*Promoting resilience in nearshore communities along Florida’s Big Bend and Forgotten Coast*

Oyster reefs are significant biological communities which support considerable biodiversity, provide keystone habitat for juvenile fish, forage fish, invertebrates, and birds, and support economically important fisheries. Oyster reefs also function as barrier islands in many areas dampening wave action to reduce coastal erosion and protect human coastlines and coastal communities from storm damage. Oyster reefs have declined throughout the Gulf of Mexico including Florida’s Big Bend and Forgotten Coast (approximately Cedar Key to Port St. Joe) a coastal region unique in the Gulf of Mexico because of its low energy shoreline habitats dominated by sea grass meadows and oyster reefs, low human population density, and high percentage of coast line under state or federal management. Reasons for these declines are uncertain. However, recent evidence suggests that reductions in freshwater flow, coupled with storm events, may trigger a cascading decline in oyster reef resilience through loss of suitable spat settlement substrate and high juvenile mortality rates leading to a low-abundance steady state limited by available habitat and freshwater inputs. Under this scenario, re-establishment of historic oyster reefs may not be possible unless (1) suitable substrate is provided, (2) freshwater inputs are retrained to promote juvenile oyster survival, and (3) oyster shell substrate is allowed to accrue through natural mortality (i.e., positive shell budget).

The overarching theme of these two projects is improve the resilience of coastal regions along this coastline by promoting resilience of oyster reefs as a conservation proxy to enhance other key coastal ecosystem constituents such as water quality and essential habitat for fish and wildlife species. This is done by scaling-up successful oyster restoration programs in Apalachicola Bay following Hurricane Elena by an agency-industry partnership and in Suwannee Sound by a university-industry-agency coalition which provided measurable benefits to the target ecosystems and their human users. These efforts are science based and designed to allow separable assessment of different restoration techniques as well as resilience to factors such as effects of fishing, changes in freshwater inputs to coastal ecosystems from changing climate, or storm events. By assessing these factors, these programs can evolve over the project life to maximize investment return measured both in terms of ecosystem benefit and knowledge gained.

Apalachicola Oyster Resilience Network

Partners: FDACS, FWC, University of Florida. SMAART, ACF Stakeholders, TNC, and other NGO, community and conservation organizations throughout

Contacts: Steve Geiger, FWC; Bill Pine, UF; Kal Knickerbock FDACS; Jim Estes, FWC

*Background-* The Apalachicola River watershed including Apalachicola Bay is one of the most biological diverse ecosystems in the US. Within Apalachicola Bay, ecologically and economically significant oyster reefs are currently in a degraded state likely due to a combination of factors including (1) extreme drought which may have increased natural mortality rates, (2) cumulative effects from multiple tropical weather events, (3) high harvest rates. While Apalachicola Bay has a long history of oyster restoration activities, the long-term success of these projects measured in terms of promoting resilience of oyster reefs to disturbance is limited. Promoting resilience to disturbance should be the key objective of restoration actions for oyster reefs particularly as environmental factors (e.g. freshwater flows into Apalachicola Bay) are very likely to become more variable in the near future due to changing climate and water management decisions. This necessitates that restoration be done in an adaptive framework that allows the testing of different restoration strategies under a range of environmental and fishing practices to identify practices that promote resilience in oyster reefs.

*Methods-* Using knowledge from prior restoration activities in Apalachicola following Hurricane Elena, we propose to simultaneously restore portions of degraded oyster bar while addressing three key areas of uncertainty: (1) what density of cultch material is required to promote oyster reef establishment, (2) what are the effects of fishery removals on oyster reef recovery and resilience, (3) what is the role of freshwater flow in promoting oyster reef persistence. These uncertainties have not been adequately addressed previously and are essential to informing restoration and fisheries management plans in Apalachicola Bay and elsewhere. We will restore small, replicate oyster reefs in Apalachicola Bay (~500-1000 acres total over 10 years) across a salinity gradient from the Apalachicola River throughout the bay each at one of three cultch densities. Following restoration the oyster reefs should be closed to fishing to allow spat settlement. Oyster reefs will be surveyed quarterly to track settlement densities, growth, and mortality of live oysters, cultch, and oyster predators. To assess the effects of fishing on oyster reef restoration restored oyster reefs will not be opened to harvest until three different specific densities (low, medium, high density, plus no fishing control) are sequentially met. As an example, all reefs must support 10 legal oysters/ m2 (DACS low density standard) before 25% of the reefs are open for fishing, while others remain closed until the next threshold is met when an additional 25% of the reefs will be open. Reefs for harvest will be chosen across the salinity gradient. Surveys will be conducted at bi-monthly intervals to track changes in oyster density, predator density, disease, and water quality. This approach should provide insight onto how rapidly oyster reefs recover to harvestable levels across a range of cultch density, the rate at which new cultch and live oyster material develop on an oyster reef, and the rate at which harvest removes both live oysters and cultch material across a range of salinities. This work will be done over a 10 year period to match recent drought cycles. This project will provide a mechanistic understanding of key factors structuring oyster reef communities while simultaneously developing both a network of restored reefs in Apalachicola Bay but also the blueprint for future restoration programs for oyster resources in one of Florida’s most valuable coastal ecosystems.

Total cost over ten years: $7,174,036 (Agency part = $5,567,786, UF part = $1,606,250)

Reduce project to 7 years: $5,567,786 total

Budget



Restoring Oyster Reefs through Reclamation of a Shellfish Aquaculture Industry in the Big Bend of Florida's Gulf Coast.

Partners: Levy and Dixie County Soil and Water Conservation Districts, Cedar Key Oysterman’s Association, Cedar Key Aquaculture Association, FWC, FDACS, University of Florida.

Contacts: Dr. Peter Frederick, Dr. Bill Pine, (Dept.Wildlife Ecology and Conservation), Leslie Sturmer (Department of Fisheries and Aquaculture, School of Forest Resources and Conservation), University of Florida. [pfred@ufl.edu](mailto:pfred@ufl.edu), billpine@ufl.edu , [lnst@ufl.edu](mailto:lnst@ufl.edu).

Oyster reefs are critical coastal biological communities that support considerable biodiversity, provide keystone habitat for juvenile fish, forage fish, invertebrates, and birds, and support economically important fisheries. Recent studies have shown a net loss of 66% of natural oyster reefs in Big Bend (Horseshoe Beach to Waccasassa Bay) in only 30 years. Loss of oyster reefs in this area has been linked to repeated episodes of reduced freshwater inputs from the Suwannee River, resulting in high salinity and associated mortality events from disease and predation. This is a one-way process: Once oysters have been eliminated from these historic reefs (2,800 – 4000 yrs old), erosion accelerates and the substrate becomes permanently inappropriate for spat settlement. Two interventions are proposed to make reefs more resilient to future uncertainty in freshwater flow: 1) restore bars close to freshwater sources, and 2) restore habitat by using durable substrate so that oysters can recolonize via larvae following future high salinity events. Healthy oyster reefs can easily grow vertically much faster than even future rates of sea level rise, and therefore present a living, self-regenerating solution to coastal erosion. Along with traditional cultching techniques, this project will use a unique, local source of durable substrate – oyster-encrusted clam aquaculture bags. Encrusted bags (cf 20,000 available) are considered a nuisance to the local aquaculture industry but contain an average of 8,000 live oysters each. Given their weight (to 400 lb) and cohesiveness, they constitute cheap and durable live oyster reef building blocks. One reef has already been built in 2007, and has passed all restoration criteria. This project aims to use this tested technique to restore primarily long-shore chains of higher energy offshore reefs because of their keystone function in entraining freshwater in the estuary. Restoration of these reefs leverages ecological function and habitat quality to a much broader area than the reefs too, affecting production of sport and commercial fisheries, nearshore shellfish, and coastal birds. Over a 6-yr period, this project will restore 62 acres (2 linear miles) of high quality reef, which is estimated to improve salinity and wave energy conditions on an additional 200 acres of oyster reef, and entrain freshwater for an additional 54,000 acres of estuarine marsh complex. This restoration is also estimated to provide storm protection for 7.5 miles of coastline from the Suwannee River to Wacassassa Bay.

Total cost over six years: $3,617,801

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| **Cost Appendix Sheet** | |
| **Cost Item** | **Cost Estimate** |
| **Planning** | |
| Contracts | $0.00 |
| Feasibility | $51,870.00 |
| Engineering, Design, Land Rights, & Bid Prep | $80,000.00 |
| Restoration Plan | $25,935.00 |
| Site Visits & Cost of Site Selection | $8,645.00 |
| Administration, Overhead and Indirect | $18,661.00 |
| Other (education and outreach) | $120,960.00 |
| **Planning Subtotal:** | $306,071.00 |
| **Construction** | |
| Contracts | $1,875,000.00 |
| Administration & Mobilization/Demobilization | $416,571.00 |
| Other (overhead) | $239,237.00 |
| **Construction Subtotal:** | $2,530,808.00 |
| **Monitoring** | |
| Contracts | $72,250.00 |
| Data Collection | $341,147.00 |
| Monitoring Administration | $115,551.00 |
| Other | $251,974.00 |
| **Monitoring Subtotal:** | $780,922.00 |
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| **Subtotal:** | $3,617,801.00 |
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| **TOTAL:** | $3,617,801.00 |

Talking points:

1. NFWF has funded related work in Suwannee Sound. This small section of coastline hosts up to 1/3 of the nation’s American Oystercatchers, and FWC/UF studies have shown that these birds are highly dependent on these disappearing offshore reefs for nighttime roosts. NFWF funded this work, and in the pre-Deepwater Horizon world had expected to fund Phase II, which involved restoration of reefs themselves.
2. This project is a resilient solution to uncertainties in climate change and sea level rise.
3. This project has large benefits to the local community in forming storm abatement structures and long term employment of sport fishing and commercial fishing professionals.
4. “Oyster reef building blocks” are continuously produced as a by-product of the aquaculture industry – this provides the opportunity for continued construction and repair in the future.
5. An unintended consequence of this project is that 200 acres of state clam leases will be rehabilitated to productive condition, enhancing a highly green and sustainable local industry.
6. The methods for extracting, removing and placing encrusted clam bags in a durable reef have already been developed and tested.
7. Part of the funds are used to purchase a barge for reef building operations. This enhances the chances that employment will be local and restoration activities will continue in the future.
8. Traditional cultch will be in the form of recycled local clam and oyster shell from restaurants and industry. Together with the encrusted clam bags, all cultch will be from local sources and does not present a further demand on gulf-wide oyster shell reserves.