USA Restoration Briefs

•University of South Alabama Oyster Reef and Fisheries Habitat Enhancement Program•

Volume Two: Fisheries Enhancement of Oyster Reef Restoration in Mobile Bay **Spring 2010**

Highlights

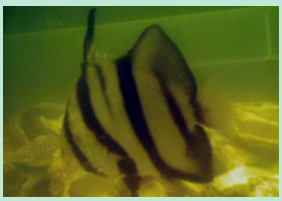
- 24 oyster reefs were created to better understand how reef height and location affect restoration success
- The study occurred near Sand, Cedar Point, and Shellbank reefs which are among the current or historically most productive in Mobile Bay
- All created reefs were successfully colonized by oysters and provided habitat for fishes and invertebrates
- Oyster recruitment was higher on high relief reefs compared to low relief
- Most fish and invertebrates did not show preference between tall and short reefs
- Reefs created in close proximity to existing reefs appeared to be more successful
- The results should help managers and scientists better understand the influence of reef design and location
- Two scientific papers were published from the graduate work of Kevan Gregalis, a former master's student under Dr. Powers.

Research Objectives

The primary goal of this study was to determine how reef height (high vs. low relief) and reef location (proximity to existing reefs and biophysical characteristics) affect oyster restoration success. To measure success, we monitored:

- Oyster recruitment and abundance
- Invertebrates and Fish abundance

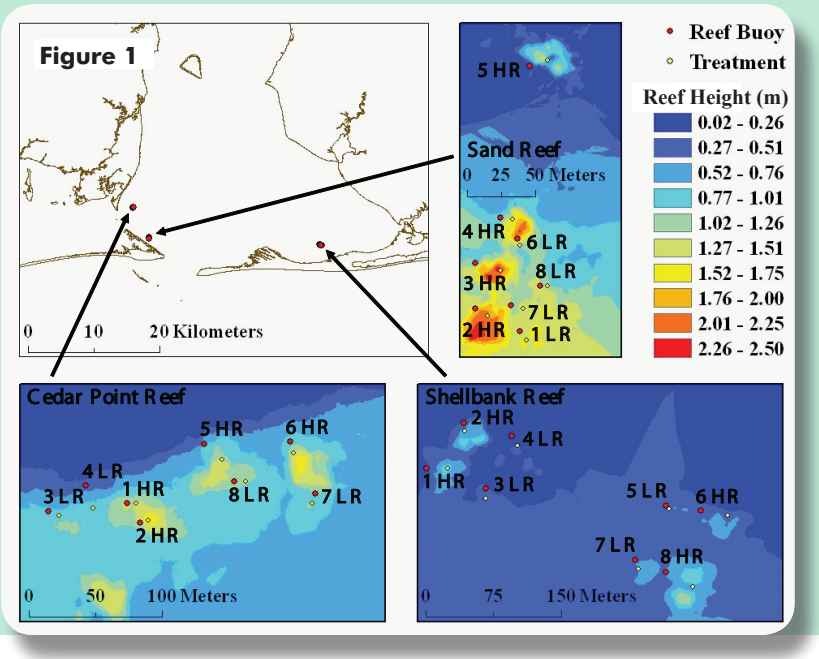
Background



Oyster production in Mobile Bay is influenced by several physical, chemical, and biological factors including water quality, storms, disease, predation, overharvest, and the occurrence of low oxygen (hypoxia) or no oxygen (anoxia) events in the near-bottom waters. Hypoxic and anoxic events frequently occur within Mobile Bay waters and can have profound impacts on numerous fisheries species.

During these events, the dissolved oxygen in the water column becomes low enough to stress many organisms, and occasionally this results in the mass shoreward movement of fish and mobile invertebrates, locally-termed "Jubilees". These low oxygen events are equally stressful for many sessile invertebrates, such as oysters, that have no means to escape the poor water quality. This has posed a challenge for many restoration efforts since most attempts have focused on maximizing acreage at the sacrifice of reef height. Recent research has shown that taller oyster reefs (greater vertical relief) have higher oyster recruitment and persist longer than short reefs, especially in areas that experience prolonged periods of low oxygen (Figure 2). However, it was previously unclear how reef height could affect the entire oyster reef community.

The habitat and feeding grounds for many fish and invertebrates provided by oyster reefs are among the many ecosystem services they provide. Recently, restoring reefs for ecosystem benefits has become popular in many coastal systems like Mobile Bay. It is important that future efforts to create or restore oyster reef habitat understand how reef design (i.e. reef height) and reef location can influence not only the success for the oysters, but also the nearby community of fish and invertebrates.



Methods

In January 2004, eight oyster reefs (625 m^2 each) were constructed in Mobile Bay near Cedar Point, Sand, and Shellbank Reefs (Figure 1). At each site, four reefs were high relief (≥1-m tall) and four were low relief (0.1- 0.2-m tall). Collection trays, gillnets, and SCUBA divers were used during sampling to determine oyster recruitment and abundance, invertebrate abundance, and fish abundance.

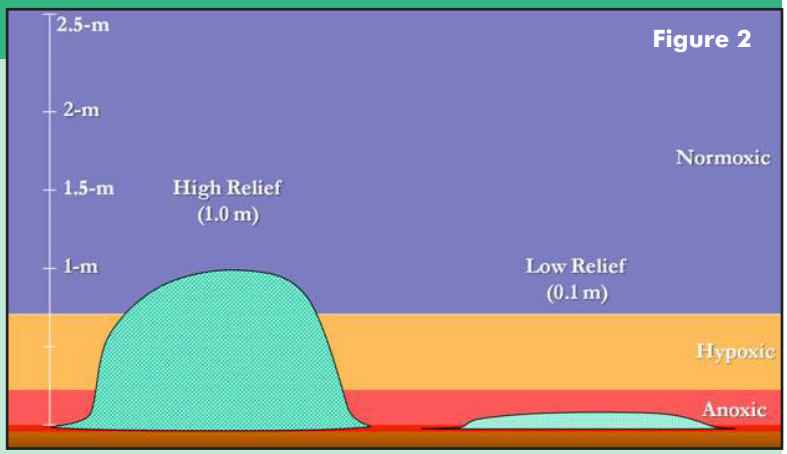


Figure 2

Findings

Overall, the 24 reefs that were created were successfully colonized by oysters and other invertebrates, as well as utilized by larger and transient fishes. These reefs persisted through the entire two year study which included three substantial storms (Ivan in September 2004, Dennis in July 2005, and Katrina in August 2005). The complete results of the study were published in two scientific journals and the general conclusions were:

Oyster Recruitment and Abundance

- Oyster abundance and recruitment varied by location. (Cedar Point > Sand Reef > Shellbank)
- Oyster recruitment was higher on high relief reefs compared with low relief.

Invertebrate Abundance

- Location very strongly influenced the communities of invertebrates present on each reef.
- The effects of reef height on community composition were minimal, but abundance was higher at low relief reefs.
- Mud crabs were the only species that benefited from increased reef height

Fish Abundance

- The resident fish communities were highly affected by reef location.
- Transient fish did not appear to be affected by reef type or location.

The oyster reef restoration resulted in habitat for fish and shellfish, but a broad enhancement by taller reefs was not observed. This uncertainty is likely a result of the high variability within these communities and further highlights the need to re-evaluate restoration approaches and goals. On average, the construction of high relief reefs costs 10 times more than low relief reefs. Although it was encouraging that all reefs had oyster recruitment and enhanced other fish species , a cost/benefit comparison could help define realistic goals and success criteria for future restoration efforts.

Publications

Gregalis KC, Johnson MW, Powers SP (2009) Restored oyster reef location and design affect responses of resident and transient fish, crab, and shellfish species in Mobile Bay, Alabama. Transactions of the American Fisheries Society 138:314-327

Gregalis KC, Powers SP, Heck KL (2008) Restoration of oyster reefs along a bio-physical gradient in Mobile Bay, AL. Journal of Shellfish Research 27:1163-1169

Application

This experimental study and the publications produced will benefit local fisheries management and shellfish restoration researchers. The results of experimental studies like this one will provide local and regional shellfish managers with critical knowledge of the factors that can influence oyster restoration success.

Within the scientific community, these results will provide the basis for further experimental studies that are crucial for achieving restoration goals. Results from this study should be used to inform future oyster reef restoration design efforts to better ensure cost-effective and successful reef restoration based on the good science and realistic goals.

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