March 2, 2010

GROWING OYSTERS ON TREES IN APALACHEE BAY, FLORIDA

A Proposal to the Wakulla County Commission from Gulf Specimen Marine Laboratories, Inc., presented by Jack Rudloe, President

Gulf Specimen Marine Laboratory is seeking a grant of $18,271.00 from the Wakulla County Commission for a educational demonstration project that would grow common eastern oysters, ***Crassostrea virginica***, on trees and woody shrubs in Apalachee Bay and adjacent waters of Wakulla County. We have been a pioneer in developing new fisheries over the past forty years, ranging from developing drugs from the sea for the pharmaceutical industry to pioneering the rock shrimp and bulldozer lobster industry, and developing a market for cannonball jellyfish for Asian cuisine.

Oyster-culture techniques utilized by Native Americans have been lost in antiquity, but early Indians most certainly harvested oysters from easily-accessible woody structures along the bay shores of the northern Gulf of Mexico. Modern people have been growing oysters on trees since 1801, when a cherry grower trimmed the branches of his grove and tossed the brush into the canal behind his farm, and it grew so many oysters that he went into the oyster business. The 1926 issue of *Popular Science Magazine* had a big article on the former U.S. Bureau of Commercial Fisheries planting Long Island Sound and much of the Connecticut shore with birch trees which they said grew the best oysters. Oyster farmers in Australia catch spat and grow oysters on tar-covered wooden sticks assembled in lattice structures for ease of handling. Similar methods are used in Thailand, Vietnam and Laos using bamboo racks.

In recent years, Wakulla County's oystermen have found it increasingly difficult to make a living because oysters have grown scarce, and the traditional bars that were previously harvested are no longer productive. If viable oyster fishing and culture are to survive, new and innovative ways must be found to cultivate oysters, to take pressure off wild stocks, and to develop a viable aquaculture program. Oysters grow on submerged wooden structures and trees naturally. One can clearly see them growing on fallen oaks and pines at the Wakulla County Mashes Sands Park in Panacea. Coastal live oaks, slash pines, and palmettos that are uprooted by storms and coastal erosion and washed out onto the intertidal zone soon become overgrown by oysters and other marine and estuarine fouling organisms.

Driftwood and snags, that wash down from rivers are a natural part of the ecosystem and becomes part of the food chain, as they are broken down by wave action, wood borers, fouling growth, and marine bacteria that soon reduce the wood to detritus. These tiny particles enter to food chain to become food for scavenging shrimp, crabs, juvenile fish of all species, and especially mullet and oysters. Trees in the intertidal zone soon become overgrown with oysters and barnacles, which fall to the bottom and turn the soft unconsolidated muddy bottoms into hard substrate that may create productive oyster bars over time.

Based on preliminary research at Gulf Specimen Marine Laboratory, we've proven that this rudimentary technology can be highly successful. We inadvertently discovered that oysters could be successfully grown on trees when we started hanging untreated blocks of wood off our

floating dock to attract wood-boring organisms to meet the needs of our research and teaching customers. Before then we just went beach combing, looking for wood that was cast up on the shore that was riddled with holes. However since driftwood is not always available, we began hanging blocks of untreated wood off our dock to culture shipworms and the wood-boring isopods known as “gribbles,”

As expected, the surface of the untreated wood soon became overgrown by oysters, while shipworms and gribbles devoured the interior. But cutting, drilling, hanging, and attaching the untreated blocks proved costly and labor intensive, so the lab experimented with hanging brush from the dock, or piling it up on the mud flat under the dock and thereby discovered that in a year or less, oyster larvae attached to the branches and oysters grew to harvestable size. The brush piles also greatly benefitted the environment and made the “Living Dock” a hotspot for recreational and commercial fishing. Schools of mullet, trout, and redfish became even more plentiful as the brush piles became overgrown with fouling organisms that attracted small crustaceans and fishes which trout and mullet feed on.

Fish and game commissions and natural resource agencies throughout the world have placed brush piles in freshwater lakes, ponds, and streams to increase fish populations and their forage species. While brush piles provide cover, they also are a source of food for detritus and deposit feeders and predators alike. Bacteria and wood borers in the marine environment break the wood down into tiny organic matter called detritus, which becomes food for bottom dwelling invertebrates such as shrimp, crabs, worms, clams AND oysters as well as bottom-feeding fish such as mullet, spot, and croakers. Barnacles, hydroids, sponges, and oysters produce multitudinous eggs and larvae that feed small fish such as anchovies, pilchards, and killifish, and these in turn are eaten by redfish and trout. Because of the rapid growth of “tree oysters,” there is some speculation that the decaying wood itself may accelerate oyster growth by producing nutrients, bacteria, and detritus as well as providing a solid surface for attachment. The position of the "tree oysters" within the water column also promotes rapid growth compared with oysters that live along the bottom where sluggish currents and sediment deposition hinder their feeding and growth.

Shrubs and tree limbs cleared from private and public lands should be planted in strategic areas that are likely to grow oysters and their growth should be monitored. The validity and reliability of the planted "oyster trees" will be monitored and compared to the attachment and growth of oysters on other solid substrates such as mesh bags containing processed oyster shells and concrete blocks.

If the pilot project proves successful, it could provide a win-win solution. Local fishermen could develop their own oyster industry, increase ecotourism by being the only place where people could come to see and eat oysters growing on trees, thereby bolstering the economy. The county could utilize accumulation of wood wastes in land fills, thereby saving landfill space for other byproducts and debris.

By increasing its oyster population Wakulla County can also stimulate the clean-up of its bays and adjacent waterways. Ochlockonee Bay, Shell Point, and Alligator Point are periodically closed to swimming, because of high concentrations of fecal coliform bacteria which have a detrimental impact on the tourist economy. Oyster fishing is often halted after rains when bacteria levels rise, putting oyster fishers out of work and requiring seafood markets to import

oysters from other locations. By “growing" oysters on trees, off the bottom, in the water column, we will not only increase production of oysters, but will improve water quality which benefits both the commercial fishing and tourism industry.

Tree oysters and fouling communities also help purify the bottom sediments. When the wood decays the oysters fall off and continue to filter pollutants along the sea floor. Recently, natural resource agencies have been planting oysters in Chesapeake Bay to enhance water quality and reduce heavy metals and other pollutants. This was demonstrated recently in Florida by the Ocean Restoration Corporation and Associates when floating rafts with fouling growth in Captiva Island greatly improved water quality. Scientists filled two aquariums with highly-polluted, turbid water from finger canals in Sarasota, but only one contained a floating raft of oysters and sea squirts that turned the water crystal clear in a matter of hours.

Local landfills are filling up with brush from land-clearing and tree-trimming operations and tree oysters would reduce or eliminate that problem. The county hires a chipper to reduce the volume of tree debris and shrubs at the landfill, which is both costly and labor intensive, and the remaining piles still takes up space. Judiciously placed in the bays, brush piles will grow oysters and enhance and increase both recreational commercial fishing by providing habitat and cover and for juvenile shrimp, crabs, and fish. Fish havens have been used for centuries by game commissions in freshwater lakes. So, why not in the sea? The brush and leaf litter would add a substantial amount of detritus to the ecosystem, which would enhance the food chain.

Growing tree oysters is a win-win situation that will not only reduce the amount of tree debris and shrubs in landfills but will provide new sources of oysters for commercial fishermen, increase sports and recreational fishing, reduce coastal erosion, and improve water quality. Tree oysters may turn out to be a cleaner, more desirable oyster for the market than common mud oysters. Raised several feet or more above the bottom sediments, they are more likely to be free of mud, heavy metals, and petrochemical contaminants. It’s time that Wakulla County undertake an initiative that would help clean up the bays and give their beleaguered commercial fishermen start a new industry and make Wakulla County become a unique tourist destination, drawing people to a place where “oysters grow on trees.”

SCOPE OF THE WORK

Numerous state and federal agencies regulate or impact the oyster fishery, and one of the major challenges will be convincing them to issue permits and allow the pilot tree-oyster project to proceed. The former Board of Conservation and the Florida Department of Natural Resources (now part of the Florida Fish and Wildlife Commission and the Florida Department of Natural Resources) have been regulating and planting oysters in Apalachicola Bay for more than half a century. In Wakulla County and other areas, the Department of Agriculture has conducted oyster-relay programs, hiring local fishermen to move oysters from areas closed to shellfishing out to nearby waters that are approved for shellfish harvesting. Natural resource agencies in various East and Gulf Coast states including Maryland, Virginia, North Carolina, and Alabama have encouraging dock owners to become “oyster gardeners” by growing oyster spat in predator free cages to improve water quality, and to use the young oysters to start new oyster reefs and bars. The Bogue Sound Shellfish Gardeners formed a club in early 2003 and worked with North Carolina Marine Fisheries to legalize the gardening of shellfish. After a pilot project to

allow growing oysters under docks, North Carolina started issuing UDOC (Under Dock Culture) permits in 2006 where people can grow oysters for personal consumption.

Traditionally, processed oyster shells are planted in bays to provide a substrate for oyster spat to settle and grow on to increase oyster production and bolster the economy. While that methodology has proven successful, it is costly and permits only one surface to be colonized by oyster larvae, while the other lies buried in the mud. Trees on the other hand have greater surface area, and may be less costly to plant than processed shells, river gravel, crushed-concrete aggregate, or imported Mexican limestone. However, selling the various state and federal agencies on this new method could be a challenge.

Many biologists don't believe it's possible to grow oysters on trees and must be convinced by seeing it take place in the field. A trip to Gulf Specimen Marine Laboratory's "Living Dock" facility where a demonstration project is taking place should convince them otherwise. We can educate people to the fact that woody shrubs, trees, and branches are a natural part of the ecosystem, especially after torrential rains, hurricanes, and beach erosion where vegetation is washed out to sea. Even then, other regulators are likely to conclude that planting excess wood debris is dumping and a potential source of pollution, or that rafts of brush and tree limbs will become a hazard to navigation and safety. Such problems can be solved if the community works together with the state, creating experimental aquaculture management zones, cordoning off planting sites, and making them visible with PVC markers or buoys.

Working with fisheries scientists, oyster biologists, and oyster fishermen will help develop the best methods for gathering and bundling brush piles that will most easily allow the oysters to be harvested when they reach maturity. Their involvement will include not just manual labor, but their consultation on all aspects of the research, from choosing biodegradable ropes and weights, to developing better ways to plant brush in areas that are most likely to produce the largest oysters in the least possible time. Planting seasons that will minimize barnacles and other fouling organisms and enhance oyster-spat recruitment must be developed. Certain tree and shrub species may grow better crops than others and many local woody species should be tested for spat attraction and maximum utilization potential. For example in 1906 the former U.S. Bureau of Fisheries concluded the birch was the best tree to plant because it grew the best oysters.

We plan to meet with the following agencies and stake holders and present the idea:

COUNTY
Work Force Florida
Wakulla County Commercial Fishermen's Association
Franklin County's Oyster Fishermen's Association
Wakulla County Tourist Development Council
Wakulla County Solid Waste Department
Wakulla County Sheriff's Department

STATE
Florida Department of Aquaculture and Consumer Services
(Division of Aquaculture)
Florida Department of Aquaculture and Consumer Services

(Apalachicola Shellfish Laboratory)
Florida Department of Environmental Protection (Dredge and Fill)
Florida Department of Environmental Protection (Division of State Lands)
Florida Fish and Wildlife Commission
North Carolina Department of Fisheries

FEDERAL
U.S. Food and Drug Administration
U.S. Forest Service, Apalachicola National Forest (source of brush)
St. Marks National Wildlife Refuge (brush source)
National Oceanic and Atmospheric Administration,
National Marine Fisheries Service (information on fish havens)

ACADEMIC and SCIENTIFIC CONSULTANTS;
Dr. Edwin Cake and John Cirino
Gulf Environmental Associates, Ocean Springs, Mississippi
Dr. Steve Otwell, IFAS, Marine Extension Service, University of Florida
Rutgers University's Haskins Shellfish Research Institute
The University of Maryland Environmental Center, Horne Point, Maryland
The Margaret Ann Jones Oyster Culture Facility, Maryland
Florida State University Marine Laboratory

Although brush may be planted in closed areas, the oysters will not be harvested, but used only to record growth rates and left to cleanse and filter the waters. If the program proves successful, other grants will be sought to develop depuration programs that will enable oyster fishers to harvest and cleanse the oysters for sale. Agencies and personnel will be interviewed, and their questions and concerns recorded and described in a final report along with recommendations that will be presented to the Wakulla County Commission and the Industrial Development Board. The information will enable grant writers to submit much larger proposals to NOAA and other agencies for a demonstration program that may change Dickerson Bay from a shellfish closed backwater to a viable oyster fishery that will enhance the local economy.

Budget

DESCRIPTION	QUANTITY	RATE	TOTAL
*Stipend for Jack Rudloe	80 hours	$125/hr	$10,000.00
Stipend for 5 fishers to plant experimental oyster plots in Dickerson Bay. Work involves clearing and gathering brush, bundling, loading on vessels and planting.	280 hours (8 hr x 7 days x 5 = 280 hr)	$10/hr $80/d x 5 = $400.00/day x 7 days	2,800.00
Boat use 7 days planting 1 day survey to identify and mark potential planting sites around Apalachee Bay.	8 days	$50/day	400.00
Materials, ropes, cages, weights, etc.			500.00
Office Materials, Xerox, binders, etc			500.00
Road trips by Dr. Anne Rudloe and Jack Rudloe from Panacea to North Carolina, Alabama and Mississippi observe oyster gardening projects and consult with oyster biologists.			Total travel $2,571.00

1 Trip to South Carolina, to talk to Oyster Gardeners in Charleston, then to North Carolina, Cape Hatteras and Wilmington to observe State oyster culture operations.	5 days	Per diem $80/day per day= $400 x 2= $800.00	
Mileage to South and North Carolina and return	Estimated 1,500 mi	@ $0.44.5/mi= $668.00	
1 Trip to Mobile Alabama and Mississippi area to observe oyster gardeners and consult with biologists.	3 days	Per diem $80 x 2 = 160 x 3= $480.00	
1 Road trip to Alabama and Mississippi Estimated 1,000 miles		@ 44.5/mile= $445.00	
Consulting fee for Edwin W. Cake, Jr. Ph.D, Gulf Environmental Associates See resume			$1,000.00
TOTAL			**$18,093.00**

* This is matching funds; approximately 3 months have been invested in preparing a preliminary report summari
the work of Gulf Specimen in growing oysters on trees over the past **2** years.

DR. ED CAKE
A Brief Résumé

Dr. E.W. "Ed" Cake, Jr., Ph.D., is the Chief Executive Officer (CEO) and Chief Science Officer (CSO) of Gulf Environmental Associates, a private environmental consulting firm of Ocean Springs, Mississippi. Through that firm he conducts environmental field assessments, prepares environmental assessments and environmental impact statements, and participates in oyster culture and fish farming and wetland-related research for local, state, federal, and corporate clients. For the past 30 years he has assisted the Gulf of Mexico oyster industry and the oil, gas, and sulfur industries along the Gulf Coast in assessment and settlement of environmental and legal problems that arise when those industries have conflicts in coastal waters where oysters are farmed or grow naturally.

Dr. Cake was awarded degrees from Florida State University in Marine Biology and Biological Oceanography, including Masters and Doctor of Philosophy (Ph.D.) degrees.

He is a certified Oyster Biologist with more than 40 years of academic, research, and consulting experience in Mississippi and other Gulf Coast States.

He served as the Head of the Oyster Biology Section of the Gulf Coast Research Laboratory (GCRL) from 1973 to 1987.

Dr. Cake served as an adjunct professor for many years: He taught Environmental Science at USM's coastal branches for 25 years. He also taught Invertebrate Zoology and Marine Aquaculture or Mariculture at the Gulf Coast Research Laboratory of USM.

Dr. Cake served as a publicly-elected Commissioner of the Jackson County Soil and Water Conservation District from 1989 through 1993. He served as the Commission's Chairperson from 1991 through 1993.

He also served as an appointed member of the Mississippi Public Trust Tidelands Commission from 1988 to 1992.

Ed Cake is a Life Member of the national Sierra Club and served as the Gulf Coast Regional Vice-President of the Sierra Club from 1987 through 1989.

Dr. Cake grew up in Virginia and Florida and is a fifth generation member of a family that included oyster fishermen (called "watermen") in Chesapeake Bay. Ed has two children and eight grandchildren. He has been a resident of Ocean Springs for 37 years and continues to be active with community choral and church music and professional and voluntary environmental issues along the Mississippi Gulf Coast including the annual coastal clean up on Deer Island.

Dr. Ed Cake has served as the Vice-President and Associate Director of Volunteers and Services for the D'Iberville Volunteers Foundation since August 29th, 2005. That Foundation and its more than 7,500 volunteers have completed and repaired more than 1,000 homes and properties, built 41 new homes, and recorded more than 380,000 hours of work effort since Hurricane

Katrina, worth more than $6.9 million in FEMA mitigation credits.

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