# Dynamics of Low-profile, Inshore Artificial Reefs in The Mississippi Sound

JUDE J. LEDOUX, JAMES R. WARREN,
WESLEY DEVERS, LISA ENGEL, and MICHAEL BUCHANAN
*The University of Southern Mississippi*
*Institute of Marine Science*
*Gulf Coast Research Laboratory,*
*P.O. 7000*
*Ocean Springs, Mississippi 39566-7000 USA*

ABSTRACT

The popularity of low-profile reefs as fishing banks and the need to increase the potential for harvestable food from the ocean has prompted many coastal states to begin artificial reef programs. The territorial waters of Mississippi contain several open Gulf artificial reef sites and inshore, artificial, low profile reefs within the Mississippi Sound. Past studies have provided valuable information on the success of the offshore reefs and their attraction and possible support of recreationally important species. Little documented data is available about inshore, low profile reefs relative to their productivity and ability to attract fish. Mississippi has established over twenty inshore low profile reefs using oyster shell, crushed limestone, and concrete rubble. The increased number of artificial fishing reefs in Mississippi's coastal waters over the last five years has provided an immediate need in obtaining information on the association of fish populations with these reefs and their subsequent use by the fishing public. An assessment and monitoring program for four of these reefs was implemented in 1998 using entanglement gear, a 4.88meter lined otter trawl, and custom fish traps. Intercept creel surveys were also initiated to obtain usage data by the fishing public. Substrate samples from oyster and limestone were also taken to provide information on seasonality and colonization of benthic fauna on these reefs. These data may provide information on the trophic relationships between attracted finfishes and a particular substrate. The attraction of finfishes by the artificial reef varied significantly by the geographic location, substrate composition, various abiotic factors, and a variety of anthropogenic factors. *Cynoscion arenarius*, *Scomberomorus maculatus*, and *Micropogonias undulatus* were the most numerous, in decreasing abundance, recreationally important species observed from the sampled reefs. These species were more numerous on the reef site than to the adjacent off reef sites; however the differences were not statistically different because of the high variability in the catch.

KEY WORDS: Estuarine, low profile artificial reef, recreational fishing

## INTRODUCTION

Artificial reefs are generally constructed in coastal waters to enhance fish populations and improve near shore fisheries as the result of fish attraction and/or production of new biomass (Fabi and Fiorentini 1994). The primary goals of artificial reefs in coastal habitats have been to enhance the production of reef-associated species (i.e., macroalgae, invertebrates, and fishes) and to increase the convenience or efficiency of harvesting reef-associated species (Seaman et al. 1989, Seaman and Sprague 1991, Pratt 1994). Inshore artificial reefs provide additional advantages for open gulf fishermen by providing proximate, economical access to fishing locations during times when inclimate weather discourages offshore travel. The territorial waters of Mississippi contain several open Gulf artificial reef sites and approximately twenty inshore, artificial, low profile reefs within the Mississippi Sound. Stroud (1965) has provided valuable information on the success of the offshore reefs and their attraction and possible support of recreationally important species. Little documented data is available about inshore, low profile reefs relative to their productivity and ability to attract fish. Mississippi, over the past twenty years, has established and maintained several inshore low profile reefs using clam shell, oyster shell, crushed limestone, and concrete rubble. With the increase over the past five years in new reefs being developed in Mississippi's coastal waters an immediate need is warranted in obtaining information on the association of fish populations with these reefs and their subsequent use by the fishing public.

The main objective of the study was to evaluate the species composition and the potential attraction of the recreationally important species by the low-profile artificial reefs placed in the Mississippi Sound. These species include, but are not limited to: Red drum (*Sciaenops ocellatus*), Spotted Seatrout (*Cynoscion nebulosus*), Silver Trout (*Cynoscion nothus*), White Seatrout (*Cynoscion arenarius*), Atlantic Croaker (*Micropogonias undulatus*), Southern Kingfish (*Menticirrhus americanus*), Southern Flounder (*Paralichthys lethostigma*), Spanish Mackerel (*Scomberomorus maculatus*), and Cobia (*Rachycentron canadum*).

## MATERIALS AND METHODS

An assessment and monitoring program for four of twenty-two available reefs were implemented in March 1998. The four reefs chosen were geographically wide spread along the entire Mississippi Coast (Figure 1). Two reefs were composed of crushed lime stone and two were composed of concrete rubble. Each sample reef was located in highly accessible areas well known and utilized by the fishing public. The sample sites selected were: Hancock County Reef, located just west of the mouth of St. Louis Bay (N 30°17.298, W 89°20.831); Long Beach Reef, located just east of the Long Beach Harbor (N 30°20.852, W 89°08.016); East Deer Island Reef; located just east of Deer

Island(N 30°21.170, W 88°48.310); and Round Island Reef, located just west of Round Island (N 30°17.570, W 88°35.884).

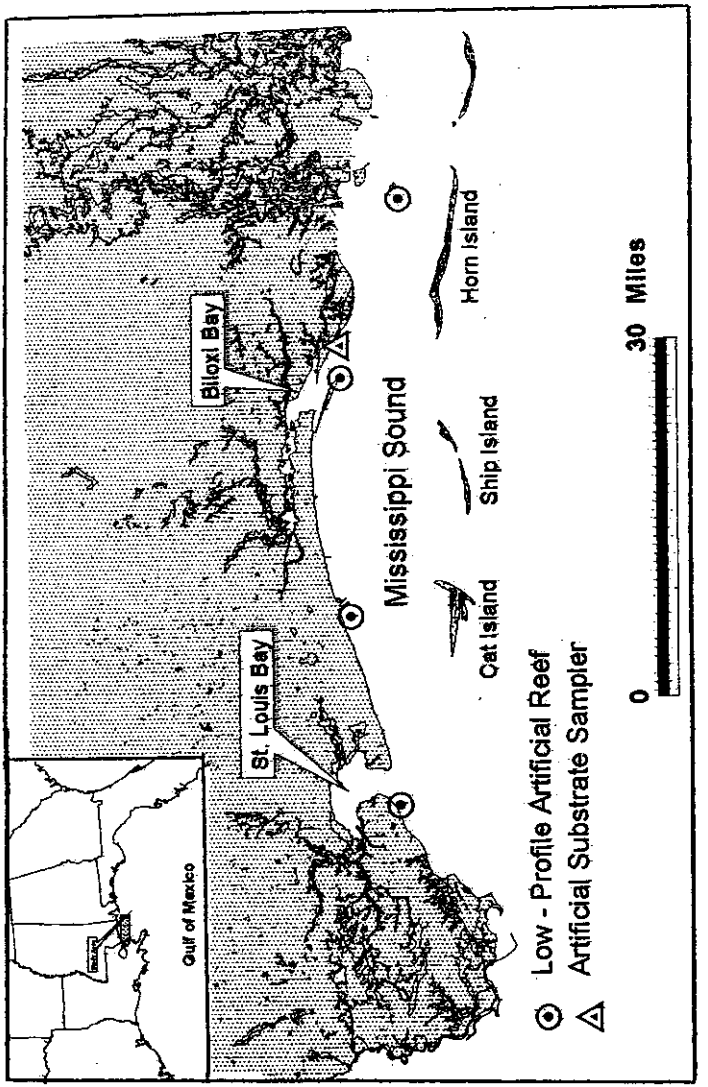


**Figure 1.** Low-Profile, Inshore, Artificial Reef Sample Sites in the Mississippi Sound

Each site was sampled once a month using a 228.6 meter multi-mesh size gill net, a 4.88 meter lined otter trawl, and up to five custom fish traps. The gill net was deployed across the reef and was allowed to fish for one hour. While the gill net was in the water, the five traps were randomly placed over the reef, and a ten minute trawl sample was taken on the reef. Upon retrieval of the on-reef gill net, a second gill net set was deployed at an adjacent "control" site approximately 0.8 kilometers from the reef. A ten minute trawl sample was obtained at approximately the same distance from the reef site. The fish traps were retrieved after the end of the net sampling on the reef and control site (approximately three hours). Total number and length range were recorded in the field for all non-recreational species. Total length, fork length, standard length (mm), weight (g), and sex was recorded for recreational species after returning to the Gulf Coast Research Laboratory (GCRL).

Bimonthly intercept creel surveys were conducted. The survey period was divided into weekends/holiday's and weekdays. From these two categories, dates were randomly selected: one weekday and one weekend/holiday were chosen. Survey questions included time spent fishing, and species and size range caught. At the end of each interview the captain of the vessel was given a "trip card" to be filled out at the end of the fishing day and mailed to GCRL. This card provided additional information on the numbers and size of fish that were caught.

Data was analyzed using Wilcoxon Paired Signed Rank Test.

## RESULTS AND DISCUSSION

All finfish species captured can be found in Table 1. Forty-seven (47) total gill net sets and trawls were done on the four reef sites over the twelve-month sampling period, producing forty-six (46) different species of finfish.

Preliminary statistical analysis was done on five recreational species. Species included: *C. arenarius*, *C. nebulosus*, *M. americanus*, *M. undulatus*, and *S. maculatus*. The total number captured on the reef and off the reef were paired for each species. A paired sign rank test was used to determine if the number on the reef was significantly different from off the reef. A "p" value was used to determine whether or not to reject the null hypothesis that the means = 0 for an alpha value = 0.05. P Values ranged from 1.0 to 0.0119974. Of the five most abundant recreational species, *C. nebulosus*, was the only fish that was statistically more abundant (p = 0.0119974) on the reef than off the reef sites.

*C. arenarius* was the most abundant fish reported by recreational fishers on the artificial reefs (Figure 2). Creel catches of recreational fishers contained *C. arenarius* thirty-four (34) percent of the time. *M. americanus*, *C. nebulosus*, and *M. undulatus* were also present twenty-five (25), Eighteen (18), and 4 percent of the time, respectively.

The attraction of finfishes to the artificial reef varied significantly by the

geographic location, substrate composition, various abiotic factors, and a variety of anthropogenic factors. The number of these species, generally speaking, was more numerous on the reef site when compared to adjacent off reef sites. Crushed limestone expresses itself as a suitable artificial habitat. The reefs composed of this substrate material have attracted a variety of both pelagic and bottom dwelling fishes.

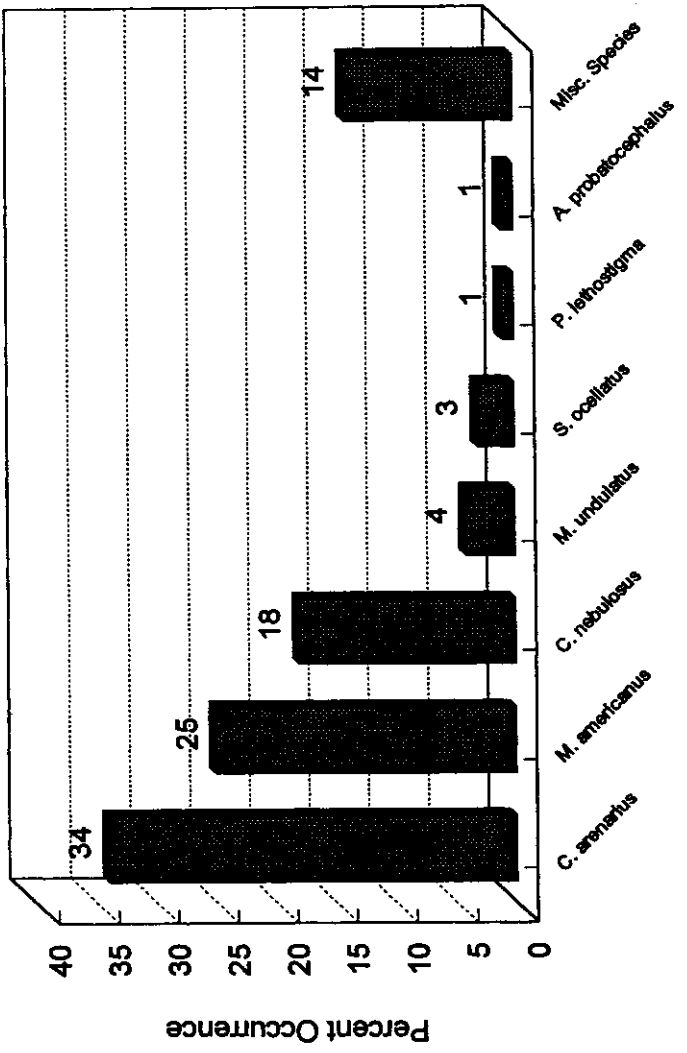


**Figure 2.** Species occurrence in creel catch in Mississippi coastal waters

**Table 1.** Total infish catch by substrate and gear type

| Crushed Limestone/Oyster Shell | | | | Concrete Rubble | | | |
|---|---|---|---|---|---|---|---|
| Gill Net | | Trawl | | Gill Net | | Trawl | |
| *Oligoplites saurus* | 2054 | *Anchoa mitchilli* | 27522 | *Oligoplites saurus* | 1207 | *Anchoa hepsetus* | 29625 |
| *Leiostomus xanthurus* | 245 | *Bairdiella chrysura* | 3686 | *Leiostomus xanthurus* | 278 | *Micropogonias undulatus* | 336 |
| *Cynoscion nebulosus* | 230 | *Cynoscion arenarius* | 1292 | *Rhizoprionodon terranovae* | 139 | *Brevoortia patronus* | 46 |
| *Cynoscion arenarius* | 101 | *Arius felis* | 146 | *Cynoscion arenarius* | 132 | *Leiostomus xanthurus* | 33 |
| *Pogonias cromis* | 76 | *Micropogonias undulatus* | 138 | *Menticirrhus americanus* | 81 | *Trichiurus lepturus* | 33 |
| *Dorosoma petenense* | 73 | *Leiostomus xanthurus* | 123 | *Pogonias cromis* | 69 | *Cynoscion arenarius* | 25 |
| *Micropogonias undulatus* | 67 | *Peprilus burti* | 96 | *Larimus fasciatus* | 46 | *Chloroscombrus chrysurus* | 22 |
| *Menticirrhus americanus* | 58 | *Menticirrhus americanus* | 54 | *Dorosoma petenense* | 24 | *Peprilus burti* | 13 |
| *Dorosoma cepedianum* | 24 | *Lagodon rhomboides* | 23 | *Cynoscion nebulosus* | 24 | *Chaetodipterus faber* | 12 |
| *Larimus fasciatus* | 23 | *Prionotus tribulus* | 12 | *Micropogonias undulatus* | 17 | *Bairdiella chrysura* | 9 |
| *Peprilus alepidotus* | 18 | *Chloroscombrus chrysurus* | 11 | *Peprilus burti* | 17 | *Synodus foetens* | 6 |
| *Rhinoptera bonasus* | 14 | *Dasyatis sabina* | 11 | *Paralichthys lethostigma* | 16 | *Citharichthys spilopterus* | 4 |
| *Peprilus burti* | 12 | *Peprilus alepidotus* | 5 | *Dorosoma cepedianum* | 14 | *Dorosoma petenense* | 4 |
| *Orthopristis chrysopterus* | 11 | *Chaetodipterus faber* | 5 | *Alosa chrysochloris* | 10 | *Arius felis* | 4 |
| *Paralichthys lethostigma* | 5 | *Symphurus plagiusa* | 4 | *Citharichthys spilopterus* | 8 | *Lagodon rhomboides* | 3 |
| *Prionotus tribulus* | 4 | *Dorosoma petenense* | 3 | *Elops saurus* | 3 | *Symphurus plagiusa* | 2 |
| *Lagodon rhomboides* | 3 | *Brevoortia patronus* | 3 | *Chaetodipterus faber* | 3 | *Larimus fasciatus* | 1 |
| *Chilomycterus schoepfi* | 3 | *Cynoscion nebulosus* | 2 | *Peprilus alepidotus* | 3 | *Harengula jaguana* | 1 |
| *Chaetodipterus faber* | 2 | *Trinectes maculatus* | 2 | *Trichiurus lepturus* | 2 | *Menticirrhus americanus* | 1 |
| *Sciaenops ocellatus* | 1 | *Larimus fasciatus* | 1 | *Pomatomus saltatrix* | 2 | *Stellifer lanceolatus* | 1 |
| *Trinectes maculatus* | 1 | *Stellifer lanceolatus* | 1 | *Mugil cephlaus* | 1 | *Peprilus alepidotus* | 1 |
| *Prionotus scitulus* | 1 | *Trichiurus lepturus* | 1 | *Lepisosteus osseus* | 1 | *Chasmodes saburrae* | 1 |
| | | *Achirus lineatus* | 1 | | | | |
| | | *Ophidion welshi* | 1 | | | | |
| | | *Prionotus scitulus* | 1 | | | | |

Bold Type - recreational species

**Round Island Reef**

Geographic location has played an important role in the abundance and sustainability of these reefs. The Round Island reef site was highly susceptible to various abiotic factors including weather, wave action, and ocean currents. It is the deepest of the four reefs, with an average depth of 2.43 meters. This reef is more open to the Gulf of Mexico than the others. It has produced a larger variety of fishes, including *R. canadum*, and various shark species. This area has been noted as a possible shark nursery ground. Sampling has shown that during the summer months, a large abundance of sharks can be found on or in very close proximity to this reef area. Since this site seems to be heavily utilized by sport and commercial fishermen, it has been noted that during the months of shrimp season, fish abundance decreased. Total capture of finfish from sampling during this high use period reflects this decrease in abundance.

**East Deer Island Reef**

The East Deer Island sample site is another heavily used fishing area utilized by recreational, commercial and charter boat interests. It has been noted in sampling that during times of heavy boat traffic in the Biloxi Ship Channel, fish were sparse in numbers. Through sampling efforts, it has been noted that excessive sedimentation due to Hurricane Georges in September 1998 has had a detrimental effect on this area. The dredging of the ship channel has also impacted the site by increasing foreign sediment deposition. The ship channel runs approximately one-half of a kilometer away from the site.

**Hancock County Reef and Long Beach Reef**

The remaining two reefs are protected from some of the aforementioned factors. These two reefs, Hancock County reef, and Long Beach reef are located in very close proximity to the beach or shoreline areas. Both are located approximately 300 meters from the shore. These reefs, combined, have supported the greatest number of recreationally important species.

ACKNOWLEDGEMENTS

We are greatly indebted to the Mississippi Department of Marine Resources for funding this project.

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