Southwest FL Oyster Working Group Meeting 2
Wednesday May 9, 2012
12:30 am – 4:30 pm
SWFRPC, 1926 Victoria Ave., Fort Myers, FL 33901

You may also join the meeting remotely via Teleconference &/or WebEx:

- **To view via WebEx:** In your internet browser, ***enter https://suncom.webex.com/,*** click on the ***Meeting Center*** tab & then on the ***Browse Meetings*** link. Click on the ***Weekly*** tab & find ***May 6-12.*** Scroll down to ***Wednesday May 9*** & click on the ***SW FL Oyster Working Group.*** Click on the ***Join Now*** button & you will be able to see the host computer screen.
- **To hear via Teleconference:** Dial (888) 808-6959 and enter Conference Code 2550232 when prompted.

AGENDA

Purpose: The purposes of the Southwest FL Oyster Working Group Meeting 2 are:

- Review progress to date on CHNEP oyster restoration goal, objectives and suitability model.
- Define CHNEP oyster restoration success criteria.
- Create a list of suitable oyster restoration techniques for the CHNEP area.
- Develop pre-restoration and post-restoration monitoring guidelines.

Agenda:

1. Welcome & Introductions – Judy Ott
2. TNC Overview – How CHNEP Oyster Restoration fits into the Big Picture – Anne Birch
3. Review Progress to Date - Jaime Boswell
   - CHNEP Oyster Restoration Goal
   - CHNEP Oyster Restoration Objectives
   - CHNEP Oyster Restoration Suitability Model
4. Oyster Restoration Success Criteria (Volety et al 2009, Brumbaugh et al 2006, Coen and Luckenbach 2000, SCCF)
   - Recruitment & Growth (reef growth & individual growth)
   - Size structure (Luckenbach et al 2005)
   - Living Density
   - Habitat Value for Associated Species
   - Condition Index & Gonadal Condition
   - Prevalence and Intensity of *Perkinsus marinus*
   - Trends over time
5. Potential Oyster Restoration Techniques (Brumbaugh and Coen 2009, Manley et al 2010)
   - Substrate materials (oyster shell, other shell, fossilized shell, sandstone, limestone etc.)
   - Bagged/Contained Cultch (FGCU & SCCF)
   - Loose Cultch (FDACS small barge method)
   - Spat sticks
   - Community Restoration (e.g. oyster gardening at docks)
6. Pre-restoration and Post-restoration Monitoring
   - Pre-restoration – water quality, recruitment, disease, predation, water flow, sedimentation
   - Post-restoration – relate back to success criteria
7. Next Tasks, Duties & Schedule

THIS MEETING IS OPEN TO THE PUBLIC

Two or more members of the Everglades West and Caloosahatchee Basin Working Groups, Peace River Basin Management Advisory Committee, Peace River Basin Management Working Group, or Southwest Florida Regional Planning Council may be in attendance, and may discuss matters that could come before the respective body.

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Wednesday May 9, 2012
12:30 am – 4:30 pm
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MEETING NOTES

Attendees:
On site: Anne Birch/TNC, Kathy Meaux/Sarasota Co., Jim Beever/SWFRPC, Dan Cobb/SWFRPC, Lucy Blair/FDEP S District, Heather Stafford, FDEP Aquatic Preserves, Eric Milbrandt/SCCF, Katie Laakkonen/City of Naples, Holly Downing/City of Sanibel, Barbara Welch/SFWMD CERP, Pete Quasius/Snook Foundation, Jaime Boswell/for CHNEP, Judy Ott/CHNEP
Via WebEx: Shelly Norton/NOAA, Andrea Graves/TNC, Paul Zajicek/FDACS, Kathy Fitzpatrick/Martin County, Steve Geiger/FWC FWRI, Eddie Hughes/CSA International, Baret Barry/Martin County

Purposes of Meeting 2 of the SW FL Oyster Working Group:
- Review progress on CHNEP oyster restoration goal, objectives & suitability model.
- Define CHNEP oyster restoration success criteria.
- Create a list of suitable oyster restoration techniques for the CHNEP area.
- Develop pre-restoration & post-restoration monitoring guidelines.

Meeting Notes:
1. **Welcome & Introductions – Judy Ott, CHNEP**
   Members introduced themselves & Judy reviewed the purposes of the meeting & the agenda.

2. **TNC Overview: How CHNEP Oyster Restoration fits into the Big Picture – Anne Birch, TNC**
   Discussion:
   - Oyster restoration is a priority for TNC throughout the US coastal states, especially along the Gulf Coast.
   - TNC is working on identifying oyster restoration needs in each state, as well as how states can work together to implement effective regional oyster restoration.
   - TNC developed a GIS based tool to help identify potential areas where oyster restoration is viable, called the Gulf Restoration Decision Tool & it is available at gulfresorationds.org.
   - The purpose of oyster restoration is to restore habitats plus allow for climate change adaptation, the metadata for the tool is readily available.
   - TNC would like to add CHNEP Oyster Restoration Plan info into DS tool as a site specific and more geographically detailed application of the tool.
   - It will be helpful for TNC DS Tool GIS staff to coordinate with SWFRPC/CHNEP GIS staff.
   - TNC also has a coastal resilience website & a recent grant from NOAA/Sea Grant to help identify climate change adaptation strategies, including community workshops on resilience.
   - TNC also prepared a letter supporting the Restore Act, which is currently in committee under the Transportation Bill. The bill directs how the BP fine money would be specifically used. Anne emailed the letter in a "sign-on" format where agencies & NGOs & others could add signatures & they would be compiled into this 1 letter. Respond to Anne at abirch@tnc.org.

3. **Review Progress to Date - Jaime Boswell, contractor to CHNEP (see Power Point presentation slides 2 – 5)**
   CHNEP Oyster Restoration Goal (slide 2):
   - Suggest goal = "Restore ???? Acres of Estuarine Oyster Habitat & Related Ecosystem Functions".
   - Define ecosystem functions which are part of the goal – e.g. water filtration, habitat provision, shoreline protection – should public involvement be included here?
   - Use 1950s oyster maps with known non-restorable areas to determine suitable oyster restoration area.
   - Run restoration habitat suitability model to determine acres suitable for restoration under current conditions.

- Use historic & suitable habitat information to for realistic & meaningful oyster restoration goals.

Discussion:

- Early in CHNEP oyster restoration process, it's important we agree on goal we're working towards.
- Need to define "ecosystem functions" specifically.
- Suggest public involvement is a separate line item. Part of the planning & restoration process is identifying how to engage public & get buy-in & in-kind services.
- Public involvement includes public education of the value of these habitats plus hands-on restoration tasks.
- Question about if shoreline protection is a "goal" of this oyster restoration process. Shoreline protection could be a function of oyster restoration.
- Need to separate goals & functions.
- Need to define specific ecosystem functions & what functions we will consider as being restored & are measurable.
- Objectives of specific oyster restoration projects are different from the overall CHNEP oyster restoration goal.
- Need a variety of projects in a variety of locations to restore all the functions needed to accomplish the restoration goal.
- Goals may include different acres & projects for different regions of CHNEP. These will depend on how the priorities are defined for each estuary & watershed.
- For example, altered salinity regimes may change oyster acres & locations – is this a natural, desirable goal?
- Consider adding Flow into the GIS Habitat Suitability Model. Could use several options – 10 year average or projected future optimal flow. Need to include optimal salinity ranges plus the locations of those salinity ranges. Need to account for anthropogenic changes & identify locations for specific estuaries.
- Need flexible criteria to account for differences between current conditions & optimal conditions, with consideration of what is likely to be changed in the short term (dams; hydrologic) & long term (sea level rise). Model will point us toward locations/project designs with specific objectives.
- Do we need acres? Obtain more accurate estimates of historic & future oyster acres. Consider defining suitable oyster restoration habitats. Consider a percentage of suitable acres over a specific time period
- Include: increase public awareness of value of oysters & increase state & federal funding opportunities of restoration
- ***Suggested revised Oyster Restoration Goal: Restore ?? % of suitable oyster habitat & related ecosystem functions by 20??.*** Include specific percent (based on model results) & list of functions (in supporting text), while meeting site specific criteria.

CHNEP Oyster Restoration Functions & Discussion:

- Water filtration, transform water chemistry, sequestering nutrients, reduce turbidity
- Water circulation - define circulation patterns
- Reducing & supplying sedimentation
- Substrate stabilization
- Habitat, attachment for epiphytes – flora & fauna, refugia, resting habitat, foraging habitat, above & within oysters, symbiotic habitat/site specific (i.e.: obligate fish), rooting habitat for establishment of mangrove islands
- Shoreline protection
- Species migration routes for sea level rise
- Human resource – recreation – i.e.: fishery, harvest – commercial vs. recreational, cultural significance – i.e.: "old Florida"

Oyster Restoration Project Objectives & Discussion:

- Shoreline protection **-** needs to be included, either as CHNEP Oyster Restoration Goal or as Project Objective (where appropriate).

CHNEP Oyster Restoration Plan Objectives & Discussion (slides 3 & 4):

1. Implement the CHNEP CCMP
2. Develop the restoration plan through a SW FL Oyster Working Group for the purposes of information sharing - developing consistency between projects & for forming partnerships for future restoration projects.
3. Provide guidance on permitting requirements & other management considerations.
4. Identify priority restoration sites for the eleven estuaries (where suitable) within the CHNEP region using a science-based approach & the best available data.
5. Identify, using a science-based approach, a suite of appropriate restoration techniques.
6. Define success criteria for oyster restoration projects.
7. Develop a science-based oyster habitat monitoring plan that can be used to test success of individual projects. (provide suite of monitoring options) (combine #7 & #9)
8. Develop a science-based long-term monitoring plan for oyster habitat as an environmental indicator.
9. Identify minimum monitoring requirements for all projects intended to assist in meeting the CHNEP Oyster Restoration Goal (min. monitoring requirements – Combine #7 & #9)
10. Identify potential funding sources for restoration & monitoring projects.

- Consideration of sawfish critical habitat is part of #3.
- Consider adding an objective related to public outreach & community involvement
- ***Add - Identify opportunities for public outreach & community stewardship/public involvement.***

CHNEP Oyster Restoration Suitability Model (slide 5)
See handout titled "CHNEP Oyster Restoration Plan GIS Model Components".
Essential Model Factors & Discussion:

- Seagrass Persistence
- Boat Channels w/Buffers - channel width = 150' + buffer =75' = total 300'; channel = score 0 & buffer = score 0.2
- Aquaculture Lease Areas – buffer would be case X case basis so in model, just include aquaculture lease areas without/buffer as being unsuitable
- Depth – spoil islands = primarily from ICW owned by USCOE; spoil island may be considered to be outside of the aquatic preserve boundary & therefore have less stringent regulatory requirements. Maybe existing ICW spoil islands could be used as restoration areas – need to contact USCOE
- Salinity
- Dissolved Oxygen
- Temperature – not much variation throughout CHNEP. Most important for spawning & literature documents effect of temperature on filtering rate. Most critical near power plant outfalls – i.e.: Caloosahatchee/Orange R. Don't include in model but add in site specific considerations.
- Current Oyster Habitat – consider it's good to be close to existing (live, high quality) reefs. Is the primary benefit to spat settlement? Yes, but also indicates how suitable the site is for long term success of reef. Need to consider quality of reefs. Need to do spat recruitment before each specific project. If the location is good for settlement but lacks substrate, it's possible that adding oyster substrate may enhance settlement. Need info on reefs with high sediment load. Sedimentation rate & spat settlement rates are site specific conditions that need to be measured before projects. GIS mapping doesn't capture oysters in high turbidity area where oysters currently exist (i.e.; Peace R). Could use existing reefs as priority areas – i.e.: within a defined distance of healthy reef. Current oyster habitat is more appropriate as post-model tool. ***Include current oyster habitat as post-model evaluation factor***. Could include it both in & post model. We don't currently have accurate oyster habitat locations. ***Next step = map current reefs & add info back into model = adaptive approach. Cross check results of model with locations where we know current healthy reefs are. Look at Sarasota Co estuary qualitative mapping & quantitative mapping in creeks.*** Does FWRI/FNAI/Labins/USGS have sediment layers for some areas of state? Probably larger scale than we need. See also Ernie Estevez/Mote's benthic communities work in Charlotte Harbor from early 1980s. Check Peace R MFL sediment maps for specific locations. ***Use FDEP Aquatic***

Preserves seagrass transect mapping – has sediment at fixed quadrat locations along seagrass transects for 10 years.

Other Model Factor Considerations & Discussion:

- Sawfish Hotspots w/Buffer
- Aquaculture Lease Area Buffers – don't need to include buffer in model
- Shellfish Harvesting Area Classifications
- Historic Oyster Habitat
- Habitat Migration Shorelines
- Managed Lands
- Shoreline Type
- ***Add FDEP APs Seagrass sediment as a post-model consideration***
- ***Add Temperature as Site Specific consideration for pre-restoration monitoring***
- Use the 1950's oyster maps in conjunction with known non-restorable areas (e.g. boat channels, spoil islands) to determine a potential number of restorable acres
- Run restoration site suitability model to determine number of acres of suitable restoration areas under current conditions
- Use both numbers to inform a realistic & meaningful restoration goal

4. Oyster Restoration Success Criteria - Jaime Boswell, contractor to CHNEP (See PowerPoint presentation slides 6 – 8)

Success Criteria Overview (slide 6):

- Coen & Luckenbach (2000) "note importance of linking success criteria to specific goals & clarify ecological functions of shellfish & shellfish habitats.
- Success criteria typically tied to fishery harvest (i.e. # harvestable oysters).
- Minimum success is demonstrated by self-sustaining oyster populations (recruitment & growth).
- Density & size structure are important (Luckenbach et al., 2005)
- Size structure (Luckenbach et al 2005)
- Living Density
- Habitat Value for Associated Species
- Condition Index & Gonadal Condition
- Prevalence & Intensity of *Perkinsus marinus*
- Trends over time

TNC Success Criteria Categories (slide 7):

- From Brumbaugh et al., 2006
- Recruitment & growth of shellfish populations undergoing restoration – Include reef growth & individual growth.
- Provision of habitat for other associated species – Consider transient vs. resident reef community (Coen & Luckenbach, 2000). Locally, 10 decapod crustacean species & 16 fish species (Tolley & Volety, 2005). Estimate of local species seems low, these numbers may be for resident species on natural oyster clumps in Caloosahatchee, other estimates are several hundreds (300 transient species).

SCCF Oyster Restoration Success Criteria (slide 8):

- Growth - Positive (increase between two sampling periods)
- Recruitment - 50 oysters/m^2/year
- Resident Reef Community Development - Comparable to natural reefs. 10 or more species of fish & invertebrates
- Water Quality & Seagrasses - Positive influence**.** Difficult to measure water quality effects. Need direct measurements of seston uptake rates plus ambient water quality. Can use flurometer to measure seston uptake rates. Seagrass are often healthy near oyster restoration projects. Seagrass may be indirect measure of water quality benefits.
- Followed guidance from Sean Powers in FL panhandle & South Carolina.

- SCCF & TNC criteria match closely.

CERP Oyster Performance Measure Criteria (slides 9 & 10):

- See Volety et al., 2009.
- Density of Living Oysters (per m^2) - 0-200, 200-800, 800-4000
- Condition Index - 0-1.5, 1.5-3.0, 3.0-6.0
- Reproductive Activity - 0-1, 1-2, 2-4
- Larval Recruitment (spat/shell) - 0-5, 5-20, 20-200
- Disease prevalence & intensity - Prevalence – 0-20, 20-50, 50-100. Intensity – 0-1, 1-3, 3-5
- Growth (mm/month) - 0-1, 1-2.5, 2.5-5
- Trends – negative slope, no slope, positive slope
- Need success criteria for specific restoration projects plus for CHNEP oyster restoration overall.
- CERP success criteria are consistent throughout the CERF territory (east, west, southwest, etc.)
- Need easily measureable parameters – some of these are difficult & expensive to measure.
- Table 4 Component Score for Oysters in Caloosahatchee Estuary – Table 4 from Volety et al., 2009

Table 4 – Component score for oysters in the Caloosahatchee Estuary for translating performance measures into a stoplight display

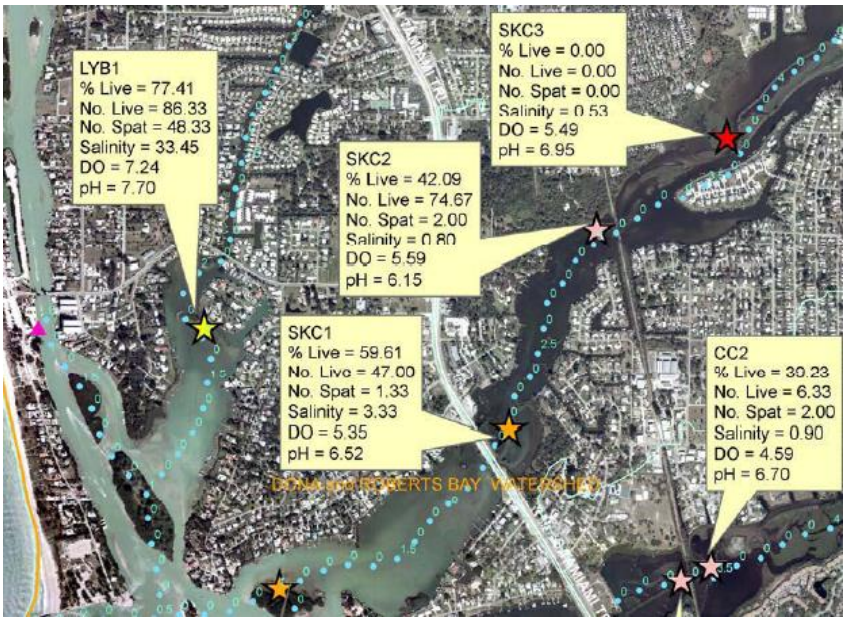
Component	Parameter value	Parameter value stoplight	Index score	Trend	Trend stoplight	Trend score	Average component score	Component stoplight
Oysters								
Living density (per m^2)	1029		1	±		0.5	(1 + 0.5)/2 = 0.75	
Condition index	2.96		0.5	±		0.5	(0.5 + 0.5)/2 = 0.5	
Gonadal Index	2.61		1	±		0.5	(1 + 0.5)/2 = 0.75	
Spat recruitment per shell	6.43		0.5	±		0.5	(0 + 0.5)/2 = 0.5	
Juvenile growth (mm/month)	2		0.5	±		0.5	(0.5 + 0.5)/2 = 0.5	
Perkinsus marinus prevalence	49.5		0.5	–		0	(0.5 + 0)/2 = 0.25	
Perkinsus marinus intensity	0.83		1	–		0	(1 + 0)/2 = 0.5	
Geometric mean of oyster component scores $(0.75 \times 0.5 \times 0.75 \times 0.5 \times 0.5 \times 0.25 \times 0.5)^{1/7} = 0.508$								
Final Eastern oyster index score = 0.5								

Sarasota County Monitoring (slides 11 - 13):

- Bi-annual – end of dry season & end of wet season since 2006
- Three ¼ m^2 quadrats at each site
- Live oysters, recently dead oysters, spat
- Percent live oysters – scoring
- Water quality

Percent Live Oysters	Descriptor	Numerical Score	Letter Score
0% - 19.99%	Very Poor	0	F
> 20% - 49.99%	Poor	1	D
> 50% - 69.99%	Fair	2	C
> 70% - 79.99%	On Target	3	B
> 80% - 100%	Excellent	4	A

	lyb1	db1	skc1	skc2	skc3	rb1	cc1	cc2
Oct-03	79.28	16.12	7.38	0.00		70.17	0.00	
Apr-04	73.85	50.74	80.04	70.15		76.24	38.85	
Oct-04	83.34	65.08	70.71	80.34		78.53	43.75	
Apr-05	81.88	80.71	89.58	93.09	67.92	77.52	73.12	16.34
Sep-05	77.65952	73.90	86.45	9.66	4.44	68.44	34.92	0.00
Apr-06	74.25972	68.10	77.85	82.84	78.62	83.16	74.65	57.33
Sep-06	77.41	60.44	59.6061	42.09	0	59.09	36.74	39.23
AVG	**78.24**	**59.30**	**67.37**	**54.02**	**37.74**	**73.31**	**43.15**	**28.23**



Metrics for Measuring Oyster Restoration Success from Coen et al 2007 (slide 14):

Table 2. Metrics associated with each of the major oyster reef restoration goals.

	OYSTER REEF RESTORATION GOAL					
Metric	**Habitat**	**Shoreline**	**WQ**	**Harvesting**	**Broodstock**	**Education**
Reef Condition						
Density	X	X	X	X	X	X
Size Frequency	X	X	X	X	X	?
Associated Fauna	X		X			X
Reef Size	X	X	X	X	X	
Reef Architecture	X	X	?	X		X
Landscape						
Fragmentation	X	X	?	X	X	
Salinity	X		X	X	X	X
DO	X sub		X	X	X	X
Chl			X			
TSS/Turbidity			X			X
Temperature	X		X		X	

- Consider these metrics for individual projects plus long term CHNEP Environmental Indicators.

CHNEP Oyster Restoration & Environmental Indicator Success Criteria:
See handout titled "CHNEP Oyster Restoration & Environmental Indicator Success Criteria Matrix".

Metrics:
- Density of Living Oysters
- Percent Living
- Size Structure
- Condition Index
- Reproductive Activity
- Larval Recruitment
- Disease Prevalence
- Disease Intensity
- Growth
- Reef Relief
- Resident Reef Community

- Transient Reef Community
- Water Quality Adjacent Seagrasses

Categories of Effects Measured by each Metric

- Environmental Indicator
- Recruitment & Growth
- Provision of Habitat
- Water Quality
- Shore Protection
- Other

Discussion of CHNEP Oyster Restoration Success Criteria & Matrix:
See handout titled "CHNEP Oyster Restoration & Environmental Indicator Success Criteria Matrix Revised".

Discussed Reef Size & Elevation:

- Next step is mapping current reefs – could use real estate maps & other aerials. Need to translate images into GIS with lat/longs.
- See references, especially Grizzle, to see methods for determining % live from aerials.
- One potential assessment tool (pre & post) = hummingbird side scan sonar. Can get scale, height, lat/longs. Can convert to GIS. Cost $800 - $3,000. Can add into Google Earth. Still need some % to be ground truthed.
- Is reef footprint a good indicator region-wide? Remember Environmental Indicators need to be measurable region-wide. Reef footprint may be more appropriate for project specific assessment. How much do reefs change over 5 years? Not too much, depends on WQ. If using reef size as a success criteria, need to define details of what "success" is - could be increasing, neutral, decreasing. Need to consider size & height, both are important & both could be changing & could be different rates of change in different geomorphic positions (i.e.: in areas with high fetch reefs tend to be flatter). Any increase would be good.
- Environmental Indicators are big picture; measure overall health of system; easy to measure.
- Next 4 columns are categories of Success Criteria from TNC.
- Can add columns of criteria as desired.
- ***Add reef size (to project specific criteria) & reef coverage (to CHNEP region-mapping criteria).***
- ***Add requirement that more mapping is needed.***

Discussed CHNEP Region-Wide Environmental Indicator Metrics:

- Density, % living & size structure are good indicators.
- Disease prevalence is important, could be used as a follow up criteria/adaptive strategy.
- See current CERP monitoring. Need to expand on CERP monitoring throughout CHNEP. Could be collaborative effort among CHNEP partners using consistent SOPs & metrics throughout area.
- Need both "must have" (primary) & "wish list" (secondary) indicators.
- ***Suggested Primary Indicators =*** density, size structure, larval recruitment, reef coverage, (Important - See TNC Monitoring Diagram on Page 12)
- ***Suggested Secondary Indicators =*** biodiversity/resident reef community (could be from FIM data) (note some obligate fish & crab species are indicators of health of reef), condition index, reproductive activity, disease prevalence, disease intensity;
- Convey results regionally; consider regional variability – i.e.: "report card"; convey trends (see Sarasota Co & CERP), water quality is important, but captured already through other programs.

Discussed Sites Project Specific Success Criteria:

- ***Primary Criteria = recruitment & growth - density of living, size structure, reef relief, reef size.***
- ***Secondary Criteria = percent living & recruitment***.

- % living (use consistent methodology, grids work well, consider recently dead vs. dead = articulated vs. not articulated. TNC doesn't use % living, they count # living & don't compare that to # dead. Include with size structure.
- Literature suggested size structure & density of living oysters at a minimum. See TNC Monitoring Fig 4 on pg 12. Need to develop simpler less destructive field sampling technique. In Indian river, use random quadrate & count every live oyster you can see.
- Need to include size structure? Would be hard & need to be careful with methods because on healthy reefs get several layers of live oysters & top layer may not be best indicator, depends on reef morphology.
- Measuring size classes include number of spat. Could measure in the field with calipers & trays.
- Important to sample natural, control reef as part of monitoring a project. Could use tray imbedded in reef. Trays - variety of types = coke bottle tray) are lined with mesh, staked in place on reef, with same material as used in restoration site added. Then count recruitment of all oysters, as well as inverts (run animals through sieve) & calculate to recruitment/area.
- What about oyster drills? Included in reef resident measurements as predators.

Discussed Provision of Habitat:

- ***Primary criteria = diversity & abundance residents (define methods – maybe tray?) & epiphytes (both flora & fauna) with categories & % cover.*** Need to measure amount, diversity, seasonal variability. Need to define methods. Need to assess similarity to natural reefs. What about drift algae & relationship to hard substrate? What about hook & line fishing for larger predators & gut contents? (no – not really indicative). Epiphytes can be defined categorically and with percent cover.
- ***Secondary criteria = transient residents.***

Discussed Water Quality:

- ***Primary criteria = turbidity & clarity.*** Need methods & SOPs, See Grizzle seston & water quality monitoring methods. Seston water quality monitoring is expensive. If measure ambient water quality, needs to be right over reef & include measurements up-tide vs. down-tide of reef. See TNC light sensor experiment. Could use data loggers. For specific restoration projects, water quality monitoring is important but not as a success criteria. Could set up specific SOPs. Consider up-tide vs. down-tide seston sediment removal.
- Do we need to (& is there a tool to) measure & analyze oysters themselves? C:N?
- Water quality monitoring is required by some funding agencies.
- Improved WQ is sometimes an expected result of oyster reef restoration.
- See TNC Monitoring Handbook for water quality methods.
- Consider Secchi & transparency tubes & field turbidity meters.
- Need SOPs & suggested equipment.

Discussed Shoreline Protection:

- Is Shoreline Protection a goal for CHNEP Oyster Restoration? Yes, as an option for objectives for some specific projects. May need a better title.
- ***Include Adjacent Habitat Protection as a project objective &/or benefit, as a secondary benefit (not the primary).***
- Shoreline protection or adjacent habitat protection is not something all projects are going to do. Shouldn't be a required goal of CHNEP region-wide oyster restoration. Could do oyster restoration for the protection of salt marsh, sediment stabilization. See TNC Monitoring page 14 – measure edge of shoreline & habitats near oyster bar. Could also be hurricane & property protection & help with tourism & economy.
- Need to identify state ownership line that remains after accretion – otherwise state ownership moves with mean high water line. Need to clarify the purpose of restoration project isn't filling state lands to create uplands above MHWL.

- In Aquatic Preserves, projects need to be in the public interest. Oyster restoration is a positive public interest because it is good habitat restoration except if used as "breakwater" to accrete land for private benefit.

Discussed Other Environmental Indicators & Success Criteria:

- Invasive species needs monitoring – lionfish, green mussels, Calurpa, exotic sea roach

5. Potential Oyster Restoration Techniques - Jaime Boswell, contractor to CHNEP (See PowerPoint presentation slides 15 - 19)

General Oyster Restoration Technique Considerations:

- See Brumbaugh & Coen 2009, Manley et al 2010
- Substrate materials (oyster shell, other shell, fossilized shell, sandstone, limestone etc.)
- Bagged/Contained Cultch (FGCU & SCCF)
- Loose Cultch (FDACS small barge method)
- Spat sticks
- Community Restoration (e.g. oyster gardening at docks)

Oyster Substrate Restoration Substrate (see slide 15):

Materials

- Fresh Oyster shell
- Fossilized Oyster shell
- Other shell (clam, whelk)
- Sandstone
- Limestone
- Cement – loose recycled
- Cement reef balls
- Vertical stakes (e.g. spat sticks, bamboo, wood) – good in high sedimentation areas
- Need to Consider
  - Interstitial Space - important
  - Vertical orientation in intertidal (Bahr & Lanier 1981)
  - Aging of fresh shell – to decrease disease & parasites
  - Availability/cost of materials
  - High-energy areas
  - High-sedimentation areas
  - Depth of water

Technique Examples (see slides 17-19):

- Bagged cultch
  - used for ecosystem restoration (Brumbaugh & Coen 2009)
  - SCCF – Clam Bayou - 4,200 bags/100 tons = 750 m^2
  - FGCU – numerous sites throughout Caloosahatchee Estuary & Estero Bay
  - SBEP – bagged shell around loose shell
- Caged cultch
  - high energy, shoreline protection (TX TNC project in Brumbaugh & Coen 2009)
  - Outperformed bagged shell in high sedimentation area in GA (Manley et al 2010), but not as good a stakes
- Loose cultch
  - fishery and/or ecosystem restoration, typically subtidal (Brumbaugh & Coen 2009)
  - Not good in areas with moderate to heavy boat traffic (Brumbaugh & Coen 2009)
  - Estimated cost - $100,000 per acre (Brumbaugh & Coen 2009)
- FDACS – Cedar Key Area - *Hoglet* (12' x 30' x 36") capacity of 24 cubic yards, 5 mph effective speed, 30 inch loaded draft & a working range of 5 to 6 miles
- Martin County – areas > 3 feet deep. 31 acres restored
- Vertical stakes

- Intertidal provides – vertical relief, good where sedimentation is an issue, outperformed bagged & caged treatments (Manley et al 2010)
- Community Restoration
  - Shallow water bag deployment
  - Bag filling
  - Oyster Gardening – keep oysters on dock. See Fl Oceanographic Society methods. is this ok in non-Shellfish Harvesting Areas?
- Use mats in Mosquito Lagoon = mats "quilted" over loose shell.
- Need to consider permitting requirements.

6. Pre-restoration & Post-restoration Monitoring - Jaime Boswell, contractor to CHNEP (See PowerPoint presentation slides 20 - 14)

Note: Because the meeting was running late, the Working Group read through the Restoration Monitoring slides without discussion & members were requested to provide comments to Jaime via email within a short time period, as specified in a follow-up email.

Pre-Restoration Monitoring - Site-Specific Considerations (slide 20):
Consider why are oysters not present &/or self-sustaining now
- Substrate limitation
- Recruitment limitation
- Water quality
- Water quantity
- Predation/disease

Suitability Assessment Metrics
- Substrate/landscape
- Recruitment (March-Oct)
- Temp, salinity, DO
- Sedimentation
- Water flow/flushing
- Predators
- Disease
- Wave action/boat traffic
- Seagrass

TNC Oyster Restoration Monitoring (slide 21):
- Before – After – Control – Restoration (BACR)
- Abundance, Density, Size Frequency – annually for a minimum of 5 years, ¼ m^2 quadrat excavated to 10-15 cm, use sampling trays embedded in reef which are non-destructive
- Recruitment – settlement collectors, use to infer relative magnitude & distribution
- Habitat Value – lift nets, drop nets, seines, gill nets, divers, video, trays
- Water Quality – TSS, Chl a, water clarity, seagrass abundance
- Shoreline protection – shoreline migration relative to reference, change in vegetative cover

SCCF *Pre*-Restoration Monitoring (see slide 22):
Consider what you need to measure before restoration to adequately test success criteria
- Native Oyster Density/Recruitment
- Resident Reef Community Composition
- Reef Relief
- Water Quality
- *In situ* Seston Uptake
- Seagrass

SCCF *Post*-Restoration Monitoring (see slide 23):

- Recruitment, growth, invertebrate reef residents - 0.125 m^2 trays, at 8 months & 14 months
- Reef Survey – Reef relief & footprint
- Seston Uptake – *In situ* flourometry, up-tide & down-tide
- Water Quality – Temperature, DO, salinity, turbidity, chlorophyll *a*
- Seagrass

CERP Monitoring (see slide 24):

- Sites along Salinity gradient
- Oyster density – spring & fall, using ¼ m^2 quadrat
- Condition index – monthly
- Recruitment – monthly, using stringers
- Reproductive & Disease – monthly
- Juvenile growth & water quality mortality – monthly, using bagged oysters
- Water quality – depth, temperature, salinity, conductivity, pH, dissolved oxygen & turbidity

Discussion of Monitoring Requirements to Be Conducted via Email:

- ***Considerations for pre-restoration monitoring:*** water quality & temperature, recruitment, disease, predation, water flow, sedimentation
- ***Considerations for post-restoration monitoring:*** relate back to success criteria

7. Next Tasks, Duties & Schedule – SW FL Oyster Working Group Participants

- Jaime will email Meeting 2 notes with request for comments by the end of the week.
- Working Group participants will provide comments on Monitoring Techniques, as well as GIS Model Components & Success Criteria ASAP.
- CHNEP & SWFRPC will conduct GIS Oyster Restoration Habitat Suitability Analysis.
- Meeting 3 of Working Group will be Friday May 25 to review draft maps of potential oyster restoration areas. The meeting will be in Fort Myers at SWFRPC from 12:30 – 4:30 pm.
- CHNEP staff & contractor will begin writing plan.
- Regulatory sub-working group will meet to discuss variety of regulatory considerations.
- Meeting 4 of Working Group will be Tuesday June 19 to review draft plan. The meeting will be in Fort Myers at SWFRPC from 8:00 am – 12:00 pm.
- Draft CHNEP Oyster Restoration Plan will be presented to TAC Wednesday July 11 (agenda packet due July 4).