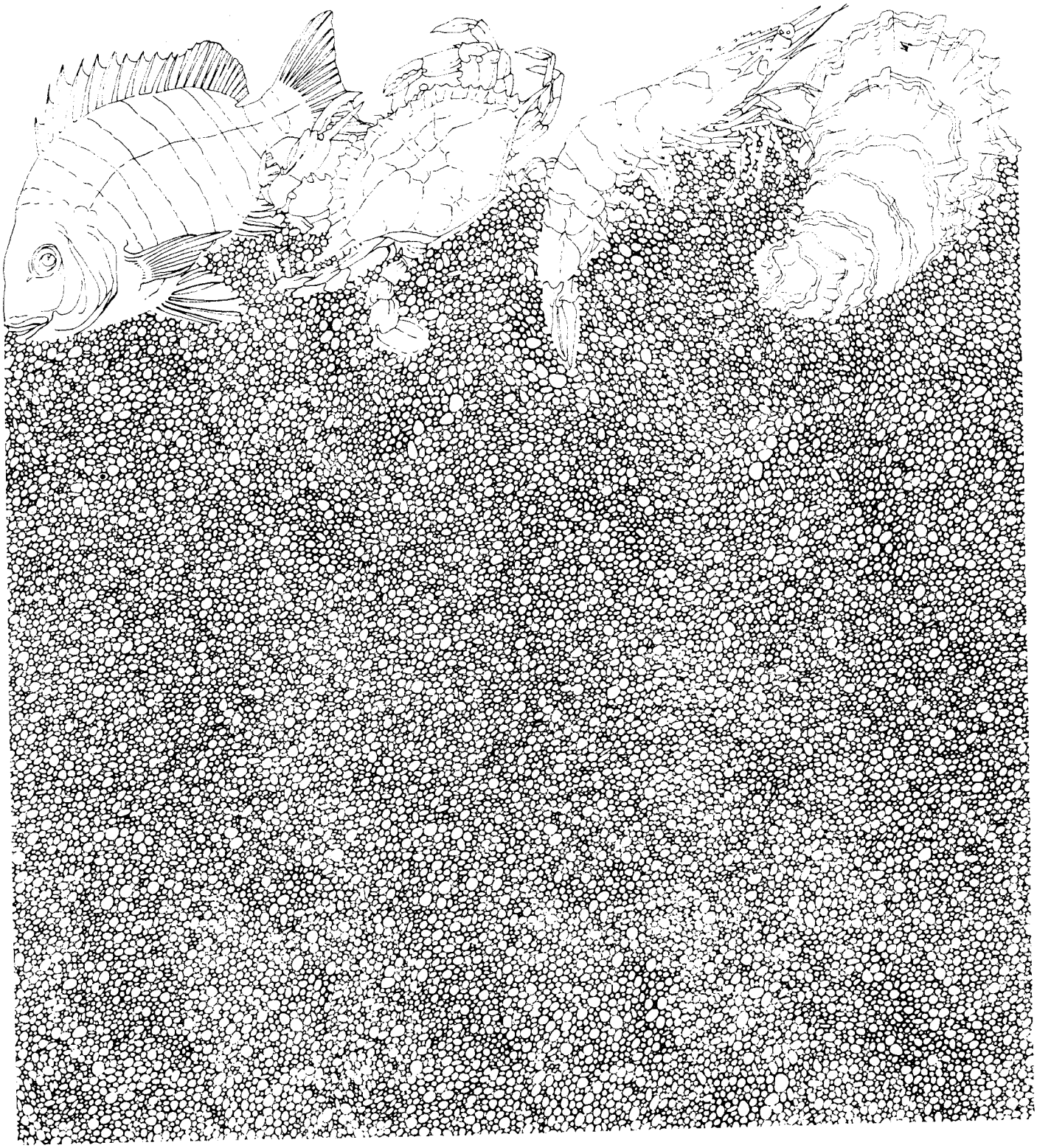
Shell Management Annual Report September 1977 - August 1978

by Mario A. Garcia

Management Data Series Number 5
1979

Texas Parks and Wildlife Department
Coastal Fisheries Branch



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EXECUTIVE SUMMARY

The Texas Parks and Wildlife Department is charged with managing the biological resources of Texas estuarine waters. The objective of the Department's shell management program is to insure compliance of shell dredge companies with Department regulations by monitoring mudshell dredging in coastal waters. Previous investigations have indicated that uncontrolled dredging is detrimental to the estuarine environment, especially to benthic and particularly to oyster reef communities.

San Antonio Bay, which receives 1.5 million ac-ft of inflow and 249,160 yd^3 of sediment from the San Antonio and Guadalupe Rivers each year, contains 20 state land tracts under general permit regulations. The part of San Antonio Bay (the only bay along the Texas coast where dredging occurred during 1977-78) being dredged during 1977-78 encompassed an area of 30 mi^2 containing 1488 ac of exposed oyster reefs; over 10 mi^2 of bay bottom have been dredge altered.

Mudshell dredging was monitored two or three times a week weather permitting. Only one dredge (owned by Parker Brothers and Co., Inc.) operated in the bay at any one time. Shell removal totalled 1,612,890 yd^3 (Table A).

One citation was issued to the foreman of the dredge Trinity I for siltation of reef 136 in state tract 99. A special permit was issued to Parker Brothers in February 1978 to remove reef 159 (containing 0.5 ac of exposed reef) in state tract 77. Reef 159 was replaced in July 1978 on Middleground Reef in state tract 149 where about 1692 yd^3 of coarse oyster shell were spread 1 ft thick over a 1 ac area on the northern edge of the reef.

Alabama estuaries and assumed that these estuaries were similar to many others and that results of his study should be applicable elsewhere. In Alabama, dredge effluent disposed of in open water either settled out rapidly or was transported as a flocculated density layer along the bay bottom. The sediment remaining in suspension as a visible surface turbidity plume did not exceed natural levels caused by normal winds in areas > 487.7 m from the discharge point and had little harmful effect on the environment. Only limited and temporary reduction in the number of benthic organisms occurred in dredge affected areas but species diversity was reduced. Small temporary reductions of these organisms in limited areas were considered of little consequence to the Alabama estuarine ecosystem.

Holland et al. (1974) reported decreases in benthos numbers and species diversity due to sediment deposition at a sampling site in Nueces Bay when shell dredging at 274 m from the site began in September 1973. Dredging continued for 3 mo; the benthos began to recover in January 1974.

The U. S. Army Corps of Engineer's final environmental impact statement on shell dredging in San Antonio Bay (1974) was based on a 12-mo study by the Texas A & M University Research Foundation. In this bay benthic population abundances in 3-4 yr old dredge cuts were < those on undredged flats; population abundances in cuts older than 4 yr were at least 80% (by number) of those on undredged flats. Species composition in cuts and on undredged flats was different. Exposed reefs were severely affected by silt, depending on reef profile. Low profile reefs were covered--killing oysters. Silt was deposited on the flanks of high profile reefs, reducing available substrate, crevices and space for oyster spat set and for associated reef organisms.

Matthews et al. (1975) noted that several dredged sampling sites in San Antonio Bay were the least productive sites having reduced benthos standing crops and species diversities. Dredging perhaps resulted in soft bottom unfavorable to many benthic organisms.

Benefield (1976) found that reef profile, sediment composition, current direction and number of dredges operating in an area influenced silt deposition on oyster reefs by shell dredging. Reefs rising 0.91-1.22 m above the bay bottom received sediment from a dredge operating 91.4 m from the reef edge. A flat profile reef received sediment from a dredge 1798 m away.

Area Description

San Antonio Bay is an ancient river valley partially filled with predominantly riverine silty clay sediments. The sand content increases toward the bay margins and is highest near the shores of Matagorda Island. San Antonio Bay receives an annual average inflow of 1.85 billion m^3 from the San Antonio and Guadalupe Rivers. The mean sediment load of the two rivers combined is 190,508 m^3/yr (Texas Water Development Board 1959-1971 data).

In San Antonio Bay 20 state land tracts located between the Intracoastal

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ABSTRACT

The shell management program was designed to monitor mudshell dredging in Texas coastal waters to insure compliance with Texas Parks and Wildlife Department regulations. Parker Brothers and Co., Inc.'s Trinity I and John P. Dearsaugh were the only dredges in San Antonio Bay during September 1977-August 1978; they removed 1,233,216 m^3 of mudshell. The Dearsaugh operated only briefly before being moved to Louisiana. The dredges were monitored 71 times; one citation for siltation of a reef was issued to the Trinity I in November 1977. One special permit to remove exposed shell was issued in February 1978. Subsequently a replacement reef was constructed on Middleground Reef in San Antonio Bay.

INTRODUCTION

The Texas Parks and Wildlife Department (TPWD) is charged with managing the biological resources of Texas estuarine waters. The objective of the Department's shell management program is to insure compliance of shell dredge companies with Department regulations by monitoring mudshell dredging in coastal waters. Previous investigations have indicated that uncontrolled dredging is detrimental to the estuarine environment, especially to benthic and particularly to oyster reef communities.

Literature Review

Masch and Espey (1967) investigated shell dredging as a factor in sedimentation in Galveston Bay and found that the amount of resuspended sediments in the vicinity of dredges was at least an order of magnitude > the load produced by currents, wind and wave action or ship and barge traffic which did not produce enough sedimentation for deposition on reefs. The most severe sediment conditions resulted from density layers formed when dredge wash waters contained sediments of >80% (weight) silt and clay size particles of which 50% were clay size. Movement of these layers was controlled primarily by gravity; i.e., they were able to move in directions different from water current directions. Consolidation did not usually begin until sediment concentrations exceeded 1750 mg/ℓ; the layer was moved by gravity or tidal action until then. These density layers could move over large areas of low profile reefs, become trapped in low spots or bury the reef if the layer consolidated to a sheer strength indispersible by existing currents.

Burg (1973) studied the effects of mudshell dredging on the biology and sediments of San Antonio Bay. Operations at distances of 457.2 m covered areas of bay bottom with an average of 30.0 mm of silt and covered reefs with up to 609.6 mm of silt. Siltation of oysters in four of six oyster baskets in the test area resulted in 100% mortality by the end of the study; the control experienced a 3.5% mortality.

May (1973) studied the environmental effect of hydraulic dredging in

Alabama estuaries and assumed that these estuaries were similar to many others and that results of his study should be applicable elsewhere. In Alabama, dredge effluent disposed of in open water either settled out rapidly or was transported as a flocculated density layer along the bay bottom. The sediment remaining in suspension as a visible surface turbidity plume did not exceed natural levels caused by normal winds in areas > 487.7 m from the discharge point and had little harmful effect on the environment. Only limited and temporary reduction in the number of benthic organisms occurred in dredge affected areas but species diversity was reduced. Small temporary reductions of these organisms in limited areas were considered of little consequence to the Alabama estuarine ecosystem.

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In San Antonio Bay 20 state land tracts located between the Intracoastal

Waterway and latitude 28°22' N are under general permit regulations. The part of San Antonio Bay being dredged encompassed an area of ~ 77.7 km^2 containing 602.2 ha of exposed oyster reefs; over 25.9 km^2 of bay bottom have been dredge altered. Water depth ranges from 1.2 to 1.8 m in undisturbed areas and from 2.1 to 3.7 m in dredged areas.

MATERIALS AND METHODS

Mudshell dredging was monitored two or three times a week weather permitting. A 10.7-m twin screw diesel boat was used to get to areas where dredges were operating. A Navy Mark II sextant was used to triangulate two angles between three accurately surveyed points which were plotted on 1":2000'-scale Mylar maps. These angles were set on an engineer's three-arm protractor, the arms aligned on the three points on the map and the dredge location was plotted. Company, dredge name, shot points used, angles and state land tract number were recorded.

Core samples were taken in the vicinity of dredging to determine sediment type, presence of density layers, silt thickness and direction and extent of silt movement. When dredging occurred in the vicinity of an exposed shell reef, the reef edge was marked with flagged cane poles and another set of markers was placed 91.4 m from the reef edge, using a Rangematic IV range finder to establish distances. Silt tray stations were maintained and monitored at the 91.4-m line and at the mud-exposed shell interface. Trays were made of galvanized sheet metal, 30.5 x 30.5 x 3.8 cm and fitted with a wire cradle. Trays were tied with 0.64-cm diameter polyvinyl rope to 5.1 x 5.1-cm wooden stakes to prevent them from sinking into the bottom. Silt trays were used only as indicators that silt was moving toward a reef; siltation of a reef was verified by sampling with oyster tongs.

RESULTS AND DISCUSSION

Parker Brothers and Co., Inc. briefly operated two dredges, the Trinity I and John P. Dearsaugh in San Antonio Bay in October 1977. After the Dearsaugh was moved to Louisiana in October 1977, the Trinity I operated alone during the remainder of fiscal year 1977-78. Dredge activities were monitored 71 times (Table 1). Shell removal was entirely from San Antonio Bay and totalled 1,233,216 m^3 for fiscal year 1977-78 (Table 2).

One citation was issued to the foreman of the Trinity I for siltation of reef 136 in state tract 99 (Figure 1) on 14 November 1977. The dredge was ordered to cease operation immediately and to relocate. A subsequent check of the reef found it to be clear and permission was given to resume dredging.

Few permit violations occurred this year because: 1) only one dredge operated, 2) dredging was effectively monitored, 3) dredging did not occur in areas of exposed reefs, 4) old dredge cuts located between the dredge and exposed reefs trapped sediment and 5) prevailing water currents during dredging minimized reef siltation.

Under the shell management program, requests for special permits and

permit amendments are evaluated considering reef size, location and oyster density as well as possible dredging effects on nursery areas, environmental impact on fishing areas and on oyster leases, and other biological and hydrological parameters. A special permit to remove reef 159 in state tract 77 was issued to Parker Brothers in February 1978. According to the TPWD 1976 reef survey, reef 159 included 0.2 ha of exposed shell. TPWD dredging regulations state that the dredge permittee must construct an artificial replacement reef not <0.4 ha if the reef being removed is <0.4 ha in size. Reef 159 was replaced in July 1978 on Middleground Reef in state tract 149 where ~1294 m^3 of coarse oyster shell were spread 0.3 m thick over a 0.4-ha area on the northern edge of the reef.

LITERATURE CITED

Benefield, R. H. 1976. Shell dredging sedimentations in Galveston and San Antonio Bays 1964 - 1969. Texas Parks and Wildlife Department Tech. Ser. No. 19. 34 p.

Burg, T. M. 1973. The effects of mudshell dredging on the biological and physical parameters of a special permit area of San Antonio Bay, Texas. File Report, Texas Parks and Wildlife Department, Austin, Texas. 37 p.

Holland, J. S., N. J. Maciolek, R. D. Kalke and C. H. Oppenheimer. 1974. A benthos and plankton study of the Corpus Christi, Copano, and Aransas Bay systems II. Report on data collected during the period July 1973 - April 1974. Special Report. Univ. Tex. Mar. Sci. Inst. 121 p.

Masch, F. D. and W. H. Espey, Jr. 1967. Shell dredging a factor in sedimentation in Galveston Bay. Center of Research in Water Resources, Univ. of Texas 168 p.

Matthews, F. A., C. A. Marcin and G. L. Clements. 1975. A plankton and benthos survey of the San Antonio Bay system March 1972 - July 1974. Texas Parks and Wildlife Department. Coastal Fisheries Project Report.

May, E. B. 1973. Environmental effects of hydraulic dredging in estuaries. Ala. Mar. Resour. Bull. No. 9. 85 p.

U. S. Army Corps of Engineers. 1974. Final environmental statement -- shell dredging in San Antonio Bay, Texas. U. S. Army Engineer District, Galveston, Texas 172 p.

Table 1. Dredge Trinity I locations in San Antonio Bay (September 1977-August 1978).

Date	Shot points A	B	C	Angle AB	BC	State Tract
9-2-77*	P1	BW	SR	39-38	39-34	108
9-8-77*	P1	BW	SR	39-01	39-39	108
9-13-77*	P1	P2	SR	44-38	33-19	108
9-16-77*	P1	P2	SR	42-50	33-23	108
9-22-77*	P1	BW	SR	38-22	39-33	108
9-27-77*	P1	P2	SR	52-15	44-31	108
10-7-77*	P1	BW	P2	46-02	07-10	108
10-12-77*	P1	BW	SR	47-34	56-29	108
10-19-77*	P1	BW	SR	43-15	44-16	108
10-24-77	Trinity I returned to San Antonio Bay from Louisiana					
10-24-77	P1	BW	P2	37-04	19-29	100
10-24-77*	P1	P2	SR	52-02	34-46	108
10-26-77	Dearsaugh left San Antonio Bay for Louisiana					
10-28-77	P1	BW	P2	37-04	19-41	100
11-2-77	P1	SR	P2	07-00	50-25	99
11-4-77	P1	SR	BW	08-30	29-00	99
11-8-77	P1	SR	BW	06-50	31-32	99
11-14-77	P1	SR	P2	38-24	20-00	99
11-15-77	SR	P1	BW	11-02	35-58	76
11-30-77	SR	P1	BW	12-18	37-12	76
12-5-77	P1	BW	P1	36-32	25-40	76
12-12-77	P1	BW	P2	36-44	25-13	76
12-19-77	Too hazy to shoot					75
12-29-77	Too hazy to shoot					76

Table 1. (Cont'd.)

Date	Shot points A	B	C	Angle AB	BC	State Tract
1-4-78	SR	P1	BW	10-45	36-04	76
1-9-78	SR	BW	P2	51-08	22-56	76
1-16-78	WT	SR	B1	100-51	49-42	76
1-23-78	Too hazy to shoot					75
1-27-78	SR	P1	BW	20-32	32-36	76
2-10-78	SR	P1	BW	15-47	36-55	76
2-17-78	SR	P1	BW	22-41	38-00	76
2-21-78	SR	P1	BW	21-50	38-26	76
2-27-78	SR	P1	BW	18-44	38-44	76
3-7-78	SR	P1	BW	14-14	39-08	76
3-10-78	SR	P1	BW	13-48	39-18	76
3-15-78	SR	BW	P2	48-22	22-33	76
3-17-78	SR	BW	P2	47-50	22-22	76
3-22-78	SR	P1	BW	06-14	38-14	76
3-24-78	SR	P1	BW	08-38	38-10	76
3-27-78	SR	BW	P2	42-46	21-32	76
4-4-78	SR	BW	P2	36-36	20-46	99
4-13-78	P1	BW	P2	34-00	28-00	76
4-20-78	P1	BW	P2	41-36	10-56	108
4-26-78	P1	BW	SR	41-16	31-52	108
4-28-78	B18	WT	B22	32-28	05-32	108
5-4-78	P1	BW	P2	38-00	13-00	100
5-9-78	WT	B22	B18	10-06	36-40	100
5-16-78	WT	B22	B18	37-46	17-46	100
5-19-78	WT	B22	B18	37-08	18-04	100

Table 1. (Cont'd.)

Date	Shot points A	B	C	Angle AB	BC	State Tract
5-24-78	P1	SR	P2	35-00	13-06	100
5-26-78	P1	SR	P2	35-50	11-14	100
5-31-78	P1	SR	P2	34-20	11-00	100
6-5-78	WT	B22	B18	42-18	22-54	100
6-12-78	WT	B22	B18	40-54	23-04	100
6-14-78	WT	B22	B18	39-18	23-20	100
6-19-78	WT	B22	B18	38-22	23-22	100
6-23-78	P1	SR	P2	30-14	02-14	100
6-27-78	WT	B22	B18	40-30	28-02	100
6-29-78	WT	B22	B18	28-06	39-46	100
7-5-78	P1	SR	BW	28-21	02-42	100
7-6-78	WT	B22	B18	38-16	28-18	100
7-7-78 •	WT	B22	B18	38-52	28-56	100
7-10-78	WT	B22	B18	38-08	25-06	100
7-17-78	B22	B18	B13	52-40	49-14	107
7-19-78	B22	B18	B13	61-12	50-00	107
7-21-78	B22	B18	B13	62-00	52-00	107
7-28-78	B22	B18	B13	49-04	66-14	107
8-2-78	B22	B18	B13	68-00	47-16	107
8-8-78	B22	B18	B13	72-00	48-14	107
8-16-78	B22	B18	B13	77-00	45-02	107
8-21-78	B22	B18	B13	82-02	41-24	107
8-24-78	B22	B18	B13	80-52	41-54	107
8-29-78	B22	B18	B13	73-06	49-28	107

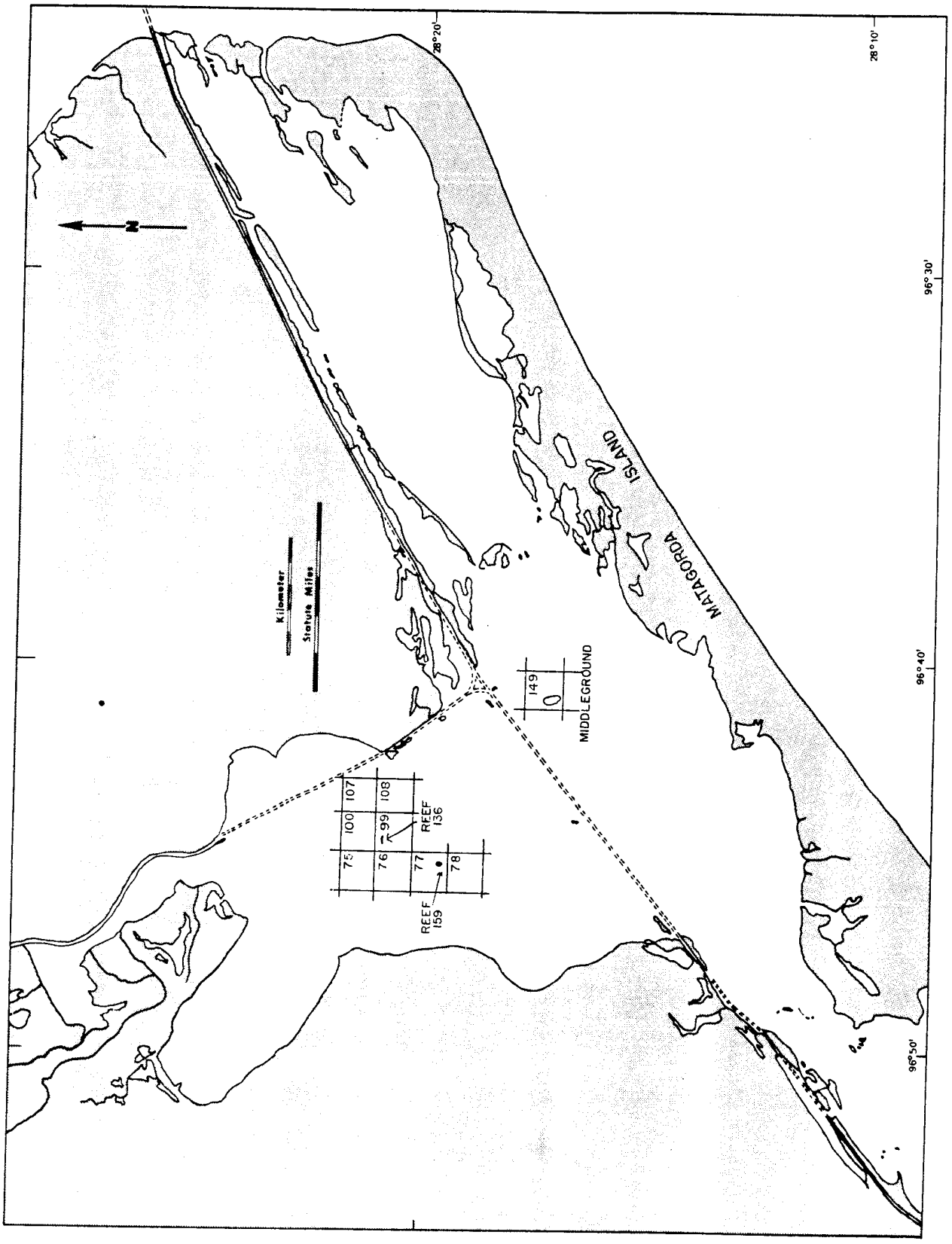

Figure 1. San Antonio Bay

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