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REHABILITATION OF PUBLIC OYSTER REEFS DAMAGED OR DESTROYED BY A NATURAL DISASTER

by R.P. Hofstetter

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EXECUTIVE SUMMARY

Flooding on the Trinity River (Texas) during 1979 was severe (7.2 million ac-ft discharged from the Livingston Reservoir). Oyster mortality began in late May when salinity dropped below 5 °/oo. By mid-July oyster populations on 535 ac in Trinity Bay suffered 100% mortality and an additional 250-300 ac experienced partial damage. Heavy local rainfall associated with tropical storms during late summer caused further flooding. Oyster growth was slowed and spawning inhibited. The overall spat set was very low (averaging 24 spat set per sample).

Because oyster populations were damaged or destroyed by flooding, a Federal Grant-in-Aid Award was obtained to spread 51,649 yd^3 of oyster shell for cultch at a cost of $619,782.96. Shell plantings were begun on 10 June 1980 and completed on 2 July 1980. Oyster shell was sprayed in a thin layer over 722 ac at nine sites in central Galveston Bay. Planting rates ranged from 44 to 75 yd^3/ac and averaged 66.9 yd^3/ac.

During September 1980 spat were found at all sites. Shells with spat averaged 67.8% of the total number recovered. These had received an average set of 4.8 spat/shell. This is equivalent to a set of 1.5 million spat/ac.

Success of the plantings from the fisherman's viewpoint can be judged when the 1980 spat reach marketable size ($\geq$ 3 inches) during the 1982-83 harvest season.

REHABILITATION OF PUBLIC OYSTER REEFS DAMAGED OR DESTROYED BY A NATURAL DISASTER

ABSTRACT

Flooding on the Trinity River (Texas) during 1979 was severe (8.9 billion m^3) discharged from the Livingston Reservoir). Oyster mortality began in late May when salinity dropped below 5 ^{o}/oo. By mid-July oyster populations on 217 ha in Trinity Bay suffered 100% mortality and an additional 100-120 ha experienced partial damage. Heavy local rainfall associated with tropical storms during late summer caused further flooding. Oyster growth was slowed and spawning inhibited. The overall spat set was very low (averaging 24 spat per sample).

Because oyster populations were damaged or destroyed by flooding, a Federal Grant-In-Aid Award was obtained to spread 39,491 m^3 of oyster shell for cultch at a cost of $619,782.96. Shell plantings were begun on 10 June 1980 and completed on 2 July 1980. Oyster shell was sprayed in a thin layer over 313 ha at nine sites in central Galveston Bay. Planting rates ranged from 77 to 142 m^3/ha and averaged 126 m^3/ha.

During September 1980 spat were found at all sites. Shells with spat averaged 67.8% of the total number recovered. These had received an average set of 4.8 spat/shell. This is equivalent to a set of 3.7 million spat/ha.

Success of the plantings from the fisherman's viewpoint can be judged when the 1980 spat reach marketable size (76 mm +) during the 1982-83 harvest season.

ACKNOWLEDGEMENTS

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INTRODUCTION

Oyster production along the Texas coast averages 1.1 million kg of shucked meats annually, valued at more than $2.2 million dockside. Usually, 75-90% of the harvest is taken from public reefs in Galveston Bay.

Redfish Bar, a 1000-ha reef complex extending from Eagle Point to Smith Point in central Galveston Bay, is the major harvest area. Oyster fishermen from all along the Texas coast and from Louisiana work these public beds during the 6-mo open season (1 November-30 April). Restrictions on gear, cargo and oyster size tend to limit the catch. The fishery is closely monitored to prevent overfishing.

All 44 private oyster leases, covering 958 ha, are in Galveston Bay. The active leases have yielded 91-272 thousand kg of shucked meats annually during the past 4 years. Lease holders depend upon public reefs in closed waters--generally upper Galveston, Trinity and Dickinson Bays--for seed oyster stock. Transplanting activities are strictly controlled by the Texas Parks and Wildlife Department (TPWD) in cooperation with the State Health Department.

Public oyster reefs are dependent upon natural spat setting to maintain productivity. Normally, major setting peaks occur during spring--typically May and June--with lesser waves during summer or early fall. When the Trinity River floods during spring, spat setting may be delayed until late summer. If flooding is severe, oyster populations may be damaged and spat setting may be extremely limited.

Since 1972 spat setting has generally been light. Setting was very poor during 1975-77. An abundant and well-distributed set occurred during 1978. Oyster populations, which had been almost depleted in spring 1978, began to recover. However, flooding on the Trinity River during 1979 was severe. The annual discharge from the Livingston Reservoir was 8.9 billion m^3 and during April, May and June the discharge was 4.8 billion m^3 (Trinity River Authority, unpublished data). Oyster mortality began in late May as water temperature rose above 25 C and salinity fell below 5 $^{o}/oo$. Surveys of the reefs in mid-July (TPWD unpublished data) showed that most of the oysters in Trinity Bay were dead. Across much of Redfish Bar, less than 20% of the oysters had been killed. Oyster populations on approximately 217 ha of public reefs suffered 100% mortality and partial losses occurred on an additional 100-120 ha. Heavy local rainfall associated with tropical storms during late summer resulted in flooding of the San Jacinto River and smaller streams on the west side of the bay. Although no mortality was noted, spawning was inhibited and growth slowed. The overall spat set was low (averaging 24 spat per sample of 0.035 m^3).

Because of damage to oyster populations caused by flooding, a Federal Grant-In-Aid Award was obtained to purchase and spread oyster shell for cultch. This report summarizes the work accomplished under P.L. 88-309 Project Segment No. 2-352-D-I (4b).

MATERIALS AND METHODS

Shell planting sites were selected according to past productivity and value to the oyster fishermen. All sites were on or near the Redfish Bar reef complex in central Galveston Bay (Figure 1). None was in an area where high mortality from flooding would be expected. Area 1 near the Eagle Point shoreline was in an area closed to oystering. It was chosen because spat setting had been good there and it had potential value as a seed oyster (25-75 mm) producing bed.

Based upon reef surveys conducted during 1973-75, nine sites totaling almost 324 ha were selected for shell plantings. Sites east of the Houston Ship Channel (HSC) (Figure 2) contained bottom types ranging from shell to shell-and-mud to stiff mud. Sites west of the HSC (Figure 3) contained bottom types of stiff mud or sand with scattered shell.

Originally, 200 ha were to be planted during fall 1979 and the remainder planted during spring 1980. Because of summer floods during 1979, all plantings were postponed until spring 1980.

Both clam shell and oyster shell had been considered as cultch material. However, preliminary bids showed clam shell to be expensive so oyster shell alone was used. Specifications called for clean oyster shell with not more than 15% by volume of shells smaller than 10 mm at the widest point and with at least 50% of shells 25 mm or larger at the widest point.

Radcliffe Materials, Inc. (New Orleans, Louisiana) received the contract for shell planting. The work was authorized by the U. S. Army Corps of Engineers under Permit 13933 dated 12 December 1979.

Oyster shell was delivered to staging areas near planting sites using large, penned barges with capacities of over 1500 m^3. A crane off-loaded the shell to smaller, flush deck barges holding 300-900 m^3. These barges were maneuvered over the planting sites by a tug boat. A smaller barge contained pumps and high pressure water hoses (Figure 4).

Planting sites were marked with flagged poles or floats. Marker positions were plotted by sextant for future reference. As the shell barge was maneuvered within the marked area, shell was sprayed overboard using three high pressure hoses (350 kg/cm^2). An observer from the Coastal Fisheries Branch of TPWD was present at all times to supervise the plantings. Anahuac Towing and Shell Co. provided the tug boat (Mary B), pump barge, pumps and personnel to man the hoses.

Shell, sprayed overboard up to 15 m from the barge, fell to the bottom in a thin layer. Coverage at each site was estimated from the total hectares covered by the planting equipment and the total number of cubic meters planted.

Planted shell samples were collected at each site by means of a small oyster dredge. Planted shells were separated from natural reef shells, the number of shells with spat was determined and spat were measured to the nearest mm. The final examination of all sites was made on 25 September 1980.

RESULTS

Shell Plantings

Shell plantings were begun on 10 June 1980 and completed on 2 July 1980. The contractor planted 39,491 m^3 at a cost of $619,782.96. Shell was spread at nine sites covering 313 ha at rates ranging from 77 to 142 m^3/ha and averaging 126 m^3/ha (Table 1).

Spat Setting

Preliminary examination of Site A (Figure 2) about one week after completion showed that a spat set was taking place. During July spat were found at all sites except Site I (Figure 3). On 25 September 1980 spat sets were found at all sites (Table 2). Of the planted shells collected, those with spat ranged from 37.0% (Site I) to 85.7% (Site E) of the total and average 67.8%. The average number of spat on these shells ranged from 3.3 (Site H) to 6.5 (Site I). The average of all sites combined was 4.8 spat/shell. The overall set, including shells with and without spat, averaged 3.2 spat/shell. Setting was still in progress, judging by the number of spat < 5 mm. Maximum size ranged from 34 mm (Site D) to 53 mm (Sites H and I).

DISCUSSION

Best planting rates for various bottom types were not determined. However, spat sets on the 84-142 m^3/ha plantings over shell, shell-and-mud and stiff mud bottom exceeded the setting rate on natural reef substrate (43% of the natural shells received 3.7 spat/shell). The least successful planting was that on sandy-mud bottom (77 m^3/ha) where only 37% of the shells received spat. Probably more shell was needed to form a stable layer of shell on the surface.

Buried shells were recovered at Sites B, D, F and I. This would be expected where light plantings were bridging across mud and sand. At Site D some of the shells had spat attached, indicating recent burial. Shrimp boats were working in the area and trawls may have disturbed the planted bottom.

One oyster drill (Thais haemastoma) attacking a newly set spat was collected at Site A. Drills were not found at any other site.

A 4.8 spat/shell set on 67.8% of the planted shell is equivalent to planting 86 m^3/ha of "spatted" shells. Based upon samples, 1 m^3 would contain about 8700 shells. These shells, bearing 5 spat each, would provide 3.7 million spat/ha in addition to the set on natural reef shells.

Success of the plantings from the fisherman's viewpoint can be better judged when the 1980 spat reach market size (76 mm +) during the 1982-83 season. Until then they can be culled easily from market oysters during the 1980-81 season and, in the process, spread over a larger area.

Table 1. Shell plantings in central Galveston Bay: June-July 1980.

Planting site	Area (ha)	Shell planted (m^3)	Planting rate (m^3/ha)
South Redfish Reef			
A	83	11,775	142
B	30	4,114	137
C	36	4,641	129
D	43	5,520	128
North Redfish Reef			
E	34	3,906	115
Todd's-Switchover			
F	19	2,561	135
G	22	3,131	142
H	42	3,535	84
San Leon-Smith			
I	4	309	77
Total	313	39,491	126

Table 2. Oyster spat set on planted shell in central Galveston Bay as of 25 September 1980.

Planting site	% of shells with spat	Average no. spat/shell	Size range (mm)	Average size (mm)
South Redfish Reef				
A	76.9	5.2	3-45	17.1
B	65.1	4.3	4-46	16.9
C	63.2	5.2	5-45	19.1
D	64.1	4.7	2-34	12.7
North Redfish Reef				
E	85.7	4.2	3-41	12.5
Todd's-Switchover				
F	61.3	4.4	9-51	24.5
G	68.4	5.3	6-44	16.6
H	70.5	3.3	5-53	25.8
San Leon-Smith				
I	37.0	6.5	10-53	19.3
Total	67.8	4.8	2-53	16.9

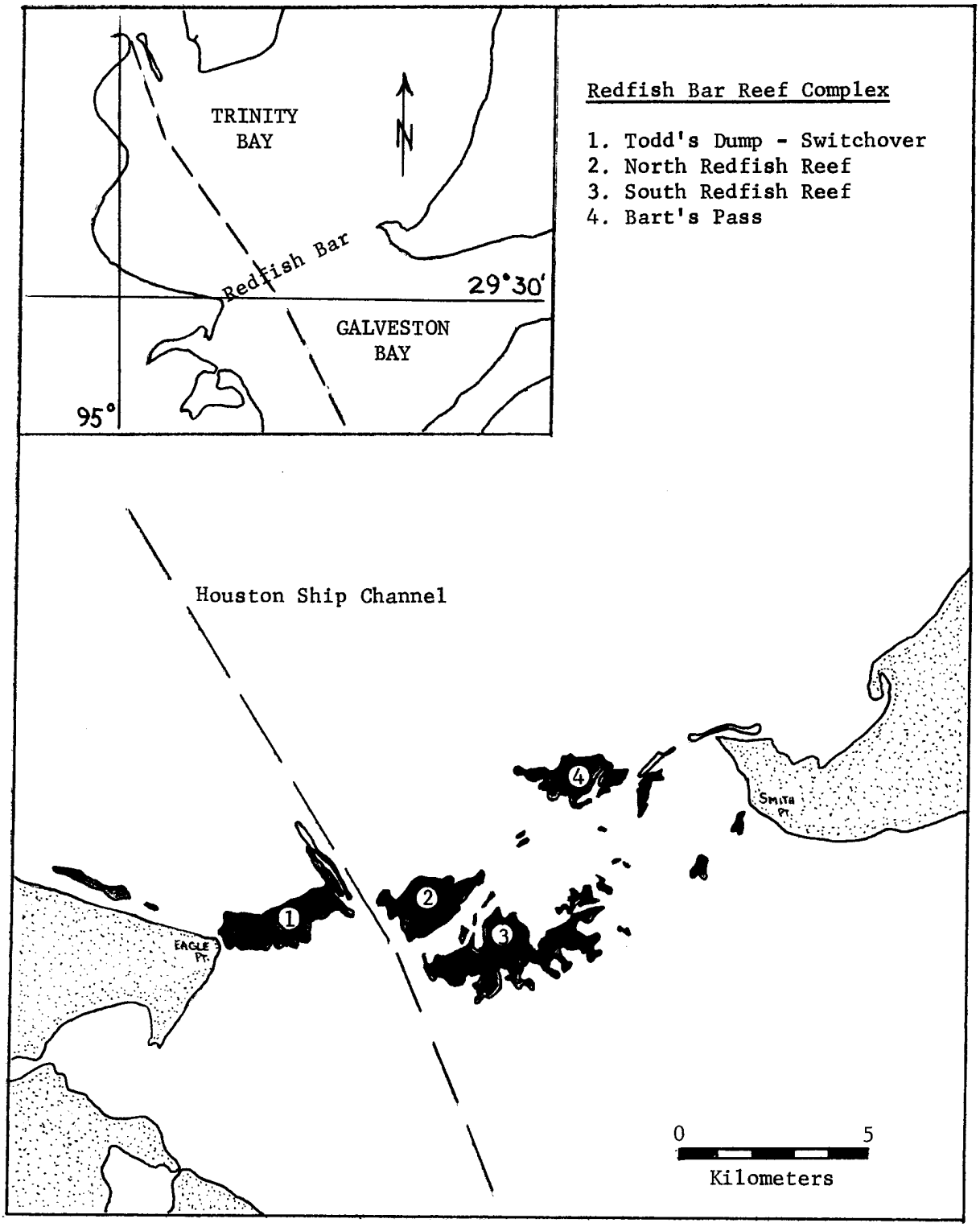

Figure 1. The Redfish Bar complex of oyster reefs in central Galveston Bay between Eagle Point and Smith Point.

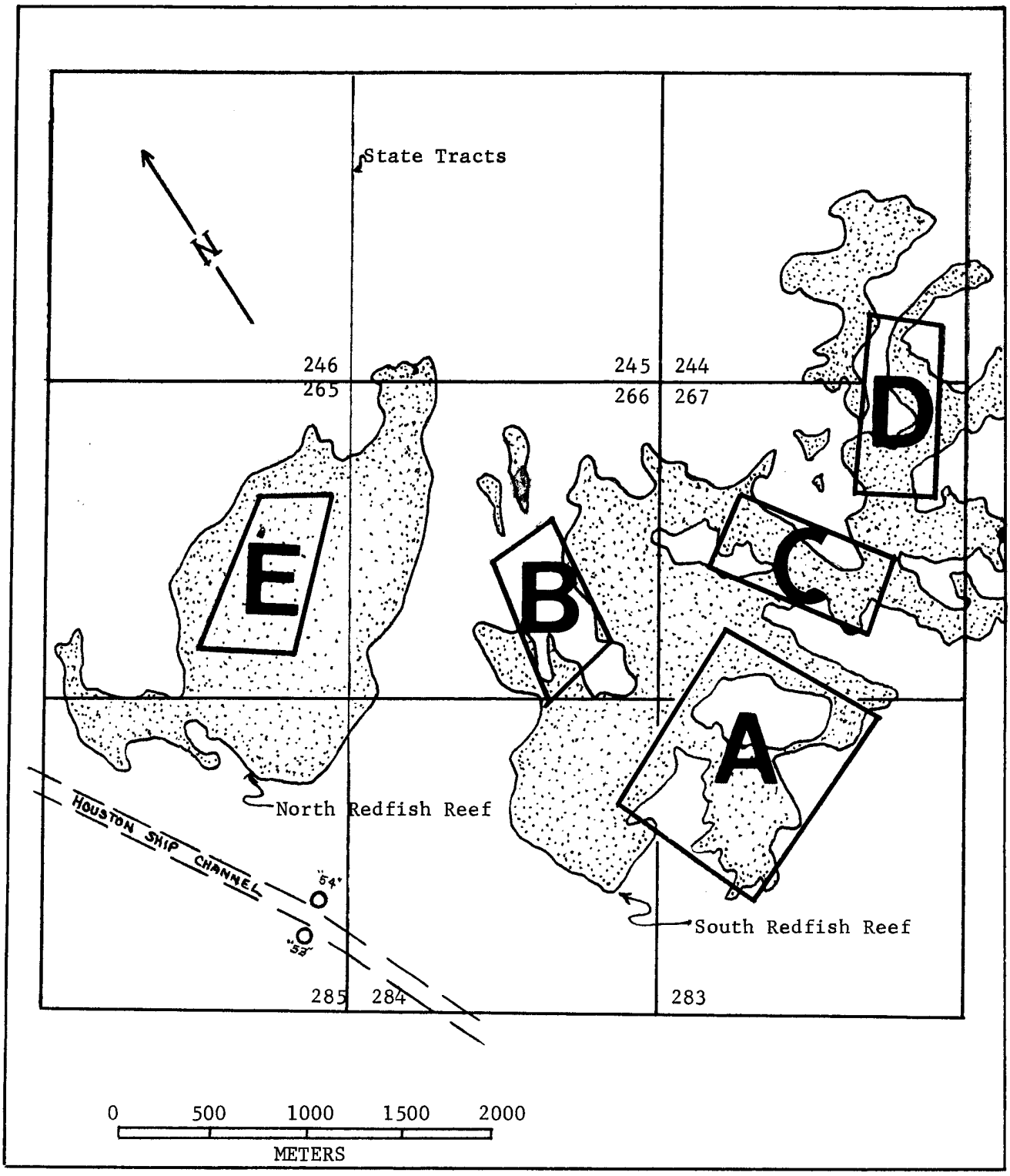

Figure 2. The Redfish Bar oyster reef complex east of the Houston Ship Channel in Galveston Bay showing shell planting sites.

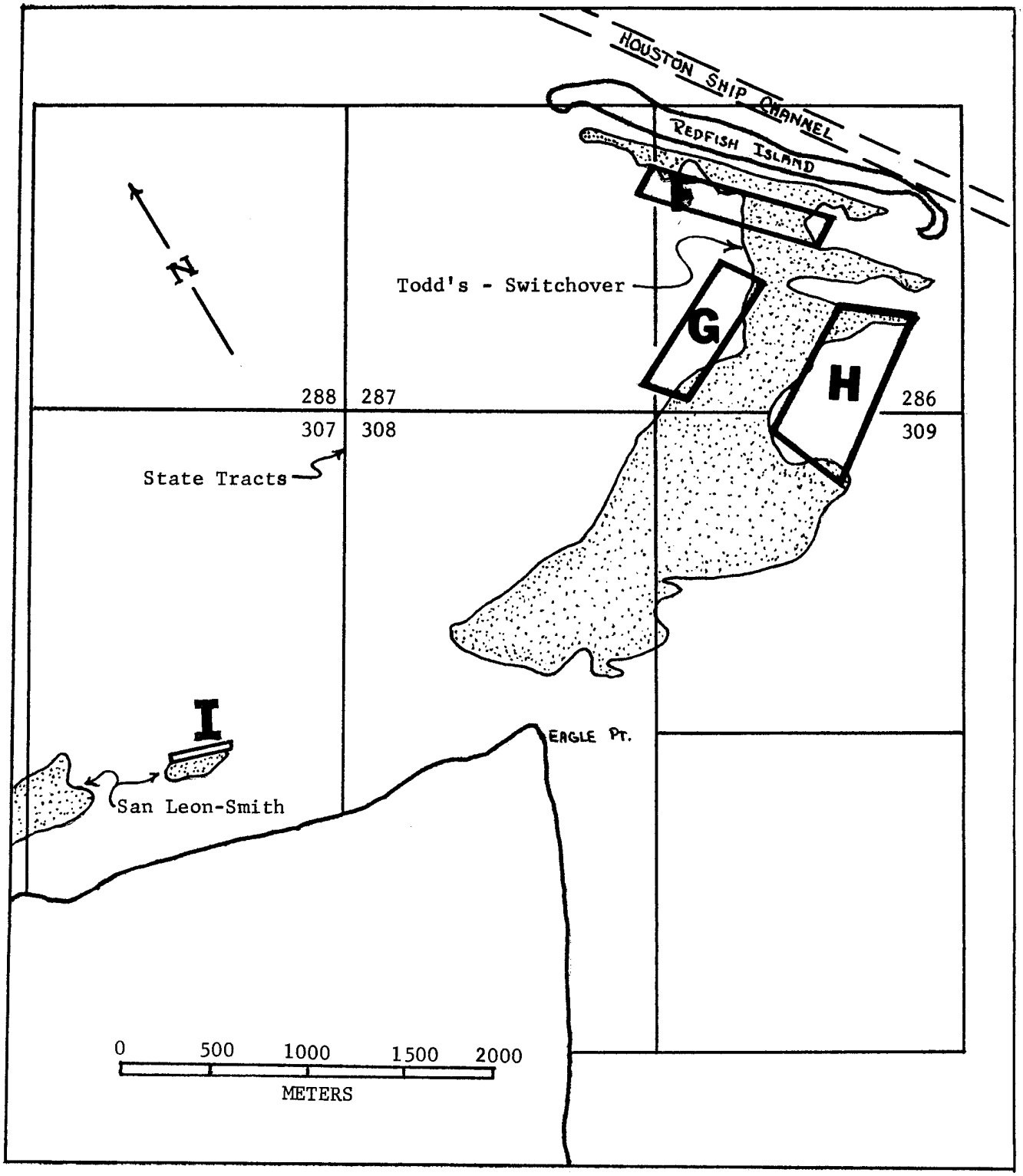

Figure 3. The Redfish Bar oyster reef complex west of the Houston Ship Channel in Galveston Bay showing shell planting sites.

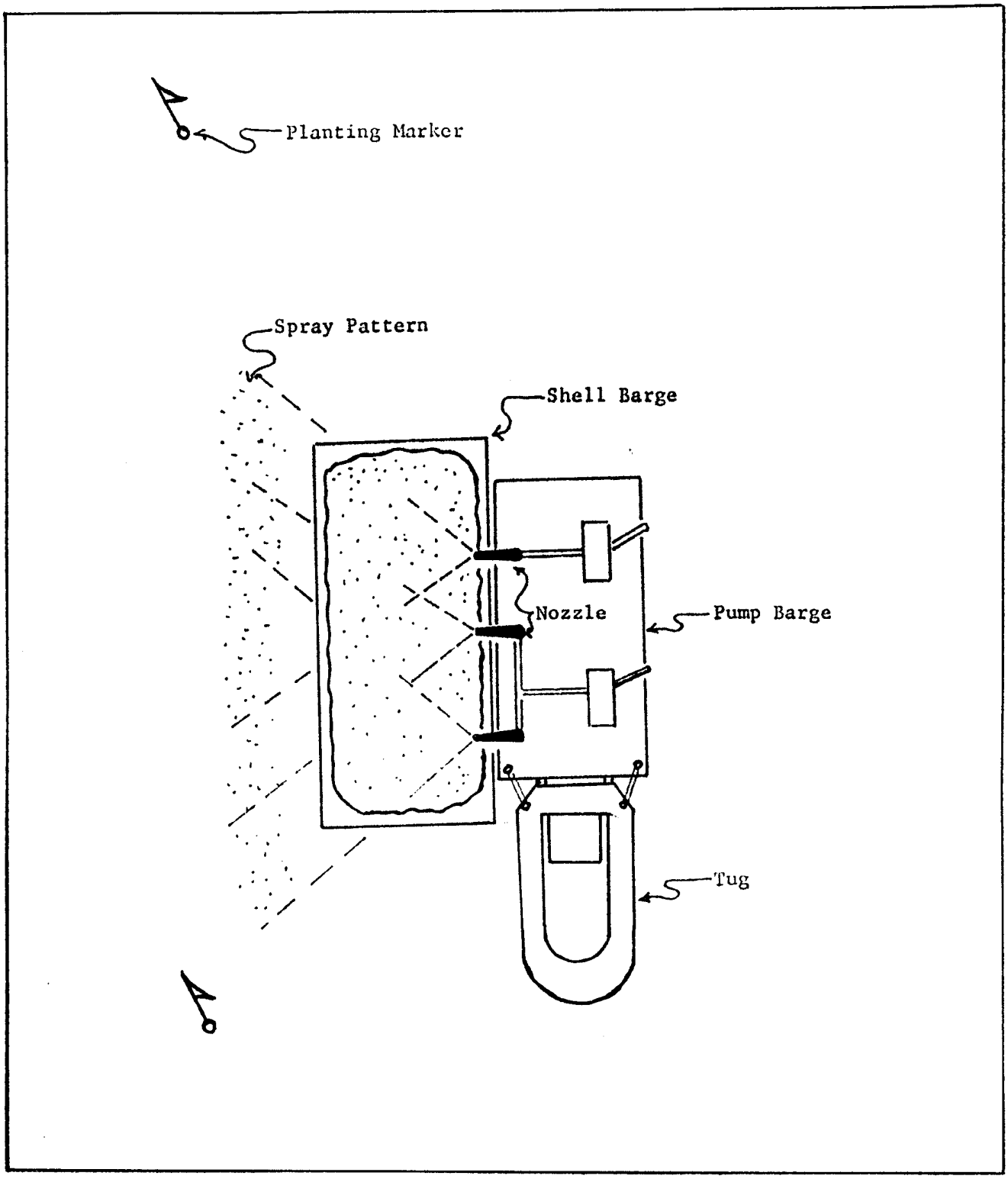

Figure 4. Diagram of shell planting method using high pressure water hoses to spray oyster shells in a thin layer off barges.

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