Schedule for Big Bend Oyster Restoration Meeting

11 April 2011
Florida Wildlife Research Institute Lab
11350 SW 153rd Ct, Cedar Key, Florida

0900 Meet at Florida Wildlife Research Institute Lab. This is the long, elevated blue building on your left as you come over the first bridge into Cedar Key).

0900 – 0915 Introductions, background, goals, and schedule for the day. Peter Frederick, Department of Wildlife Ecology and Conservation, University of Florida.

I. Brief overview of ongoing research and restoration activities in Big Bend


0930 – 0945 Oyster population dynamics in relation to salinity and energy in the Big Bend. Bill Pine, Department of Wildlife Ecology and Conservation and Fisheries and Aquatic Science Program, University of Florida.

0945 – 1000 Oyster dynamics and predator communities. David Kimbro, Florida State University Marine Lab.

1000 – 1015 Aquaculture and habitat restoration in the Big Bend. Leslie Sturmer Fisheries and Aquatic Science Program, University of Florida

10:15 – 10:30 Oyster habitat restoration activities in Big Bend. Mark Berrigan, Division of Aquaculture, Florida Division of Agriculture and Consumer Services.

1030 – 1040 Break

II. Synthesis and steps towards restoration

1040 - 1100 Discussion of oyster habitat restoration in Big Bend – goals

1100 – 1200 Uncertainties in restoration methods and resilience.

1200 – 1300 Lunch at the lab

1300 – 1700 Development of restoration plan outline, Funding and enactment strategies.
Nicole Adimey, Coastal Restoration Program, U.S. Fish and Wildlife Service, Jacksonville Fl.
Shirley Baker, Fisheries and Aquatic Sciences Program, School of Forest Resources and Conservation, University of Florida
Mark Berrigan, Bureau of Aquaculture Development, Florida Department of Agriculture and Consumer Services, Tallahassee FL.
Melissa Charbonneau, Big Bend Seagrasses Aquatic Preserve, Florida Department of Environmental Protection
Jerry Beckham, Cedar Key Oysterman’s Association
Janelle Brush, Florida Fish and Wildlife Conservation Commission, Gainesville, Fl.
Anne Birch, Coastal Restoration Program, The Nature Conservancy, FL.
Peter Frederick, Dept. Wildlife Ecology and Conservation, University of Florida.
Steve Geiger, Florida Fish and Wildlife Conservation Commission
Boze Hancock, TNC-NOAA National Partnership Coordinator, The Nature Conservancy
John Kasbohm, Lower Suwannee National Wildlife Refuge
David Kimbro, Florida State University Coastal and Marine Lab
Marti McGuire, Marine Habitat Specialist, NOAA, Tampa FL.
Maria Merrill, Marine and Estuarine subsection, Florida Fish and Wildlife Conservation Commission
Bill Pine, Dept. Wildlife Ecology and Conservation and Fisheries and Aquatic Sciences Program, University of Florida, Gainesville, FL.
Ellen Raabe, U.S. Geological Survey, St. Petersburg, FL.
John Scarpa, Harbor Branch Oceanographic Institute, Florida Atlantic University.
Darlene Smith, Levy County Soil and Water Conservation District
Leslie Sturmer, Cooperative Extension Service, Fisheries and Aquatic Sciences Program, School of Forest Resources and Conservation University of Florida, Cedar Key FL.
Summary of Big Bend Oyster Restoration

11 April 2011
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11350 SW 153rd Ct, Cedar Key, Florida

Participants:
Patrick Baker, Fisheries and Aquatic Sciences Program, School of Forest Resources and Conservation, University of Florida
Mark Berrigan, Bureau of Aquaculture Development, Florida Department of Agriculture and Consumer Services, Tallahassee FL.
Melissa Charbonneau, Big Bend Seagrasses Aquatic Preserve, Florida Department of Environmental Protection
Sue Coulson, former Mayor of Cedar Key, and longtime commercial oysterwoman.
Janelle Brush, Florida Fish and Wildlife Conservation Commission, Gainesville, Fl.
Anne Birch, Coastal Restoration Program, The Nature Conservancy, FL.
Peter Frederick, Dept. Wildlife Ecology and Conservation, University of Florida.
Steve Geiger, Florida Fish and Wildlife Conservation Commission
John Kasbohm, Lower Suwannee National Wildlife Refuge
David Kimbro, Florida State University Coastal and Marine Lab
Maria Merrill, Marine and Estuarine subsection, Florida Fish and Wildlife Conservation Commission
Bill Pine, Dept. Wildlife Ecology and Conservation and Fisheries and Aquatic Sciences Program, University of Florida
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John Scarpa, Harbor Branch Oceanographic Institute, Florida Atlantic University.
Leslie Sturmer, Cooperative Extension Service, Fisheries and Aquatic Sciences Program, School of Forest Resources and Conservation University of Florida, Cedar Key FL.

Synopsis of presentations:
Jenn Seavey - GIS analysis of oyster habitat dynamics, 1983 – 2010. Aerial photography was examined from 1967 through 2010 to assess changes in extent and type of oyster bars from Wacassassa Bay to Horseshoe Beach. An apparent decline in total habitat occurred through 2000, and then a marked increase from 2000 – 2010. The majority of the decline was on economically important offshore bars, with complete collapse of most parts of the Suwannee reef complex, the Lone Cabbage chain, and the outer Corrigan’s reef. The apparent increase from 2000 – 2010 was due largely to the rapid expansion and loss of elevation on the offshore and nearshore sand/oyster bars following loss of oyster structure on them (the latter borne out by ground trothing). So there was likely a massive decrease in total oyster area during those years. Inshore marsh/oyster habitat increased modestly during the same period, but
the acreage lost offshore was overwhelmingly larger than the increase at inshore sites. Causes of decline are unclear, but the steady reef decline does correspond to a sharp decrease in the Suwannee River discharge/rainfall ratio, and a series of very low freshwater flow events consequently occurred during 1995 – 2008. Decrease in freshwater flow is very likely to be a driver of reef loss, both by increasing disease related mortality and by increasing the prevalence of predation on spat and juvenile oysters. Note resilient bars are those that are close to freshwater sources like mouth of Suwannee, or springs located in nearshore waters. Intense storms may offer a tipping function by breaking up oyster structure once oysters are largely dead.

**Bill Pine - Oyster population dynamics in relation to salinity and energy in the Big Bend.** Unlike many areas currently receiving oyster restoration attention, the Big Bend has until recently (1990s) supported a large and significant fishery, and continues to support harvest at a lower level today. Past workshops and research have suggested that recruitment and predation rates have changed markedly in the area as a result of decreased freshwater discharge, and coupled with storm events, have resulted in the loss of offshore oyster habitat. Sampling across salinity and wave energy gradients at four major sites with 3 replicates each in the Big Bend coastline, we have measured changes in density, proportion live/dead, spat settling and spat survival since June 2010. Inshore sites consistently show the greatest stability, highest densities, and greatest proportion of live oysters, and offshore sites the lowest. While spat data are still undergoing analysis, it suggests an excellent supply of larvae at all sites, but lower survival and a lack of appropriate substrate at offshore sites. Generally, this monitoring program shows excellent statistical ability to detect change in populations of oysters at the level of the bar, either in response to continued declines, restoration effects, or oil spills.

**David Kimbro - Oyster management involves understanding the interplay between harvest, disease, predation and growth.** The Kimbro lab is currently involved with ongoing oyster work at multiple sites on the Gulf and East coasts, designed to test the hypothesis that differences in predator communities may be driving the responsiveness of oyster populations to predation in terms of survival. Locally, information from sampling sites at Cedar Key suggests that densities of Xanthid crabs and fishes at the local bar level is associated with survival of spat. At the scale of estuaries, the role of freshwater in harvest is unclear. While harvest seems to be generally depressed in years with high freshwater inputs, harvest two years following is often enhanced. It is possible that oyster closures during high flows may contribute to this pattern, but mortality of adult oysters also occurs in high freshwater flow situations. The role of freshwater inputs to dynamics in oyster populations is therefore somewhat controversial and may vary quite a lot by site.

**Leslie Sturmer - Aquaculture and habitat restoration in the Big Bend.** Hard clam aquaculture was initiated in the early 1990s as a retraining program in the Cedar Keys area for oystermen out of work because of the decline of oyster reefs, and has developed into a major area industry. This means that there is intense vested interest in water quality in the area. The clam industry produces large quantities of clamshell which can and has been used locally as culch to enhance oyster beds. In addition, abandoned clam leases result in large numbers of derelict clam bags that are colonized by oysters and can be used as restoration material. Derelict bags contain an average of 8,000 live oysters, and are high
quality cultch that can be used to stabilize bars and direct water flow because of their durability. One artificial reef has been created off of Atsena Otie key, and has resulted in a living reef now 4 years old. An estimated 20,000 derelict bags and a workforce provided by local watermen are available for reef building.

Mark Berrigan Oyster habitat restoration activities in Big Bend.- The Florida Division of Agriculture’s aquaculture program is responsible for augmenting and enhancing shellfish reefs in the state, and the use of cultch materials (shucked oyster shell, limerock and fossil shell) have been used extensively in the Apalachicola fishery. In the Cedar Key area, locally produced clam shell has been used successfully as a cultch material, with high spatting rates and good survival on some bars. Historically, many gaps in long reefs such as Corrigan’s and Suwannee reef were placed or enhanced by local fishermen, and are thought to be important to the production of oysters. Creation of gaps has not been practiced for decades, and it is suggested that creation of gaps and areas of high flow may be integral to the restoration of oyster reefs in the area. As well, much of the offshore reefs have become flattened and will not retain live oysters without the creation of vertical relief and addition of durable substrate.

Discussion:
1) What would be the goals of an oyster restoration effort in the Big Bend area? To be more specific, what values or attributes would you like to see come from a successful effort in 10 years time?

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<tr>
<th>Successful fishery</th>
<th>Structure/stabilization</th>
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<td>Food Web Dynamics</td>
<td>Positive shell balance (production&gt;loss)</td>
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<td>Structure at a landscape level</td>
<td>Successful migration of oyster habitat inland</td>
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<td>Increase in total habitat</td>
<td>Maintain local way of life</td>
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<tr>
<td>Ecological and economic services</td>
<td>Functional/sustainable oyster habitat</td>
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<td>Diversity of habitats with functional connectivity.</td>
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Many of these were overlapping, and participants were allowed three votes for the most important of these. Ecological and economic services, Functional/sustainable habitat, Way of Life, Diversity of habitats, and Successful migration all scored very high.

2) Which of the restoration values/attributes/goals that we have proposed are incompatible?
- Is a fishery incompatible with restoration of ecological values? General agreement on NO
- Must restoration be allowed to proceed for some time before harvest can begin? Perhaps, but oysters live short lives here (1.5 years) and reef establishment can be rapid. Further, harvestable oysters require unique conditions to be produced, which only rarely occurs on most reefs.
- Is planning for reef inland migration in conflict with maintain reef type diversity? Not if a gradient/diverse approach is taken.

3) Are all the goals supported by all participants?
Yes. Note that the local community is very poorly represented at this meeting for logistical reasons. However, indications are that all of these values would be embraced locally.

4) are there any goals/values that are not supported by any participants – can we get behind them all? Yes.

5) What are the uncertainties about or roadblocks to restoration?
(This was a long discussion that occupied most of the afternoon.)

- **Permits, permission.** Long lead time on USACE permits and Endangered Species permits. Not clear that there are any endangered fishes that would be affected, and turtles would probably be enhanced through enhancement of oyster habitat. Endangered birds would probably be affected positively (shorebirds, oystercatchers, Wood Storks, seabirds) by restoration.
- **What processes and attributes do we need to restore** in order to restore AND maintain oyster reefs? Recognition that multiple factors are at play – see attached photo of relationships between salinity, predation, disease, oyster survival, recruitment rates, and substrate.
- **Discussion about hard and soft substrate** – will cultch stay where it is put on offshore bars? Do we need a combination of types of substrate (eg cultch surrounded and buffered by walls of derelict oyster bags)? Use of bags on edges of and to create high flow areas... Use of different materials?
- **If current bars are gone, should we attempt to put them back in the same place** or in more resilient places – eg closer to freshwater sources... General agreement that we cannot restore some of the bars.
- **Scale of restoration** – restoring entire reef complexes seems out of the questions – billions of dollars. Can we do something smaller scale that we can learn from and achieve results with? Probably but cannot answer larger scale questions with small experiments.
- **Entrainment behind chains of reefs** – certainly happened at Lone Cabbage and Suwannee reefs, probably at Wacasaasa too. Entrainment of freshwater on landward side probably was self-reinforcing and may have buffered reefs from fluctuations in salinity. Can we restore entrainment? Possibly in the long run, no in the short term.
- **How large should restoration be?** Many answers here. To achieve all goals (eg sustainable fishery, large scale storm abatement), restoration needs to be done at a large scale in many locations on the coast. This is something to work towards, and large projects like this are underway in other places. However, we need some proof of concept because the area is quite different from other estuaries. A proof of concept was suggested to be between 3 and 30 acres in extent, and up to 2 km long.

**Summary of this discussion** – We have strong reasons to believe that freshwater flow, persistent structure, gaps in reefs that concentrate flow, predation rates, entrainment and storm events are likely to be major drivers of the restoration and maintenance of oyster reefs. We can proceed with adaptive restoration by incorporating these variables in the design of a series of pilot restorations so that we enhance our increase in knowledge as restoration progresses.
One of the stronger scenarios for degradation of bars in this area involves a sequence – an extended period of reduced freshwater flows leads to increased adult mortality (disease) and poor recruitment, effectively driving oyster populations down rapidly. This is followed by a degradation of reef structure by storms and wave action, effectively dispersing hard substrate and leaving a sand/shell bar. Normal recruitment to these sites is then poor even under good conditions, because spat are very vulnerable to predation in open, flat substrate. Note that boat wakes, pollution, and overharvest were generally not believed to be important drivers of reef degradation in this area. As well, larval supply is thought to be robust throughout the Big Bend – backed up by numerous observations, and some spat sampling data.

To reverse this process it is argued that substrate enhancement is required in some form, by increasing elevation (“fluffing”), adding more microtopography (refugia for oyster spat) and/or by establishing semi-permanent substrate that is relatively durable to wave action. These actions will work only if there is adequate freshwater flow to moderate salinity however.

A possible restoration scenario that we can agree on: Lone Cabbage

This site offers an immediate source of freshwater (East Pass of the Suwannee), a distinct salinity gradient (inshore vs. offshore as well as distance from East Pass), historically important reefs of which several still exist with remnant oysters, a history of entrainment (now degraded) and a wave disturbance gradient (inshore vs. offshore sites).

Existing bars offer the structural base for adding cultch and other structure, and the offshore part of the barrier offers the chance to measure storm abatement effects of restoration, as well as a test of whether a restored bar can keep up with SLR.

The site is in a very clean watershed with no known pollutants, there is very low boat traffic and no large boat traffic, there is no harvest ongoing on the site, and there are no conflicts with existing aquaculture. There is likely to be an option of declaring the site temporarily closed to harvest during restoration activities. This site also offers a number (up to 10) existing bars that could be used as replicates or treatments of different cultch materials or other treatments.

Negatives about the site include that it is distant from much human activity and therefore has low public visibility. This was also noted as a plus. Similarly it is currently very degraded as oyster habitat indicating its restoration potential may be low. The counterargument is that it this is exactly where restoration might succeed in reversing trends.

The bare bones of this particular restoration scenario included deposition of cultch materials with buildup of bars and deepening of cuts and passes where historically appropriate. Cuts would be armored (with controls) with some sort of durable structure. Treatments would be replicated both along the offshore bar, but at nearby inshore and nearshore sites where degraded bars exist. Monitoring would include both treatment and locally appropriate nontreatment bars. It was suggested that many organisms besides oysters should be monitored including birds, fish, inverts.
There was general interest from numerous agencies and institutions in being involved in this ongoing work, and though no one had any money to contribute, there may be considerable expertise and monitoring capacity that can be provided by the attendees. We agreed to stay in touch and offer assistance as opportunities for funding arise.