

Evaluation of Waste Concrete Road Materials for Use in Oyster Aquaculture

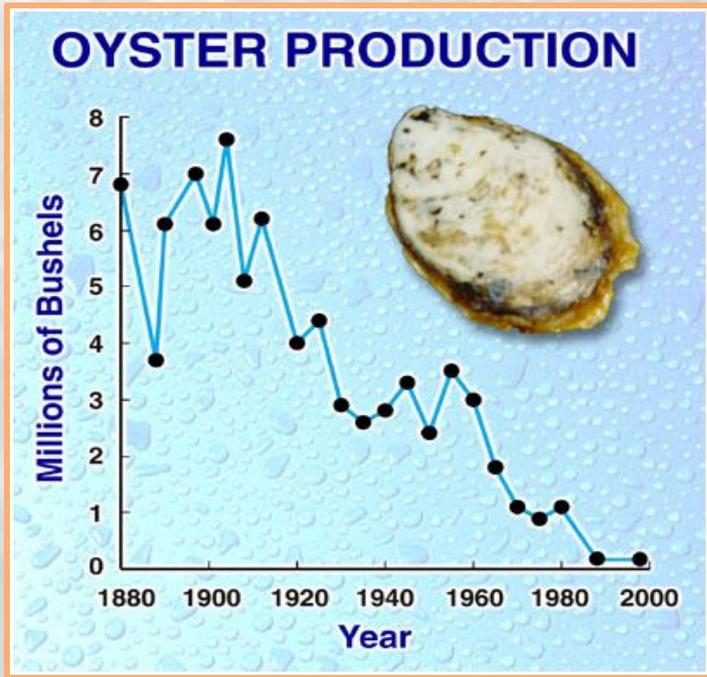
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Background



Native oyster populations in the Chesapeake Bay are at less than 1% of historic levels due to the two protozoan diseases, overharvesting, and pollution (CRC, 1999). Individual oysters filter 4-34 liters of water per hour, removing phytoplankton, sediments, pollutants, and microorganisms from the water column (CERP, 2007). **Historic oyster populations of Chesapeake Bay could filter excess nutrients from the estuary's entire water volume every three to four days.**

To use recycled concrete as bottom conditioning material for oysters, we need to ensure that inundation of RCA in the Bay does not result in the leaching of compounds that may adversely impact growing oysters or the Bay's aquatic ecosystem.

Introduction

- The SHA intends to increase the use of recycled materials and to use products in an environmentally responsible manner. Recycled concrete aggregate (RCA) to be used within the aquatic setting of the Chesapeake Bay, its chemical behavior under saturated conditions must be understood to avoid potential adverse impacts to the bay's aquatic ecosystem.
- The objective is to determine the suitability of RCA as conditioning material for on-bottom oyster aquaculture in the Chesapeake Bay.



Research Progress



Phase I (2011 - 2012)

- Evaluate the impact on water chemistry from the introduction of RCA
- Evaluate the effect of RCA on the survivorship and growth of oyster spat



Phase II (2013-2014)

- Evaluate the potential introduction of organisms attracted to the RCA pile
- Determine potential disruptions to the use of traditional harvesting gear
- Identify regulatory or administrative structures that oversee the use of RCA



Phase III (2015-2016)

- Evaluate the RCA for toxic organic substances
- Provide methodologies for SHA evaluation of materials

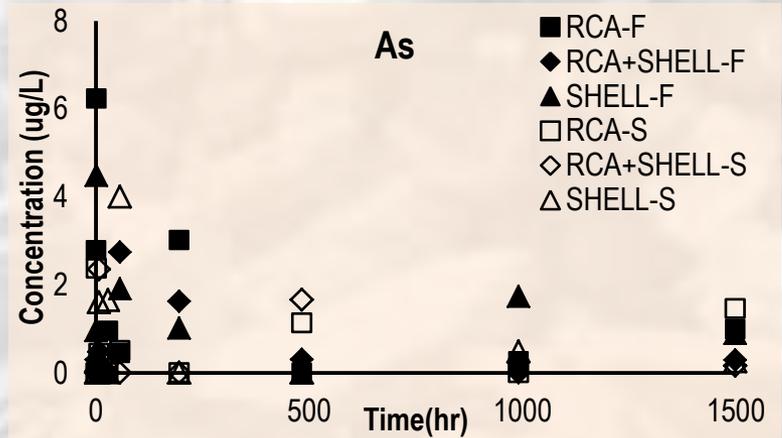
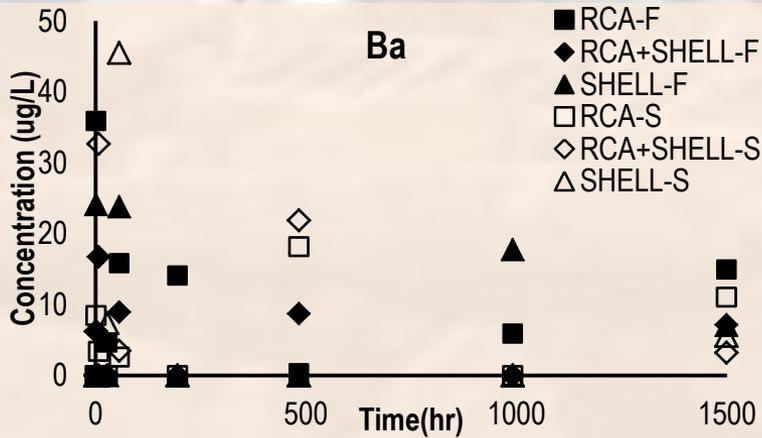
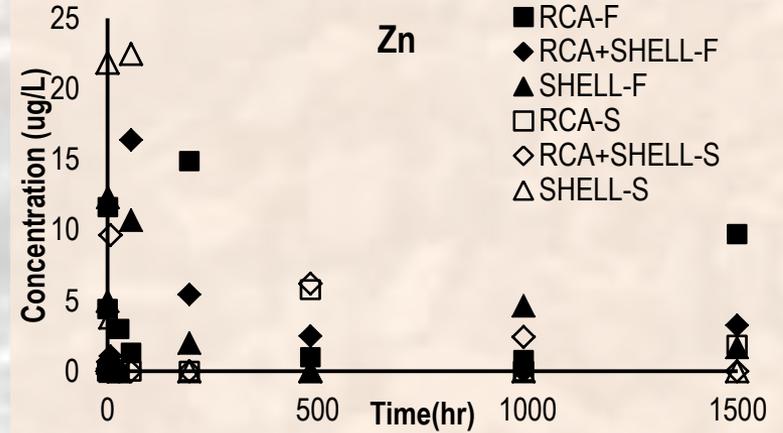
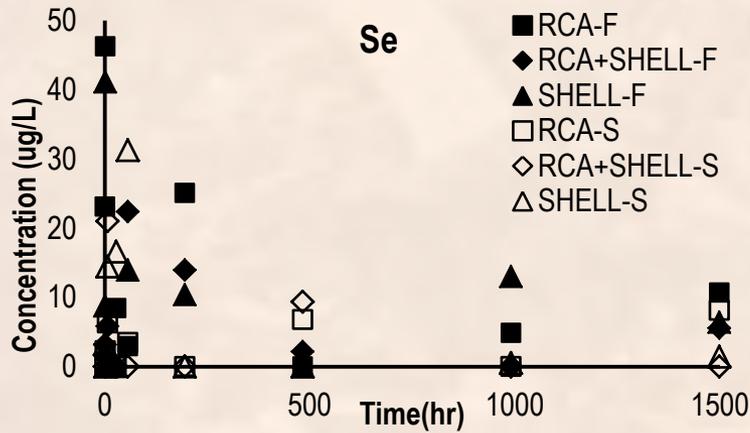
Phase I



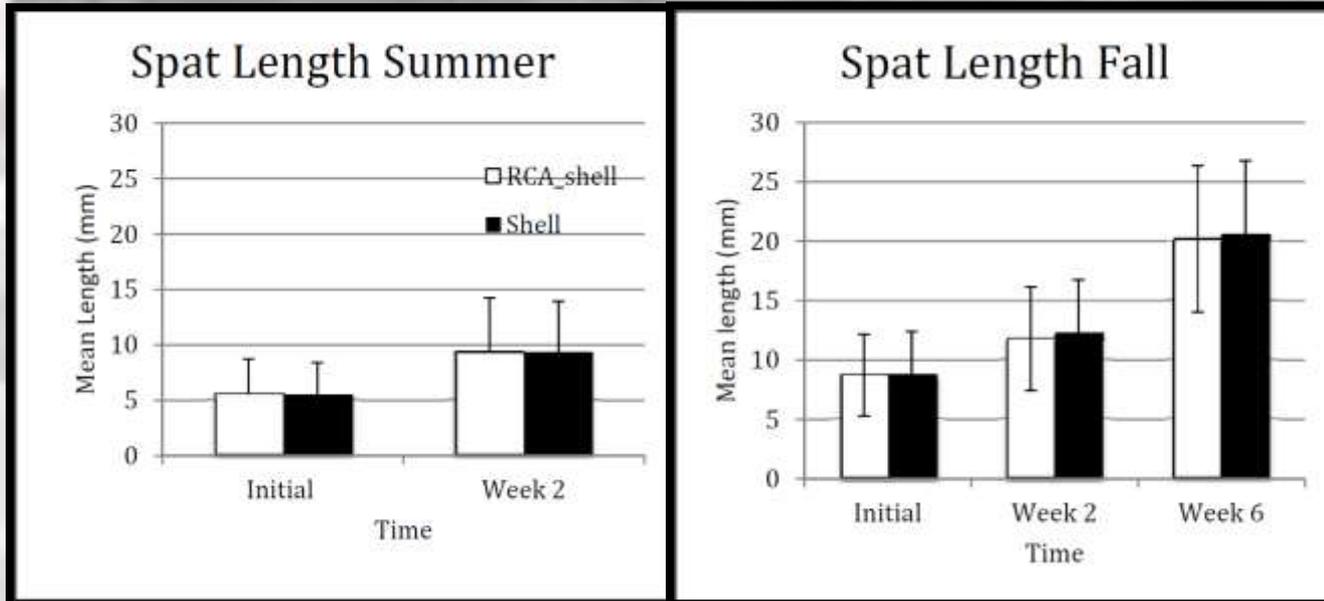
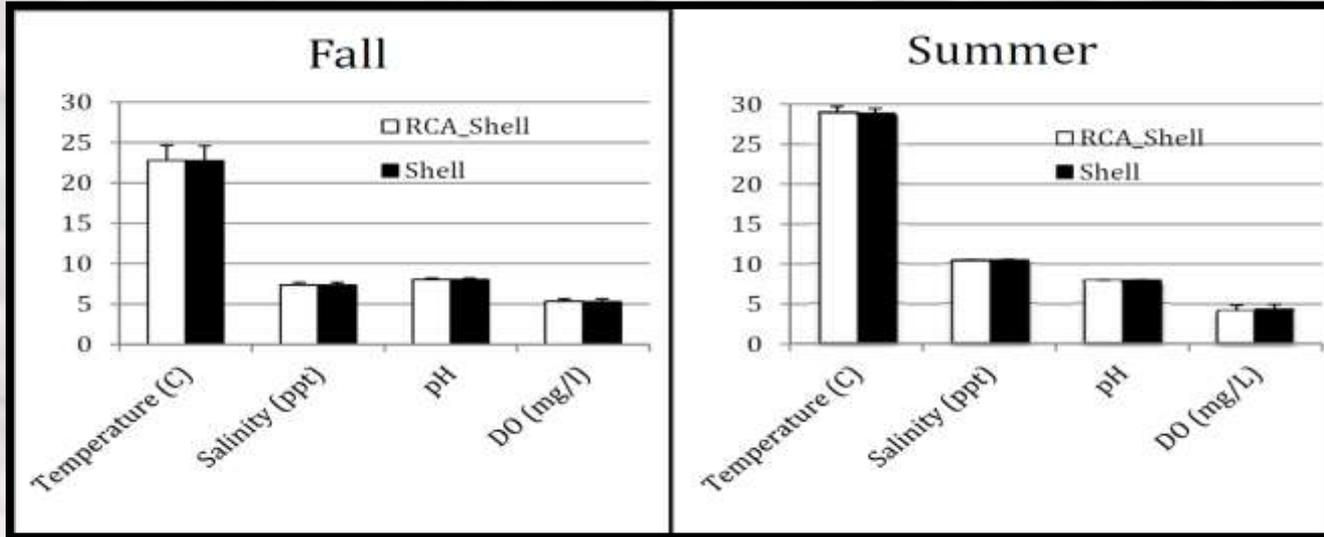
Phase I experiment



Flow Through Leaching Test



Oyster Growth and Survivorship



Phase II

Task 1: Meeting with Management Agencies

Task 2: Community impacts

Task 3: Commercial Harvest Methods Testing

Phase II Evaluation of Waste Concrete Road Materials for Use in Oyster Aquaculture – Field Test

Patuxent Environmental and Aquatic Research Laboratory

St. Leonard, MD 20685

Project Number: SP309B4J

Artificial Reefs Construction in Marine and Estuarine Systems

Federal

- U.S. Fish and Wildlife Service
- Minerals Management Service
- National Marine Fisheries Service
- Regional Fishery Management Councils
- National Ocean Services
- Office of Ocean and Coastal Resource Management
- U.S. Army Corps Of Engineers
- U.S. Coast Guard
- Environmental Protection Agency

State

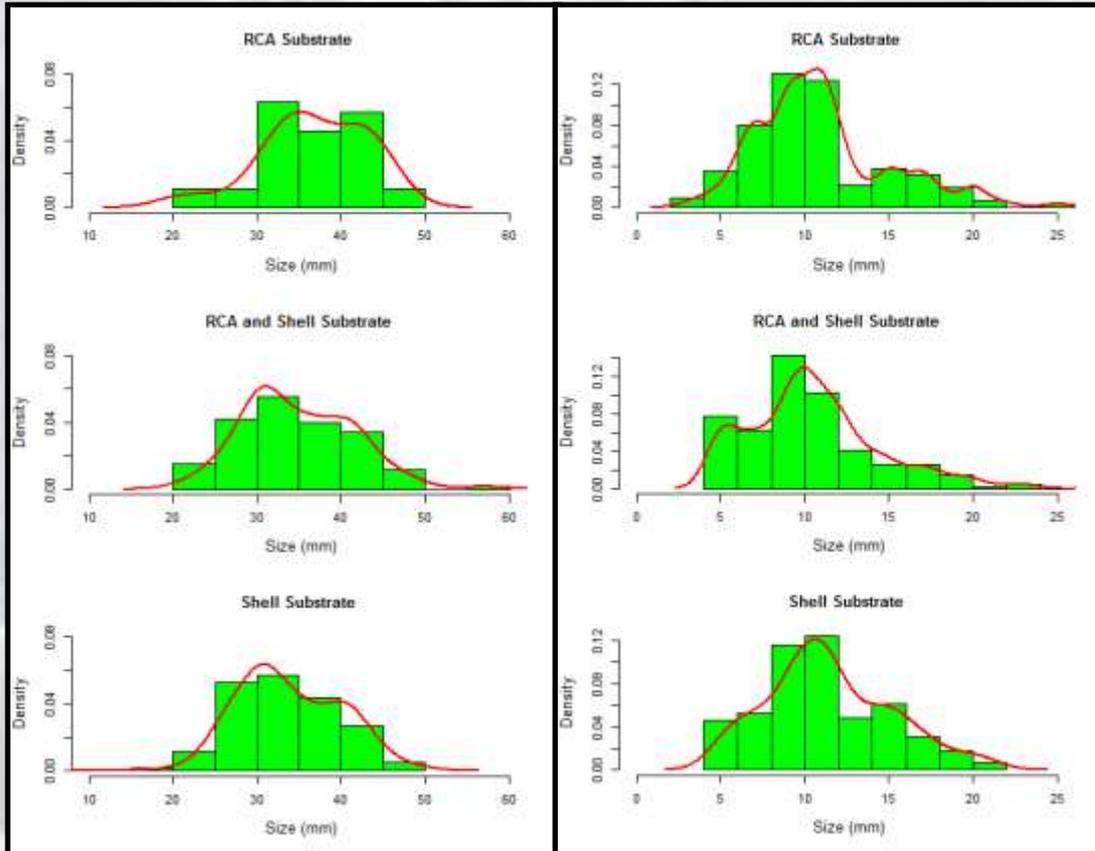
- **Department of Natural Resources**
- **Department of the Environment**
- Department of Health
- Board of Public Works
- Department of Planning
- State Highway Administration
- Critical Area Commission
- Aquaculture Review Board
- Maryland Sport Fish Advisory Commission

Permit Application

- The State of Maryland has two structures to approvals.
- The first is the Joint Federal/State Application for the Alteration of Any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland.
- The second is the formation of two review boards that bring together many agencies at a single meeting to review applications.

The two review boards are the **Aquaculture Review Board** and the **Joint Evaluation meeting**. The aquaculture review board focuses primarily on oyster aquaculture related projects. The joint evaluation meetings are designed to provide a one-stop shop for reef projects.

RCA's Community Impacts



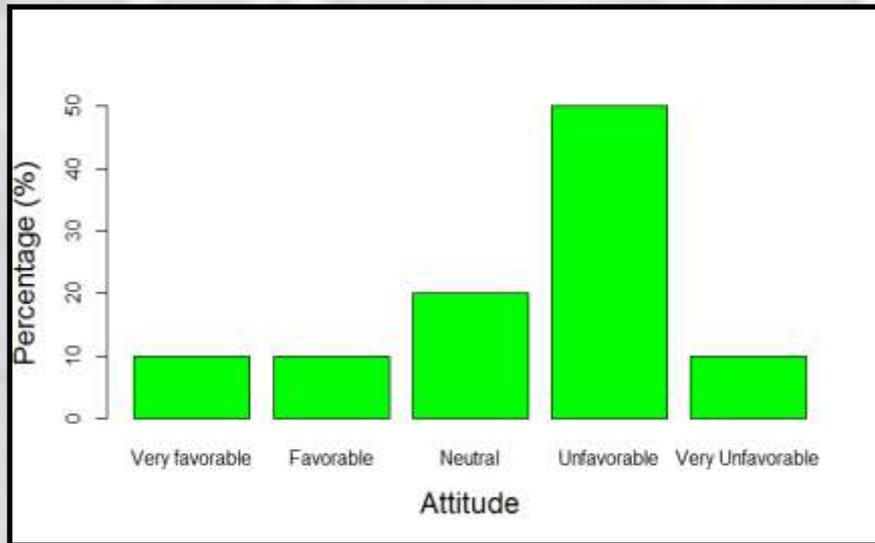
The size distribution of Goby in Patuxent River site in different substrates.

The size distribution of Mud crab in the Patuxent River site in different substrates.

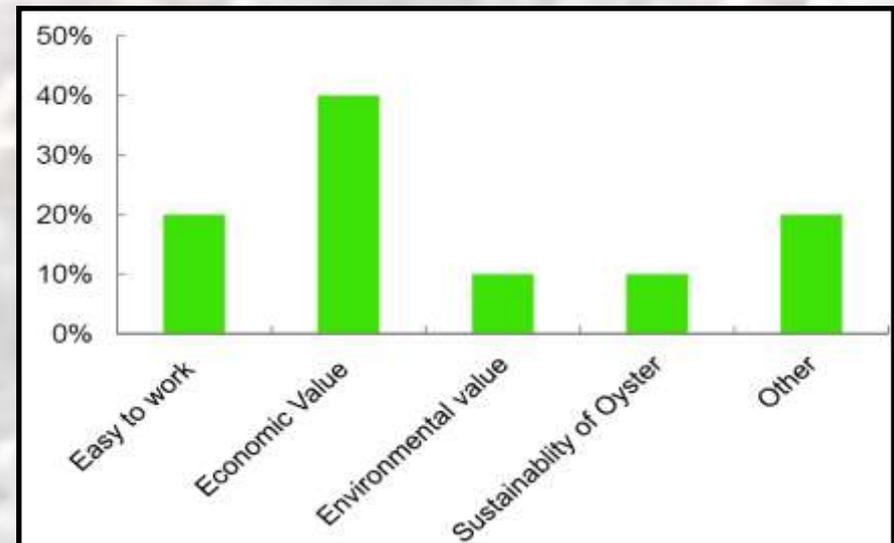
The results indicate no significant difference between substrate type (RCA, oyster shell) and benthic community structure, oyster recruitment, and the abundance and size distribution of key faunal species.



Commercial Harvest Methods Testing



The opinion of tonging oyster on RCA when using it as an alternative substrate for oyster aquaculture in this survey



Factors affecting the acceptance of RCA as an alternative substrate for oyster aquaculture

The general attitude toward tonging oyster on RCA was negative among the participating fishermen. The major complaint was the weight of RCA relative to oyster shells. However, the watermen did suggest that the RCA could be used if a veneer of oyster shell was placed on top or if the RCA was used on reefs that were not going to be tonged.

Project Summary

Phase I

- RCA as a base material for oyster reefs did not adversely affect oyster spat growth and survival, or the surrounding environment. None of the metals leached at a rate that exceeded EPA drinking water standards.

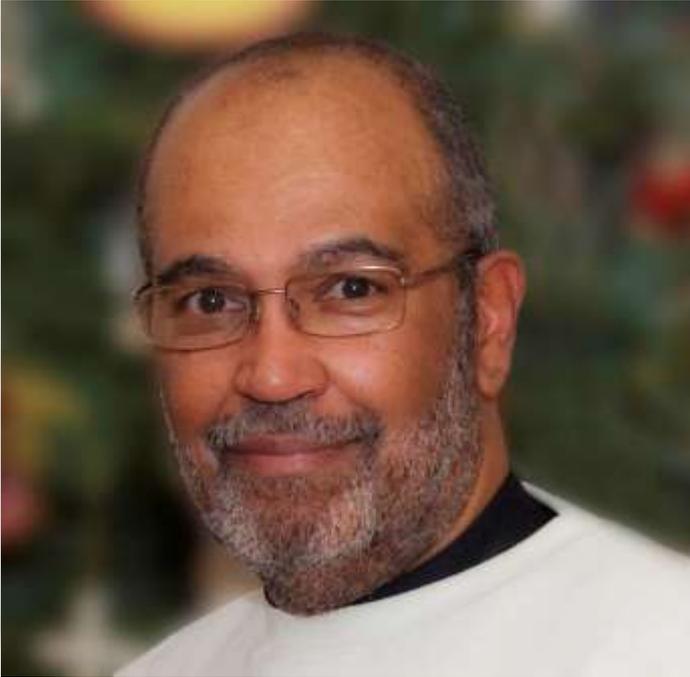
Phase II

- There was no significant difference between substrate types on benthic community
- RCA makes a suitable substrate for supporting oyster aquaculture but would require a veneer of old shell to be placed on top so as not to introduce additional weight to the catch when using shaft tongs

Phase III

- RCA as a base material for oyster reefs did not contain any hydrocarbon chemicals and did not detected any water extractable SVOC. Low concentration of anthracene, fluorine, phenanthrene and pyrene were detected. However, the MDE cleanup standard are much higher than detected concentrations
- The result concluded that RCA give no concern for hydrocarbon component releasing into Chesapeake Bay water shed, if RCA is used as a bottom conditioning material for oyster aquaculture

Acknowledgments



- Research Professor Mark Bundy passed away on June 1st at the age of 69. Dr. Bundy was an Associate Research Professor at PEARL and has been the Director of Environmental Programs at the PEARL for the past 8 years. Mark was involved in the strategic planning of all of the PEARL'S programs, including PEARL's commercial oyster support programs. Every day friends and colleagues here can feel his impact on the Patuxent River. Professionally and personally Mark was a lover of the outdoors. He had a passion for sport fishing and photography. Mark lived his life unapologetically and we loved him for it. He will be truly missed.