes. Highest abundances in Depth 2 and slight decrease Depth 4. Preliminary data and analysis. ARs – not finding a lot, just in Depths 3 and 4. Bivalves and barnacles. Interesting, but caution that this is preliminary. Final note from samples, finding high number of opercula from some gastropod, but none of the rest of the gastropod, component of sediment? Fair number of them out there.

RT: Sipunculids – aren't they typically in unconsolidated substrate or associated with mollusks?

DM: Also can be found within limestone and certainly within WR. Would like to have student measure sizes, high number. Not unusual that they're in there. Walton Rocks and Rio Mar good place to find them and she would often find them.

JB: Artificial habitat had WR but some of the natural did not?

DM: Correct.

JB: Shallowest depth, creating habitat where might not otherwise exist?

DM: in terms of fair comparisons, didn't have artificial habitats within intertidal, so can't really say anything. Observation in deeper water, finding WR near bottom in cracks/crevices associated with ARs and sometimes in higher abundances than natural reefs. WE know they like specific current regimes, etc. Some ARs good at doing that, particularly Singer Island AR seeing fair amount of WR.

DS: Consistently find WR bridging boulders, down in crevices, more on the outer rows. Natural sites have to really be searched to find the WR.

VK: Function of relief? All depends on relief features you have, different on ARs versus natural.

JB: What's best for attracting?

DM: Compared recruitment on different substrate types, similar level on concrete, limestone and granite. Also explored enhancement of recruitment using chemical cues, didn't really work. Hydrodynamics, and possibly relief, probably most important.

MS: Do they need something less stressful to get established and once established can survive in stressful area?

DM: edges of reefs, within crevices, and then they accrete rapidly onto their tubes and mushroom out from there. Would be great to give numbers. No current, not a good thing, having a current is optimal. Shallow water intertidal more turbulent. Need water flow to get sediment onto tube, feed, and spawn.

KHA: Smaller sampling size, came in at bridge of 2009, got cut short in sampling this month. Did attempt to go out and visibility was poor relative to TS Isaac and ACOE releases. Marine turtle field survey, originally in-water surveys, currently visual transect surveys. Looking at the data, cursory view of different ways to look at data that superimposes depth and fishes. Did not stay within those sites because transects would be too short to be effective, but still can look at the depth strata. Working with the criteria of excellent water clarity – need to see full water depths. Minimum top-to-bottom visibility or better. High standards for this area because not doing in-water surveys, so want to really be able to see into the water, under the ledges, on the bottom, etc. Not counting turtles at surface only so makes these data more valuable. Can pull

some information from Larry Wood's studies on hawksbills to supplement. Trying to incorporate turtle activity in addition to basic observations. Turtles predominantly juvenile green turtles and one loggerhead (18 turtles total during March 2012), none on artificial reef areas. July 5 had a couple turtles in shallower depths, most on first or second reef, not in intertidal zone but on reef closest to shore (1-2m and 2-4m water depths). 3 loggerheads, 7 greens on that trip. Will look at data in different ways, based on different criteria. Bulk of turtles observed in depth range 3.5 to 10 feet at Ocean Ridge sites. No turtles in AR areas or in deepest stratum, similar trend in July. Original stratification – 4 turtles on a particular transect.

JK: Are you surprised that you're not seeing turtles on the ARs?

KHA: From my personal experience, noticed that in areas like Boca turtles basically used the AR as a resting area (late evening) and also Kirsten Jones spent lots of time on those reefs had same observation. In preliminary stages until it starts growing some of the turf macroalgae that turtles seem to be so fond of. IRG Palm Beach report, have been sampling on Singer and spot sampling trips did see a green turtle and David saw green turtle on Ocean Ridge AR, so it's possible that they use the reefs as macroalgae establish.

MS: Phipps AR observation was that macroalgae closely-cropped but didn't notice any turtles.

DS: Keep incidental observations of turtles. Paul Davis from PBC noted hotspot close to MacArthur Beach Park.

KHA: Sabellariid worm reef sticks out there. The exposed WR north of Singer Island.

RT: Are you doing belt transect? How wide?

KHA: Yes. Our criterion is 25m radius off the boat. If we can't see that far, then the survey is not completed or counted.

RT: What's the potential regarding the bias in seeing turtles in the deeper water?

KHA: The main objective is to keep the water clarity uniform.

RT: Right, but assume would see more turtles in shallow water than deeper water if you're not just looking at the surface.

KHA: Surface ratio and then amount of visibility when looking down into the water.

RT: Just wondered what your feeling was.

VK: Low numbers from those surveys, how conclusive can you be in determining differences between nearshore and offshore? Are there enough data to be conclusive? Maybe you need additional effort or change in methodology.

MS: Regulator perspective. Lots of regulators seeing determination as black and white. If have study with insufficient data, observations good, but not trend analysis. Good to specify when have data population large enough valid enough for trend analysis versus light observations that are useful but not proof one way or another.

RT: The efficacy of the sampling shallow versus deeper could be an issue. Other studies have run separate transects. What proportion of animals at surface versus deeper in the water?

KHA: 30 km linear distance of sampling. Granted, in proportion to what's available out there. Intertidal, will probably only get 10% of area on transect, good representation of what's out there. Will still have to run turtles per transect, data eventually calculated, but dataset not large enough at this point. Problem would run into here, would feel more comfortable if 10 separate transect samples, but do we have that currently in the contract? No, that was a shortcoming of being able to do the project. To answer Vladimir's question on feeling about being able to write something up and present the data competently. These data are definitely preliminary at this point, but can represent the nearshore and offshore. Don't believe can break down into the strata.

CM: Bottom type, way to tie turtle observations to different bottom types to tie into different algal species. Using site descriptions?

KHA: No, and purposely made transects to intersect with CSA sampling sites.

CM: Would it be beneficial to have that component in a future survey where those data were collected. Verify from your observations of your sighting and then determine the species of algae or HB to correlate the function of the HB habitat to the turtles?

DS: Should be able to do that in a coarse way.

KHA: Trying to continue on your transect, can mark spot and go back.

VK: (to DM) Question asking not criticizing your data, excited to see all additional data you've collected.

DS: (showing photo) When JB asked question about AR and WR, WR forming a "bridge" and when wave energy or currents maybe force the sand grains up through and facilitates the building of the mounds.

VK: The same at the edge of small ledges, have vortex that suspends particulate matter, which is why they form on the break of the ledge. We did simple experiment with breaking waves sending ink and showed circular movement of sand and suspended matter.

DS: Ken Lindeman also on the line, he's helping with all phases of the project, particularly with the newly-settled fishes. Wanted to look at another ecological aspect of the gradient of nearshore HB that nobody looks at. Censuses done by folks at Nova and elsewhere recognize over 200 spp of fish and at least 100 settle (planktonic existence to settle to seafloor and take up residence).

How it occurs varies with species and can be important determinant whether fish that settle or move (shallow to deep water). Common species known to settle on NHB. Some species managed by SAFMC. When settle, grunts are very conspicuous, wrasses settle and bury, others settle and you never see them. Grunts very conspicuous and easy to sample, once in hand fairly easy to ID, and most will settle in shallow water. Newly settled fish are very small, early juveniles – growth continuous process look at pigment and striping patterns to determine stage. Newly settled a lot tougher to ID, find them in the wild and capture the whole group of newly settled fishes. Looking at basic questions to evaluate microhabitats of their settlement sites by measuring variables of microhabitat characteristics. What important as cues for settlement of these species, across reefs and depth gradient. Based on avian ecological methods. Using use vs availability approach very effective, radio tagging is tricky and criticized but still valuable to this study. Examined similar items regarding epibiota, biotic characteristics and substrate and then measured the relief and distance from margin of particular feature and water depth. Presence/absence of the fish and the characteristics are the quadrats where the fish were and weren't. Turf algae high component of random site, shows sites taken up on to the reef itself and why turf algae highest. Sand pretty high in both because tend to be found around the edges, which is why we measured distance to edge. Biotic characteristics generally not important. But caution these are preliminary data. ARs similar results but little higher in fleshy algae versus macroalgae. Biotic components of images not important. Water depth, distance from edge, and relief – some differences with water depth (not across gradient, just collapsed into overall depth), distance from edge, they're all on the edge, and relief was similar between the two and high vs low didn't seem to be a big factor because they look for edges. Definitely microhabitats differ between randomly selected sites (grunts), some overlap in use for other species. Damselfish very different, settle in the middle. If big sand patches, grunts settle on edges, don't settle in reef structure, but damselfish do and individually, not in groups like grunts. Grunts most abundant and frequently occurring. Most interesting thing is the grunts themselves are extension of a habitat, because other fish like sweepers, wrasses and others taking advantage of the grunt schools. Settle not necessarily in holes or shelter, strategy to avoid getting eaten is numbers. Other key thing separating the little grunts (family), then see if any species-specific differences even at these small gradients.

MS: Have been operating on assumption that larval/juvenile fish see more of them on low relief because higher relief leads to bigger fish and higher predation. True? Does it have anything to do with selection or survival, settle where they want and survive more or select low-relief?

DS: Have had similar assumption, but no quantification on the angle of predation. But higher relief reefs, higher rates of settlement, but probably more predators. We do see number of them settling on low-relief edges and sand patches. Flat, featureless NHB, but at same time a predator could be a 2" long snapper or hairy blenny. Low-relief not totally safe or innocuous.

VK: Proximity to shoreline because normally observe step through water, coming to your ankles, see school of fish, tend to stay shallower where can find them.

MS: The literature says they go as far into shore as they can.

DS: We hope to determine species that do not settle in very shallow water, some settle both water depths, but only a couple that settle in 30m water. Most from 5m on in, want to see if partition water depth within gradient we're looking out, may be difficult to parse that out but would like to try.

RT: What are the newly-settled fishes foraging on?

DS: Planktivorous. Planktivores take advantage of turbulence. Some switch over quickly and then forage in the sand.

RT: Damsels are territorial when older?

DS: Very much so, re: newly-settled grunts do damsels affect where they settle, maybe damsels preclude them from settling in middle of reef.

KL: Early juvenile grunts transition from planktivory in some prominent species like sailors choice and others between 3 and 5cm, so larger guys presumably starting to bottom feed on invertebrates and others after 5cm. Damsels could be affecting early settlement through territoriality but not a lot of quantitative data for that. A lot of processes all meshed up here and are they only selecting habitat or because of predation – probably both, but no definitive experiment on habitat selection on these grunts or a lot of other species. Predation very important and a lot of other confounding variables. Is probably a combination of both.

VK: Predation different scale of predators and different sizes of juvenile fish use different target prey. Definitely shift from smaller predators to larger predators along depth gradient and with relief. Can this be sorted out?

KL: Given the resources, which we appreciate to conduct the study, addressing as yes we can. Feel that to be accurate so many variables to be considered difficult to go with that. Very aware of desire by DEP and other agencies to get answer to this. We're going to do our very best to address those questions as the data come in. It's going to be difficult to give black/white answer you and constituents want. Will look at depth gradients and report what the data allow us to report.

VK: Quite clear to collect data is important and as much as you can, interpretation is next. The picture getting more clear for you and maybe ask new questions and then change components of sampling design. We do understand hard to answer questions. But moving forward to answer it even in little steps is progress. With any research, we are simply finding things so you can begin to understand how things work.

KL: Do our best to get you what you'd like, we want black/white answers as well.

CM: What are your questions, thoughts and what can we do to ensure we meet the intent of the project?

VK: What David showed us running parallel to shore in same zone. Increase sampling effort to include ??

DS: When we first went out in 2009, scouted east coast to find sites, no artificial reefs in place, told to use the Boca reef as one of the sites and headed south from there. Spanish Lakes slated for a nourishment project after that. Another site in Boynton that has disappeared since 2009. Another site in 6-7m offshore Boca, once Ocean Ridge reefs built, it wasn't worth running down there. Located all sites in Palm Beach area, only place could find range of water depths. Wasn't just talking about partial burial of transect. No such thing as pristine natural HB. Went in August right before TS Isaac, water clear but too rough to work, outer row completely buried, came back a week later, was totally uncovered. Not an energetic storm, not like what we're experiencing now with Hurricane Sandy. Deeper sites lost, same thing happened at Ocean Ridge, inner ones buried but not completely, but outer ones completely buried by migration of sandbar.

VK: It's hard because of the working conditions, but should look at similar things in each zone not covered/uncovered and keep the same numbers.

DS: The only thing we have in comparable depths is that same AR offshore of Phipps in 6-7m and seems to be pretty persistent.

CM: The same sandbar feature buried the outer row of boulders on Phipps 0.8 acre reef and then became uncovered but bare because it had been buried for a while. It's more persistent/stable but we did record that phenomenon out there.

DS: If move latitudinally, will have to account for habitat differences.

MS: Initial takeaway from early data presented today, seeing some differences between natural and ARs with functional groups. Our mandate is to look at functions of these areas. The difference in community assemblage, should that be considered a functional difference? If clear distinctions in functional differences, should we look at cumulative impacts? If raw data at end of study show difference, is that a matter of time lag, if given enough time would it provide the same function, need to manage to ensure functions established, or should we consider other mitigation?

DS: Great questions, and as KL has already said we'll do our best. Literature with ARs – we do a lot of work in ME and reef ecologists reviewed ARs vs natural reefs and pointed out hard to compare because of the age and the time it takes for succession or organisms that require time to grow. Corals might take longer time. If let time lag out would we get same thing? Don't know. Low diversity of algae, high cover turf, sponges in early stages. Dupont PEP reef. Will not get perfect convergence. Can certainly get ecological functions from ARs, not an ecological dead-end.

DM: We should be pointed toward ecological function, and if get to level we'd like, that's what we'd be addressing. In terms of nearshore habitats, unique suite of environmental characteristics, relief being important, more subject to sand scour and areas with right

hydrodynamics and relief more persistent communities. If look at sites and get feel for who's supposed to be where under certain conditions, that will be interesting.

DS: From epibiota data, if looking for convergence of community, restoring ecological function? Not really. Why looking at what sort of habitat WR/algae provide to invertebrates and newly settled fishes and how turtles use them. Compare communities standard multivariate sense, but doesn't drill down to ecological functions.

VK: The time factor is definitely something need to look to. Obviously differences with different depths. High stress nearshore with j-type succession and deeper more s-type succession. Observations of ARs, takes long time because many types of groups because recruitment takes a long time and dependent on many things. ARs in Broward County with submersible, came back at 3 years, saw bacteria and little macroalgae, few corals. Many years later, coverage of corals, small 5-6cm diameter and recruitment finally happened but 8 or 9 year of AR.

MS: Instances where transplantation necessary or where shorten timeframe?

VK: Can shorten time because no coral recruits in area not like macroalgae.

JL: What is the climax trying to achieve and is that determined by water depth?

VK: Yes and proximity of shoreline where breaking waves.

MS: Success criteria looking for similar assemblage or different assemblage perform same functions?

VK: Need to look at older reefs, because newer reefs very interesting in terms of succession. The deeper should be several years old reefs.

JL: Sand movement, where burial in nearshore on natural hardbottom. Not sure what we're trying to target when it's always changing.

VK: Trying to build in-kind mitigation with similar conditions.

CM: What happens if go back out there and there's no AR to be found because they're all buried by sand. Have only short limited time to conduct study. How tease out the information?

VK: Definitely a gamble, but have to have a back-up. Can't give answer at moment.

MS: We only have finite number of sites.

JL: Finite time, too.

VK: Cannot cover everything with your survey.

CM: What thoughts?

DS: 0 is not a bad number in that you may have not lost something. Looking forward to coming back to see what happened to one that had been buried. Provides valuable info on the real world and how working out there.

VK: Natural vs AR would be good thing to compare – burial.

DS: Try to fill holes best we can with reefs of opportunity. So much variation out there that can get mired in quadrat-to-quadrat variation, want to be able to make generalizations representative of depths. Don't have luxury of random sampling because have to fill needs for each particular strata. If site buried mark as zero, can find surrogate site for it on the fly.

VK: Agree.

JB: Agree too. Have you seen variation of fish communities with relief?

DS: Yes, have seen it.

JB: Something may be buried, but may still be providing functions to fish communities.

DS: Epibiota seem to do pretty well as long as sand coarse and not hard-packed and water can flow through on microscale. Lot of these species adapted to such conditions and are flourishing.

VK: Some of them only live in this type of environment.

CM: If find replacement sites for natural sites due to burial, would you do the same thing for ARs with burial doing something to affect the ARs. Limited with ARs because going to different location not really an option.

DS: If buried, just IDed buried because didn't know where to go. In particular water depth, boulder representative of that would be nice to know age of reef to factor into any analysis. Can do side analysis of reefs sampled in Year 1. Will have very descriptive account of that at least based on that first sampling event.

DM: If sample one or two more times post-burial, opportunity to observe recovery or succession after burial.

DS: Terrestrial biologists ahead of us, look at frequency, duration of disturbance events and factor in manmade events or 100-year storm kind of thing.

CM: That's just part of what we're dealing with.

VK: Should be always in mind AR burial because not necessarily uncovered in same way as with natural HB and may not be uncovered in future.

TJS: When found already covered last time, set precedent on how handle when they're not available. If change that now, wouldn't have continuity in sampling.

VK: Can also compare persistent things.

TJS: If see rocks of AR sticking up, but if can't see no data and not being able to collect data is data. If natural sand waves coming from ocean toward beach, natural process in this area, mimicking the natural system.

VK: Just looking at what happens with burial – partial or complete. The difference between the systems offshore versus nearshore should lose this part of. Main task to see differences in nearshore and offshore, seasonal. Chance to sample AR to compare but time is short.

CM: One site buried and week later uncovered, did you sample?

DS: Yes, but not scraping biofilm or anything. Still getting a dataset – zeroes.

CM: Not just saying burial and not going back.

DS: Precedent is set. We saw it got buried and uncovered so rapidly and Isaac didn't have much of swell.

CM: Worried because like with Boca there was a beach project and storms and already know frequency of disturbance pretty high, lot of sand movement down there. It makes more sense to follow what you're sampling and document frequency, duration of these disturbance events.

DS: Mentioned at outset, placement of ARs don't mimic the strata. Built them as intertidal and deconstructed because emergent. Calling Strata 1 through 4 for ARs and natural, but depths are off. True gradient for natural, but not for ARs. So good to get idea of dynamics and sand movement but as far as having deep site reflecting deeper strata from natural perspective, don't think we're losing it there. Should find something else, but don't know what to find in that depth that is not buried.

CM: In terms of layout of mitigation reefs that depth gradient won't be the same as originally intended?

VK: What else can do?

DS: Can still analyze it and relate it to other strata and will still get to ramifications of building reef in deeper depths than what impacted. We will have true reference base to compare, maybe ends up being simple deployment for beach project and factor other things in like the age thing. Subjective look at them and the data show reached similar stage of cover by usual bryozoan, turf algae, sponge assemblage.

VK: Can look at some of other reports when built other ARs because usually have reports for first 3 years, maybe follow early succession.

CM: Sample size and what KHA will be able to do with turtle data. Follow-up questions?

VK: KHA answered that maybe additional effort will be made or number of data collected in future better opportunity to interpret for what looking for because numbers too low right now to make conclusions. Either make more effort or expand it somehow. Will have to think about it.

RT: Look at what similar assessments have documented. Concerned that methodology not consistent with other efforts occurring in the area so couldn't compare to those efforts. Might be able to pull out data to compare. You did the sampling with the poorer water clarity but still didn't see any animals at the surface?

KHA: Conditions pretty poor all around except Ocean Ridge AR site. Have comparison for two sampling periods, but think that I'm just adding that component to that to determine where turtles are, sampling not that much different than others except that I record those data. Have gone out with IRG and sampled quite a bit. Just adding that to the database, sampling is consistent just additional component. Same sampling as done in Brevard County and IRG in Indian River. Trying to maybe one day do a detectability when have poor water conditions.

RT: Important aspect missing from work that's being done with turtles now. There's always been suggestion that size class varies with depth as well. Time at surface might vary with size class, too, so need to be aware of potential bias there.

VK: Looking to the data that would be related to the bottom/hardbottom, utilization of HB by turtles. If can't see all the way to the bottom, losing the data on what looking for.

KHA: It is tricky because dealing with highly-transitory animal, but always write the bottom type data down and try to make that assessment directly. It also comes out when overlay waypoint over the maps.

RT: All good information. Hear lots of concern over preliminary data, but this isn't a lab experiment. We're getting more information than what we had at beginning of Phipps. Will help with these projects.

VK: Basic diver survey protocol, look around every 20 seconds and make counts what see for the turtles.

RT: Incidental sighting is great.

CM: Adaptive management – what can we do during Year 2 not currently doing that could add value? Or continue under same protocol knowing we may run into these anticipated issues and what to do?

VK: Protocols should be adjusted, look at everything all together. Would like to stay in touch more to see if project not going as intended, would be easier to adjust quickly and not postponing to the fall or time of report.

CM: If team goes out, quick conference call and ID path forward?

VK: Don't you think it would be beneficial?

CM: Agree best thing to do, but when everything happening simultaneously it's hard to do.

VK: Not necessary to have quorum, just small group of surveyors to discuss what going to do.

JL: Moving forward on track, need to deal with something quickly, get together, document it, send it out.

CM: If go out and encounter AR burial, how many times resample?

DS: If totally buried, would have to monitor it somehow. Will be interesting to see what happens after this giant swell we're having. I don't see other than burial issue – but will record zeroes and document – but wouldn't want to make any other big changes. With only 2 surveys left, stay the course. But if entire reef gets buried, too many zeroes, would have to stand down, look at schedule and see what could do. Dan has lots of data to sort out and can't back him up with that.

VK: You can't really change all the way through with methodology 2/3 of way through. Replacement of equivalent sites if losing.

DS: Two places: one north of Singer Island mostly buried built in '99 limestone boulder some may be in right water depth, Phipps which is already buried.

CM: Still plenty of area to sample, but definitely being affected by seaward migration.

DS: Palm Beach County building others in 15m, but too deep. Wouldn't be wise.

VK: Not that new or that deep.

DS: The only other reef deployment aware of.

CM: Meeting minutes and PowerPoint presentations to DEP as final copy after edits and brief outline/summary of recommendations for next year and path forward.

VK: Would also like to see some kind of preliminary summary or speculation of what seeing related to our goal to see how it's moving.

DS: The data summary table needs to be revised because one cell is not quite right, will fix it and get to Cheryl.

JL: Page 8 and 9?

DS: Yes. Survey 4 is incorrect. Just discovered that the other day.

VK: Good you found it and can fix.

KL: Heard phrase climax community in terms of succession and found myself thinking that it's a very difficult thing to define in this geophysical space with these habitats and creatures. I understand that that's what succession is going towards, but the frequency of disturbance is so high and may increase over time that maybe can discuss that further down the road. Nearshore habitat on windward side of barrier islands north of the Bahama shadow kind of scares me.

VK: Don't have clear climax communities, just have absolutely unstable communities in nearshore and more stable in deeper. Not necessarily climax community, addressing stressors in different habitats.

KL: Clever term like dynamic climax or something and throw it into report and give it a nice acronym.

VK: This is possible if you have any data where you can slice data from 10 year period, where HB uncovered and that is your climax and compare it to the 10 years on the AR that can be 8 or 10 years old. Would we be able to do that?

KL: Tried in '09 report to push topics into new areas and will do our best and encourage you folks to push us.

VK: Looking forward to seeing your interpretation of data and even speculation from incidental observations. That is study, which is different from monitoring. Scientists to do this work with as much detail and thought as you can.

KL: Dan's work so important because so many invertebrates involved. Conversations between Vlad and Dan would be very productive.

DM: Would be happy to talk with Vlad.

KL: Hope it can happen once in a while.

VK: Similar with what talking about if something happens to discuss it. If questions on other matters, please give a call and we can talk or exchange emails. Stay in touch. What Dan was presenting, can't go into detail more with that, can't afford. When write and analyze everything also have to answer the questions. Are the data collected good enough for the task?

CM: That's the bottom line.

DS: Have only seen 1 lionfish, intermediate site on Palm Beach.

JB: Good to hear.