

**Project Name:****Partnership for Adaptive Inter-tidal Oyster Reef Restoration in Smith Island Bay**

**Submitted by:** Barry Truitt, The Nature Conservancy, and Dr. Jim Wesson, Virginia Marine Resources Commission.

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**Congressional District:** 2<sup>nd</sup> District – Virginia, Representative Thelma Drake (R).

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**PROJECT DESCRIPTION / Project Abstract:**

The ecosystems of the coastal bays on the seaside of the Eastern Shore of Virginia are renowned for their local, regional, and global value to migratory birds and marine life of all kinds. The bays serve as critical nursery areas for numerous finfish, both predator and prey, and coastal sharks, most especially the brown or sandbar shark. Endangered sea turtles, both Loggerhead and Ridley also utilize the channels and shallow bays during part of their life cycle. The inlet-influenced, ocean dominated system in the bays has very good overall water quality. But the coastal bays have suffered two ecosystem state changes in the recent past: the loss of the seagrass *Zostera* in the 1930's and the more recent commercial extinction of the native oyster (*Crassostrea virginica*) in the 1990's due to over-harvest and disease. The state change in native oyster populations has resulted in the loss of critical ecosystem services such as water filtration, habitat, and biomass provided by the oysters.

An innovative partnership of Federal, state, non-governmental organization, industry and trade group, school students, and community volunteers is proposed to address the restoration of functional, inter-tidal oyster reefs and their ecosystem services in Smith Island Bay in the shadow of the historic Cape Charles lighthouse. Functional oyster reefs in the coastal bays are described as inter-tidal reefs showing vertical relief of mixed age and size oysters that filter and improve water quality, provide habitat for other species, and contribute biomass to the overall food webs in the coastal bay. Because the availability of shell as substrate for future restoration efforts is becoming limited, an adaptive approach is proposed that will utilize both dredged, natural fossil shells and man-made "oyster reef balls" for reef construction. Experimental design of the specific reef constructed at each restoration site will be closely coordinated with NOAA and other experts to maximize information gained to drive future oyster reef restoration efforts in the coastal bays of Virginia. TNC will be responsible for monitoring the structure and function of the restored oyster reefs in the long-term (up to five years).

**Location and Land Ownership (public and private):**

The project reefs will be located in Smith Island Bay, on both inter-tidal, riparian private oyster ground owned by The Nature Conservancy adjacent to Smith Island and on nearby "Baylor" or public ground managed by the Virginia Marine Resources Commission. The oyster grounds owned by TNC at Smith Island have been utilized for oyster production since the colonial era. Their death knoll came in the early 1990's as commercial growers utilized small oysters there for soup production, hoping to get some return before disease impacted them. TNC has located three sites of remnant oyster reefs on TNC-owned inter-tidal in the shadow of Cape Charles lighthouse behind Smith Island. These sites will be incorporated into the reef design and maintained as shellfish sanctuaries in the future by TNC (Appendix III). A combination of dredged fossil oyster shells and "oyster reef balls" will be utilized in the construction of the reefs. TNC Site #1 consists of 10 patch reefs varying in size from .1 acre to .28 acre and totaling approximately 1.32 acres. TNC Site #2 consists of 7 patch reefs varying in size from .05 acre to 1.1 acre and totaling

approximately 2.52 acres. TNC Site #3 is a high energy site containing one large, heavily "reefed up" former reef totaling 3.6 acres in size. (Appendices IV-VI).

A similar combination of dredged fossil oyster shells and "oyster reef balls" will also be utilized for the construction of 3 functional oyster reefs on state-owned, Baylor Ground that will also be maintained by VMRC as a shellfish sanctuary in the future. VMRC Site #1 consists of remnants of Baylor Ground #23 along south Smith Island and is a high energy site. VMRC Site #2 consists of 2 patch reefs of .26 acre and .4 acre in size in Baylor Ground # 19 in Magothy Bay and also is a high energy site. VMRC Site #3 consists of approximately 9.8 acres of Baylor Ground # 41 east of Mockhorn Point in Smith Island Bay. This site has been the focus of past VMRC oyster restoration activity which this project will complement. (Appendices VII- IX).

All sites will be surveyed with a Trimble Geo XT GPS/field computer and sampled/monitored during pre-construction of any reefs. Post construction, all reefs will be surveyed for areal extent and sampled/monitored for up to five years as part of TNC's Oyster Reef Sanctuary program on the Virginia Eastern Shore. TNC will provide post-grant updates through the TNC Shellfish Restoration Network on progress with oyster restoration in the coastal bays.

#### **Anticipated Benefits to Species and Habitats:**

The six functional reefs constructed by the partnership will provide critical ecosystem services such as water filtration for water quality maintenance and improvement. Good water quality drives the value of the bays, marshes, and tidal flats to a diverse array of migratory and nesting birds, finfish and coastal sharks, and sea turtles. Smith Island Bay has been designated as a "Habitat Area of Particular Concern" (HAPC) for the sandbar shark. Nearby tidal flats are part of an "international reserve" for shorebirds. The islands are designated "National Natural Landmarks" by the Department of the Interior. Finally, the barrier island/lagoon system has been designated a "Man and the Biosphere Reserve" by UNESCO because of its global importance to biological diversity.

The vertical relief provided by the "oyster reef balls" and the shell plants will increase the value of the reefs as essential nursery habitat for fish and other benthic species. Over time, it is anticipated that the larger, older oysters that persist on the reef will develop some degree of resistance to *Dermo* that can be passed on through reproduction to other reefs in the area.

#### **Desired Future Conditions (in measurable terms):**

The goal or desired future condition for the project is the restoration of 6 functional oyster reefs totaling approximately 2 acres in Smith Island Bay. Functional oyster reefs in the coastal bays are described as inter-tidal reefs showing vertical relief of mixed age and size oysters that filter and improve water quality, provide habitat for other species, and contribute biomass to the overall food webs in the coastal bay. Through monitoring, we propose to measure settlement and recruitment, oyster size, density, and biomass (ash free dry weight), and to note other species present, specifically ribbed mussels and their size, density, and biomass. The constructed reefs will be exposed to differing regimes of wave energy in Smith Island Bay. We plan to evaluate the effectiveness of the "oyster reef balls", both with and without oyster shell incorporated into them during molding, as reef substrate under differing regimes of wave energy by examining their vertical component and complexity within the reefs and oyster settlement and recruitment.

#### **Partners:**

(1) The Nature Conservancy/Virginia Coast Reserve:  
TNC will provide its VCR Chief Conservation Scientist (Barry Truitt) as project co-manager. TNC will be responsible for administration of the project grant, coordination of the partners during project implementation, and providing the community volunteers for deployment of the reef balls and on-going monitoring. TNC will also survey the remnant reefs present at the sites and will work with NOAA and other experts to finalize design protocols for the adaptive restoration to maximize the information gained. This critical information will be used to drive future oyster reef restoration efforts in the coastal bays of Virginia. TNC will co-apply with VMRC for any necessary permits required under the Joint Federal/state Permit Application process.

**(2) Virginia Marine Resources Commission:**

VMRC will provide its Conservation and Replenishment Department Head (Dr. James Wesson) as project co-manager. VMRC will be responsible for sub-contracting for the construction of the inter-tidal oyster reefs at all sites utilizing nearby fossil oyster shells. VMRC will assist TNC in all phases of the reef ball deployment and on-going monitoring.

**(3) Virginia Ready Mix Concrete Assoc. / Allied Concrete Co., Charlottesville, VA.:**

The VRMCA, a concrete trade association, and Allied Concrete Co. of Charlottesville, Va. (Mr. Gus Lorber) will provide up to 300 reef balls, both with and without shells incorporated, at no cost to the project. Allied Concrete will coordinate with the Reef Ball Development Association and TNC on the molds and construction of the reef balls and on the volunteer participation in the reef ball construction phase. Allied Concrete Co. will also coordinate with TNC the use of volunteer students from the Tandem School in Charlottesville or from another secondary school in the area in the deployment phase of the oyster reef balls. TNC will identify a source of oyster shells for incorporation into the oyster reef balls during manufacture. Allied Concrete will also provide for transportation of the oyster reef balls from the Allied Concrete plant in Charlottesville to the Ocean Cove Seafood dock in Townsend, Va. for deployment at the reef sites.

**(4) The Tandem School:**

The Tandem School in Charlottesville will provide student volunteers to be involved in the reef ball construction and deployment phases of the project. If students from this school are unavailable at the time of reef ball manufacture, students from another secondary school in the Charlottesville area will be recruited.

**(5) Ocean Cove Seafood, Tommy O'Connor:**

Ocean Cove Seafood, located in Townsend, Va. on the shores of Magothy Bay, will provide a bulkhead site for off-loading and deployment of the reef balls and dockage for boats during reef construction at no cost to the project.

**(6) The Eastern Shore Community:**

TNC has an excellent volunteer program on the Eastern Shore that will recruit and utilize local volunteers in all phases of the project.

This project, Partnership for Adaptive Inter-tidal Oyster Reef Restoration in Smith Island Bay, is fully aligned with TNC's *Conservation by Design*. Projects to restore functional oyster reefs are a priority strategy in both the Virginia Eastern Shore Seaside Conservation Area Plan (CAP) and the Chesapeake Bay Lowlands Ecoregional plan. We fully expect oyster restoration to also be a high priority in the forthcoming Virginia Eastern Shore/Lower Chesapeake Bay Marine CAP.

**NEPA, ESA, EFH or other regulatory compliance issues:**

No NEPA, ESA, or EFH regulatory compliance issues are involved. TNC and VMRC will make a co-application for a Joint Federal/State permit required for deployment of the oyster reef balls. No state permit is required.

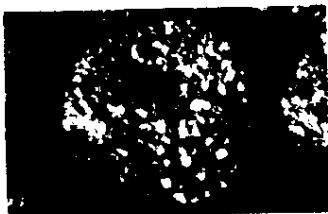
**Restoration Methodology and Design Considerations:**

TNC Reefs: All three remnant TNC reef sites (Appendix III) will be monitored and sampled, surveyed using high accuracy GPS technology, and assessed for vertical complexity pre-construction. Presence/absence of "reefed" shells on the reefs will be used as an indicator of wave energy at the sites. The VCR Chief Conservation Scientist will work with NOAA and other experts on site specific designs that will incorporate the pre-construction condition of the individual patch reefs within a site. Pre-construction conditions and corresponding restoration actions include: (1) functional reef with mixed age/size oysters - no restoration action to the planting of shells for new reefs in adjacent areas, (2) shoaled or sediment impacted reef, lacking good substrate or vertical complexity for recruitment - shell planting and/or deployment of oyster reef balls, and (3) "reefed" shells on a reef, indicating high wave energy - shell plantings and/or oyster reef ball deployment as breakwater.

**VMRC Reefs:** The three VMRC reefs will be located on nearby public or Baylor ground owned and managed by VMRC (Appendix III). They will also be sampled/monitored and surveyed pre-construction. The same design considerations will be incorporated into the design of the construction and restoration of the VMRC reefs.

The fossil shells will be mechanically dredged from deposits in nearby Smith Island Inlet and transported to the reef sites. A total of 62,500 bushels of fossil shell at \$1.60 per bushel will be dredged and transported to the 6 reef sites. Fifty per cent of the shells (31,250 bushels) will be utilized at the TNC reef sites, generating one acre of "restored" reef in total. Fifty per cent of the shells (31,250 bushels) will be utilized at the VMRC reef sites, also generating one acre of "restored" reef in total.

A total of 300 "oyster reef balls" will be manufactured with 'marine friendly' concrete at the Allied Concrete Co. on behalf of the Virginia Ready Mix Concrete Association. Molds for manufacture of the reef balls will be secured from the Reef Ball Development Association. Two hundred oyster reef balls (18" x 12", weight 35 lbs.) will be manufactured with shell material incorporated into their surface texture and 100 oyster reef balls will be manufactured with no shell for comparative recruitment purposes.



Oyster Reef Ball

One of the most important design considerations of this adaptive project is the generation of useful information to be utilized in the design of future oyster reef restoration projects in the coastal bays of Virginia's Eastern Shore.

**Environmental permits and consultations:**

TNC and VMRC will co-apply for the Joint Federal/State Permit Application by October 31, 2006. TNC will initiate consultation with NOAA and other experts on final design protocols for the adaptive restoration by October 31, 2006 with experimental design criteria finalized by March 1, 2007.

**Goals/Long Term Measures of Success:**

The long-term goal and measure of success for the project is the construction and restoration of 6 functional oyster reefs, totaling 2 acres in size, that will be maintained as oyster sanctuaries and provide ecosystem services to the water quality and general health of Smith Island Bay. **Project-specific Benchmarks for Measuring Short-Term Success include:**

**Structural Objective #1: Construct 2 acres of functional oyster reefs at 6 sites in Smith Island Bay utilizing fossil shells and/or other available clutch and oyster reef balls.**

Parameter: areal coverage or acreage

Technique: Trimble GEO XT GPS/field computer

Baseline: 0 acres of functional reefs

Reference: 1 acre total among the three sites owned by TNC at Smith Island, 1 acre total among the three sites on adjacent public or Baylor ground in Smith Island Bay.

Target: 2 acres

Timing: bi-annual monitoring (fall and spring) for 2 years post construction

**Structural Objective #2: Increase in topography of oyster reefs outside of oyster reef balls**

Parameter: vertical relief of reefs

Technique: chain method survey; transect perpendicular to shore at middle of reef

Baseline: post construction earliest numerical value is the first fall after construction  
 Reference: Comparison with adjacent unrestored inter-tidal flats. Also, existing adjacent patch reefs will be utilized as reference sites.  
 Target: 25 cm elevation over adjacent unrestored sites.  
 Timing: bi-annual (spring and fall) for 2 years post construction

**Functional Objective #1: Increase in oyster recruitment and survival**

Parameter: oyster density and size frequency  
 Technique: Hand collection within defined area  
 Baseline: post construction earliest numerical value is the first fall after construction.  
 Reference: Existing adjacent patch reefs will be utilized as reference sites.  
 Target: To be determined.  
 Timing: bi-annual monitoring (spring and fall) for 2 years post construction.

**Functional Objective #2: Increase in oyster biomass**

Parameter: oyster biomass  
 Technique: Ash free dry weight of subsample (10 oysters) from each monitoring plot or calculated by length (technique developed by Roger Mann at VIMS).  
 Baseline: post construction earliest numerical value is the first fall after construction.  
 Reference: Existing adjacent patch reefs will be utilized as reference sites.  
 Target: 35 g DW/m<sup>2</sup>  
 Timing: bi-annual monitoring (spring and fall) for 2 years post construction.

**Functional Objective #3: Increase in ribbed mussel survival and recruitment**

Parameter: mussel density and size frequency.  
 Technique: Hand collection within defined area.  
 Baseline: post construction earliest numerical value is the first fall after construction.  
 Reference: Existing adjacent patch reefs will be utilized as reference sites.  
 Target: To be determined.  
 Timing: bi-annual monitoring (spring and fall) for 2 years post construction

In addition to the structural and functional components noted above, we plan to assess macro-algae per cent coverage of the restored reefs during monitoring and also note any other organisms such as mud crabs present on the reef.

**Community Engagement:**

The Tandem School in Charlottesville will provide student volunteers for the manufacture of the reef balls at Allied Concrete Co. in Charlottesville. If the Tandem School is unable to participate in the project, another secondary school in the region will be recruited. TNC will provide community volunteers for assistance in all phases of the project, most especially on-going monitoring. A trade group is providing the oyster reef balls at no cost to the project and a local shellfish aquaculture company is providing dockage for boats and deployment of the oyster reef balls at no costs.

**Outreach:**

The project partnership will seek and coordinate local outreach efforts including local and regional press, community and school groups, and within TNC's Shellfish Restoration Network. The partnership also plans to present project results at a suitable marine forum such as "Restore America's Estuaries" or a TNC/GMI marine meeting.

**APPENDIX I - PROJECTED BUDGET TEMPLATE AND NARRATIVE**  
**Community-Based Habitat Restoration Project**

**Non-Federal MATCH**

<b>FUNDS</b>	<b>REQUESTED NOAA FUNDS</b>	<b>REQUESTED GMI FUNDS</b>	<b>TNC Local SITE MATCH</b>	<b>Third-Party In- kind MATCH</b>	<b>PURPOSE</b>
Personnel	15,600	15,600	4,323.69	6,918	A
Fringe benefits	1,872	1,872	1,729.48	3,082	B
Travel		3,900			C
Supplies	3000	4,500		50,000*	D
Contractual	57,250			50,000*	E
Other			2,912		F
<b>TOTAL</b>	<b>77,722</b>	<b>25,872</b>	<b>8965.17</b>	<b>110,000</b>	

All match funds are confirmed

**BUDGET NARRATIVE**

**\*certified non-federal match funds**

- A. We are requesting 6 month salary for a TNC field technician from NOAA to assist with the volunteer recruitment, pre-construction monitoring and survey, reef construction and reef ball deployment, and on-going monitoring and patrol (\$15/hr x 40hrs x 26weeks for a total of \$15,600). We are requesting 6 month salary from TNC/GMI for a TNC field technician to assist with reference site monitoring and biomass (ash free dry weight) determination. \$4,323.69 of TNC local site match is salary for Chief Conservation Scientist for approximately 1 month. \$6918 of Third party (VMRC) in-kind match consists of \$3591.00 for salary for VMRC Department Head for approximately 1 month and \$3327.00 for salary for VMRC fishery specialist for approximately 1.5 months.
- B. Fringe for new TNC field tech position (TNC/GMI) is \$1,872 calculated at 12%. Fringe for new field technician position (NOAA) is \$1872 calculated at 12%. Fringe for TNC Chief Scientist is \$1729.48 calculated at 40%. Fringe for VMRC Department Head is \$1409.00. Fringe for VMRC Field Tech is \$1673.00.
- C. Local travel for TNC field tech is requested from TNC/GMI at 2000 miles at 405/mile or \$910, \$490 to attend an appropriate marine forum for presentation of project results, and \$2500 for boat usage fees (boats vary from 19 to 24 ft and daily boat usage fees range from \$53 to \$79).
- D. Requested supplies from NOAA include \$1000.00 for assorted monitoring supplies, signage, and equipment for biomass determination (ash-free dry weight): balance at \$1300 and drying oven at \$700. We are requesting \$4500 from TNC/GMI for a used muffle furnace. Allied Concrete Co., on behalf of the Virginia Ready Mix Concrete Association will manufacture and provide 200 oyster reef balls (value \$200 each) and 100 plain oyster reef balls (value \$100 each) for a total contribution of \$50,000 as match.
- E. Contractual - TNC will contract with VMRC for construction of the 3 reefs at Smith Island (31,250 bushels of shell at \$1.60/bushel; total value \$50,000). VMRC can include indirect costs of \$7,250 calculated at 14.5 %. Matching funds from VMRC will construct the 3 reefs on Baylor Ground (31,250 bushels of shell at \$1.60/bushel; total \$50,000.00).
- F. Other - TNC local site match is volunteer help - 200 hours at \$13.00/hr = \$2600. Fringe for volunteers is \$312.00 calculated at 12%.

## **APPENDIX II - WORK PLAN**

**Start Date:** October 1, 2006      **End Date:** March 31, 2008

### **Timeline for Anticipated Actions:**

June, 2006 – Award

October, 2006 – Completion of pre-construction monitoring  
Completion of GPS survey  
TNC/VMRC Joint Federal/State Permit Application made

December, 2006 - Completion of contract with VMRC for reef construction  
Initiation of reef ball construction  
Completion of reef design consultations and protocols

April 1, 2006 - Construction of reefs with fossil shells (dredging, transport, planting)

May 1, 2007 – Completion of oyster reef ball manufacture

June 1, 2007 – Initiation of reef ball deployment

October 31, 2007 – Post-construction monitoring

April 1, 2008 – Seasonal monitoring

October 31, 2008 – Seasonal monitoring; final project report\*

\* TNC expects to continue the monitoring program bi-annually into the future as part of our overall adaptive Oyster Reef Sanctuary Management Program at VCR. We also plan on providing increased security and patrol of all restoration reefs, especially during the fall/winter public oyster season, to prevent looting.