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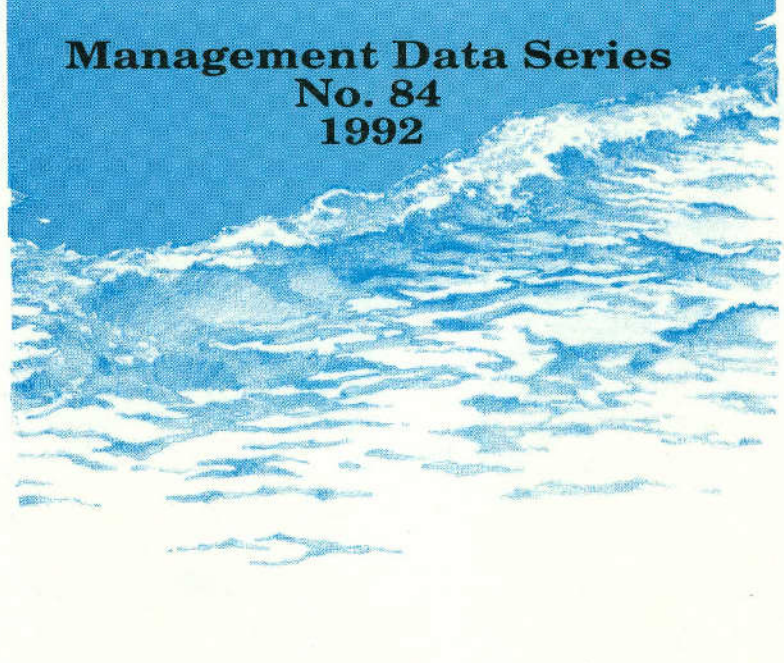

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REHABILITATION OF PUBLIC OYSTER REEFS DAMAGED BY A NATURAL DISASTER IN GALVESTON BAY

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ABSTRACT

The Galveston Bay area received excessive amounts of rainfall and flood water releases from Lake Livingston Reservoir in spring and summer 1989 resulting in decreased bay water salinities and significant Eastern oyster (Crassostrea virginica) mortalities. Clean oyster shell (3,135 m^3) was purchased and placed at two sites on 26-28 September 1991, under a NOAA Interjurisdictional Award for restoration of oyster populations. Spat setting was observed at these sites after shell planting.

INTRODUCTION

Eastern oysters (*Crassostrea virginica*) are the second most valuable commercial fishery in Texas (Johns 1990). From 1982 to 1988, annual Texas landings of oysters averaged 2.1 million kg of oyster meat ($8.1 million in ex-vessel value). Galveston Bay is the most productive oyster area in Texas contributing 70% of the total Texas landings. The Texas Parks and Wildlife Department (TPWD) routinely monitors abundance of spat ($\leq$25 mm), small(26-75 mm), and market ($\geq$76 mm) oyster populations. Fifty-six randomly selected sites on oyster reefs in Galveston Bay are sampled each month with oyster dredges (Dailey et al. 1991).

In spring and summer 1989, the Galveston Bay area received excessive amounts of rainfall due to several weather disturbances. From May-August, 95 cm of rain fell on Galveston Bay (Anonymous 1989) compared to average annual rainfall of 112 cm (Riggio et al. 1987). The rain caused 6.6 billion m^3 of water to be released from the Livingston Reservoir into Galveston Bay via the Trinity River. The five-year annual average release for May-August is 1.8 billion m^3 (Trinity River Authority 1989). The result of the fresh water influx was a decrease in salinities of Galveston Bay for an extended period. In June 1989, salinities in upper Galveston Bay ranged from 0-9% and averaged less that 4%. The previous year's average for June was 12.4% (TPWD unpublished data).

Prolonged exposure to decreased salinities increases oyster mortality and inhibits spat setting, especially in warmer months (Hofstetter 1983, Quast et al. 1988). By June 1989, relative abundance of live oysters in TPWD routine sampling dropped below the average for the previous four years. Trinity Bay, which received the greatest amount of freshwater, had almost 100% mortality of oysters by July. In 1989, Galveston Bay contributed only 36% of Texas total oyster landings (Johns 1990). Increased mortality of oysters combined with an already depressed oyster population in Galveston Bay caused concern that reproduction and reestablishment of oyster populations in Galveston Bay might be impaired. Since oyster spat setting is enhanced by the presence of clean hard substrate (cultch) on which to attach (Quast et al. 1988), a NOAA Interjurisdictional Award was obtained in 1991 to spread clean clam or oyster shell in Galveston Bay to help rehabilitate depleted oyster populations.

MATERIALS AND METHODS

A NOAA Interjurisdictional Award was approved to rehabilitate 66 ha of public reefs in Galveston Bay by placing 6,239 m^3 of clean clam or oyster shell on reefs damaged by flooding in 1989. Specifications required that the shell be clean, not more than 15% by volume be less than 10 mm at the widest point, and at least 50% of shell be greater than 75 mm at the widest point. Ponchartrain Materials of New Orleans, Louisiana, received the contract. Because of the high cost of shell material, only 3,135 m^3 of oyster shell could be purchased. Consequently, the area to be rehabilitated was reduced from 66 ha to about 33 ha.

The Redfish Bar reef complex was chosen to receive the cultch material because the area is less prone to flood damage than reefs in upper Galveston Bay and because previous shell plantings in the area have proven successful. Two areas of about 16.5 ha each were selected based on bottom type and accessibility. The areas had hard shell bottoms with moderate coverage of live oysters. A minimum water depth of 2.1 m was necessary for the barges to be able to maneuver over planting areas. The planting was timed to take advantage of the fall oyster spawning season.

Ponchartrain Materials arrived 26 September 1991, with three barges carrying about 3,441 m^3 of oyster shell. Each planting site had been previously marked on four corners with poles and buoys. Site locations were recorded using the LORAN navigational system. Planting started on 26 September. Barges were maneuvered onto the planting sites, and shell was distributed over the areas using five high-pressure hoses to disperse and spread the shell. Shell was spread at a rate of about 95 m^3/ha.

RESULTS

Shell planting commenced 26 September 1991, and was completed on 28 September 1991. Ponchartrain Materials planted 3,135 m^3 (95 m^3/ha) of oyster shell with 306 m^3 remaining on the barges. The areas covered were about 16.5 ha on South Redfish Reef and 16.5 ha on Central Redfish Reef (Figure 1).

Oyster samples were taken with an oyster dredge at the planting sites from October through December to determine if spat were setting on planted shell. Samples revealed spat setting was occurring at those sites, but difficulty in distinguishing planted shell from natural shell prevented determination of the effect of the planted shell. The last sample taken in December revealed spat on 23% of the single dead shell collected.

DISCUSSION

Distinguishing planted from natural shell was difficult due to rapid fouling (algae and barnacles) of shells. Almost all dead shell collected in samples were at least slightly fouled which prevented determining, with certainty, which shells were planted and which were not. Use of clam shell would have eliminated this problem, but clam shell is not always feasible due to its higher costs compared with oyster shell.

Although success of the planted shell to encourage spat setting could not readily be determined through initial sampling, it is reasonable to assume that, with spat setting occurring in the area, spat were setting on planted shell. Previous plantings of oyster or clam shell have proven successful. In June 1980, 39,491 m^3 of oyster shell were spread over 313 ha on the Redfish Bar reef complex in Galveston Bay to rehabilitate reefs damaged by flooding in 1979. Later examinations revealed about 68% of the planted shell had spat settings (Hofstetter 1981). In August 1989, 6,117 m^3 of clam shell were spread on reefs in San Antonio Bay after 1987 flooding severely damaged reefs. Samples collected in San Antonio Bay after planting revealed spat setting occurred on planted shell (Marwitz and Bryan 1990). Similar methods for planting shell were used in the present project. Success of previous plantings indicates that using clean shell to enhance spat setting is a viable option for oyster reef rehabilitation following disasters.

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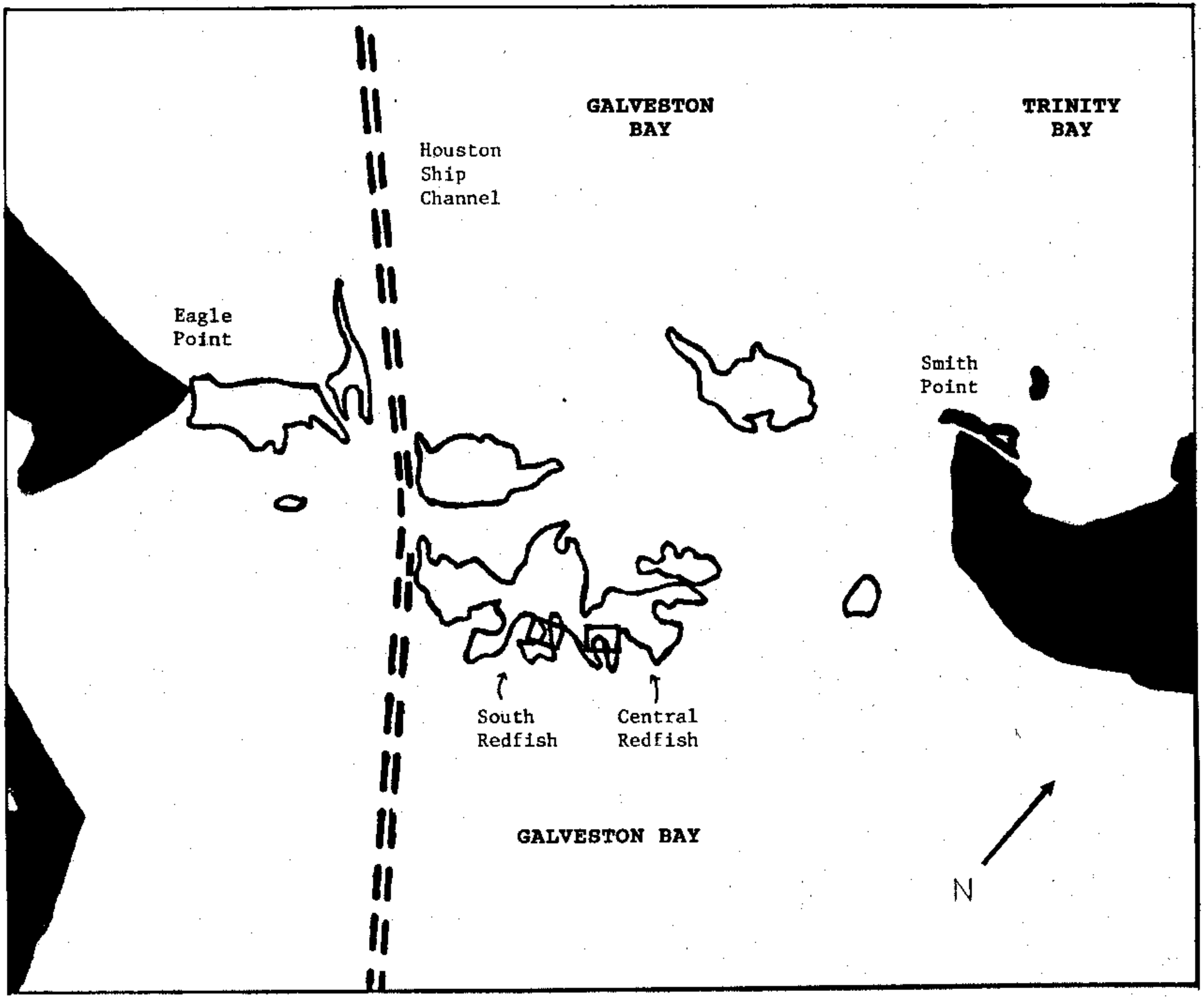
Figure 1. Redfish Bar reef complex depicting two 16.5 ha oyster shell planting sites (rectangles) at South and Central Redfish reefs in Galveston Bay that received 3,135 m^3 of shell September 1991.


GALVESTON BAY
TRINITY BAY
Houston Ship Channel
Eagle Point
Smith Point
South Redfish
Central Redfish
GALVESTON BAY
N

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