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Oyster Reef and Estuarine Landscape Restoration

Kenneth L. Heck, Jr.
NGI Conference, May 2007



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Why Oyster Reef Restoration ?

- ◆ In addition to the multimillion dollar US fishery they support, oyster reefs provide key ecological functions:
 - serve as habitat for finfish & shellfish
 - stabilize shorelines
 - filter suspended solids and phytoplankton from the water column
 - sequester excess nutrients (nitrogen, phosphorous, and carbon)

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Video of a healthy Alabama oyster reef

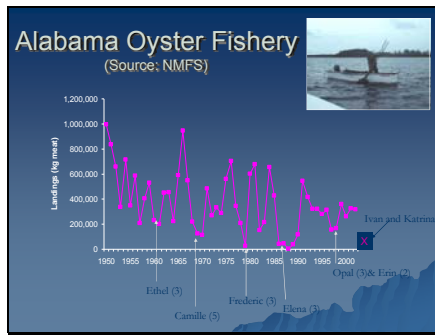
QuickTime™ and a H.263 decompressor are needed to see this picture.

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Program Objectives

- ◆ to develop the scientific understanding necessary to direct oyster restoration and enhancement in the Northern Gulf of Mexico.
- ◆ to assist in developing a long-term strategy for sustained productivity of Gulf oyster reefs and the associated ecological benefits that they provide.
- ◆ to provide this information to state and federal management agencies, the fishing industry and the general public through outreach activities.

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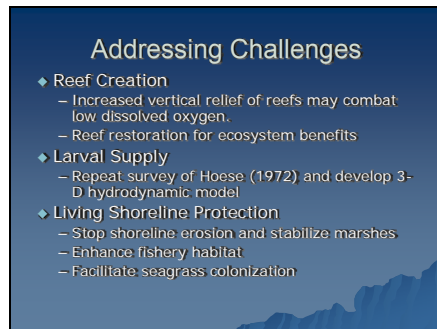


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The southwest corner of Mobile Bay is the location where the dissolved oxygen is reliably high enough for oyster reef development, predation rates are usually low, and larval supply is good. Therefore, this area is the site of greatest reef development in Mobile Bay.

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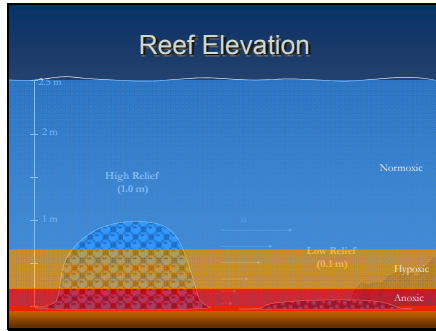
Three major elements of our reef restoration program.

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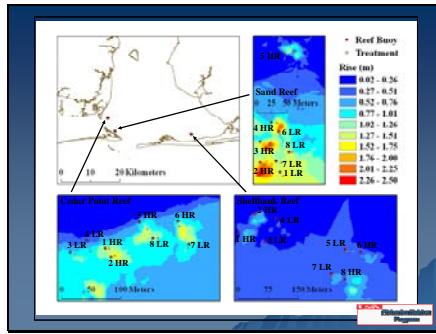
Locations of reef restoration efforts in Coastal Alabama.

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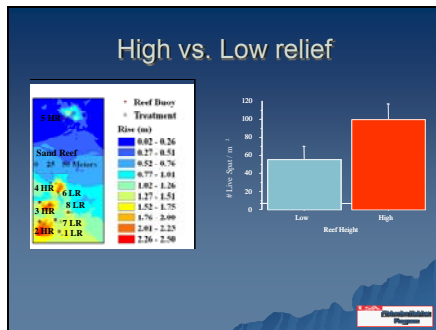
How increased vertical relief of reefs can ameliorate negative effects of low oxygen concentration.

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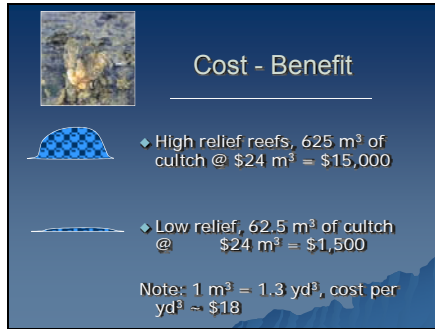
Vertical relief of restored large reefs at Sand Reef, Cedar Point and Shellbanks.

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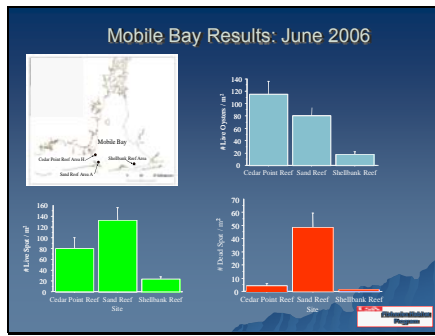
Surprisingly, we found no significant effect of vertical relief on oyster settlement and survival.

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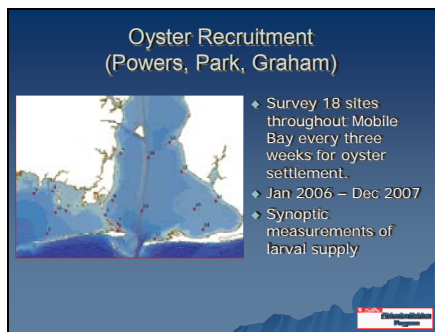
Since we saw no significant effect of vertical relief (high versus low) on oyster settlement or survival, it is most economical to restore low relief reefs.

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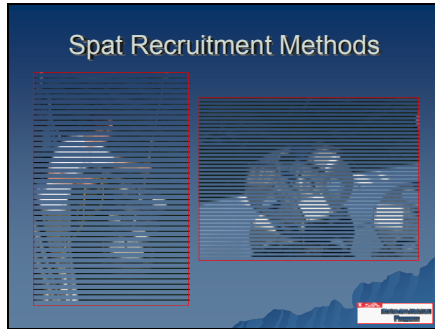
As expected, we found good larval settlement and Cedar Point (and also at Sand Reef) with greatest survival at Cedar Point.

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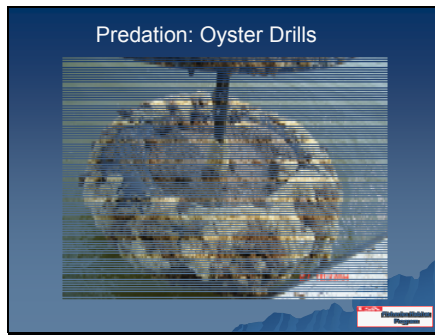
Locations of oyster settlement studies.

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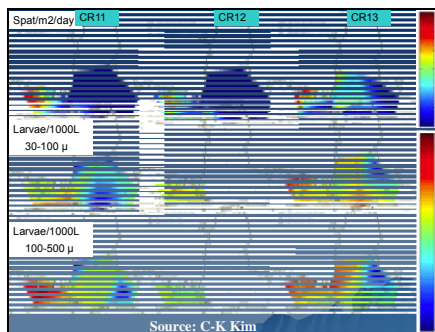
Settlement plates placed on weighted arrays to estimate oyster larval settlement rates.

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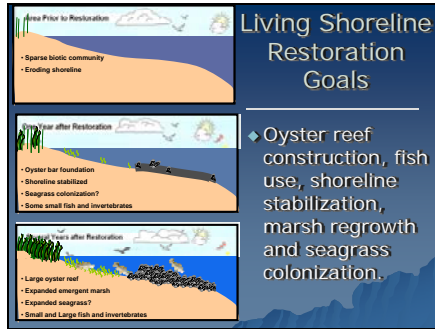
Oyster drill predation on newly settled oysters was extremely intense, as reflected by the large aggregation of oyster drill egg cases on weighted arrays.

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Results of model simulations of different sized larvae and newly settled oysters (spat) in Mobile Bay. Overall, greatest spat settlement occurred along the western shore of Mobile Bay and in Mississippi Sound.

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The diagram illustrates the progression of a living shoreline restoration project through three stages:

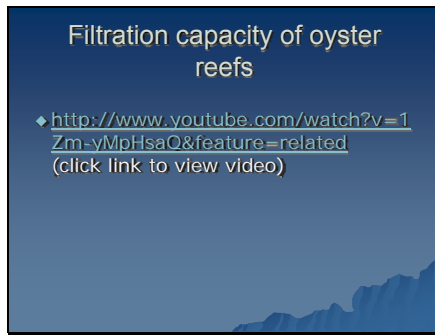
- Area Prior to Restoration:** Shows a sparse biotic community and an eroding shoreline.
- 1 Year after Restoration:** Shows oyster reef foundation, shoreline stabilization, and seagrass colonization. Some small fish and invertebrates are present.
- 3 Years after Restoration:** Shows a large oyster reef, expanded emergent marsh, expanded seagrass, and the presence of small and large fish and invertebrates.

Living Shoreline Restoration Goals:

- Oyster reef construction, fish use, shoreline stabilization, marsh regrowth and seagrass colonization.

Overview of expected results of living shoreline program element.

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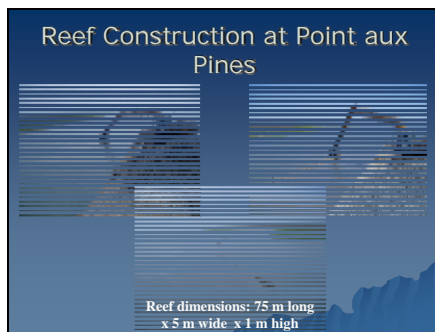


Filtration capacity of oyster reefs

- <http://www.youtube.com/watch?v=1Zm-yMpHsaQ&feature=related>
(click link to view video)

This video shows why it is possible that large oyster populations could clear up turbid water and promote the growth of bottom-dwelling plants such as seagrasses

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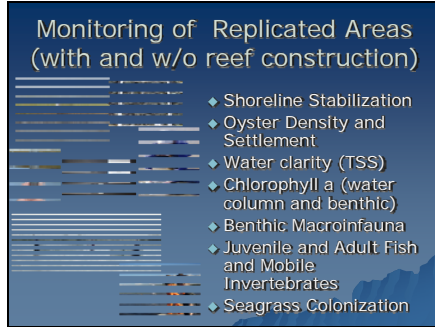


Reef Construction at Point aux Pines

Reef dimensions: 75 m long
x 5 m wide x 1 m high

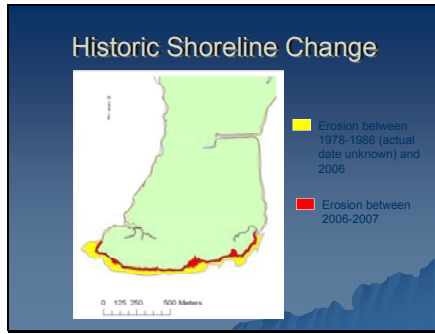
Breakwater reefs under construction seaward of eroding salt marsh in Grand Bay, AL.

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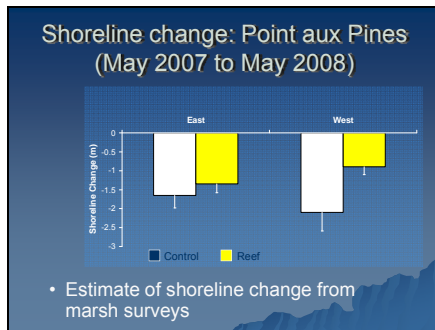
Response variables being measured in association with breakwater reef construction.

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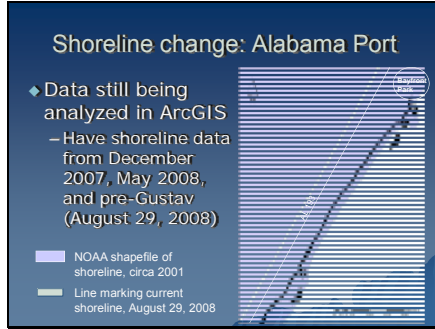
Documentation of the eroding shoreline at Point aux Pins in Grand Bay.

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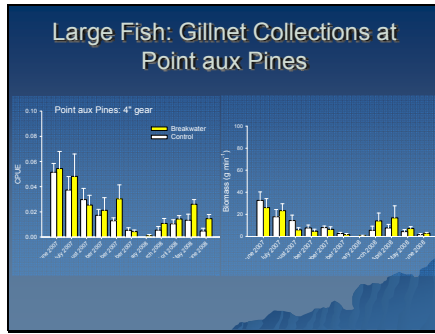
Results show that although the shoreline continued to erode in both reef and non-reef areas, the rate of erosion was reduced where reefs were present.

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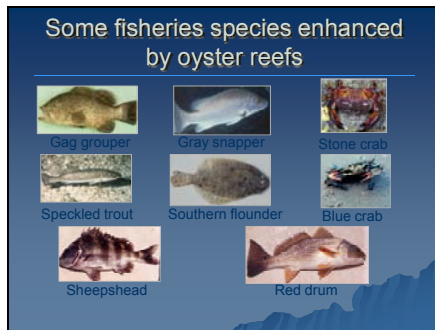
We will construct shoreline maps at a second location near Alabama Port in late 2009 and draw conclusions about the value of the shoreline protection and stabilization project.

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Usually more fish were collected at the Breakwater reefs than at the control areas without reefs.

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Some of the fish species enhanced by the presence of the breakwater reefs.

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Summary (1)

- ◆ Oyster restoration was successful in that all reefs had live oysters
- ◆ Vertical relief did not have a pronounced impact on oyster density, although DO levels were rarely below 2mg/l
- ◆ The Shellbank reefs (Bon Secour area) appear to be limited by larval supply

Overall conclusions of the different elements of the reef restoration program to date.

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Summary (2)

- ◆ The breakwater reefs reduced wave energy, trapped sediments, and reduced shoreline erosion
- ◆ Little change was seen in water clarity, and no seagrass colonization
- ◆ Recruitment of oyster spat occurred
- ◆ Sport fish were attracted to the reefs
- ◆ Building such reefs may be a viable alternative to hardening shorelines, with the added benefit of added fisheries production

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Cooperating/participating agencies

- ◆ National Marine Fisheries Service
- ◆ Alabama Marine Resources Division
- ◆ Dauphin Island Sea Lab
- ◆ Mobile Bay National Estuary Program
- ◆ Bon Secour Seafood, Inc.
- ◆ Auburn University Extension Service
- ◆ University of South Alabama (Dr. Sean Powers)