P. Hammerschmidt

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by Lawrence W. McEachron

Management Data Series Number 9
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Texas Parks and Wildlife Department
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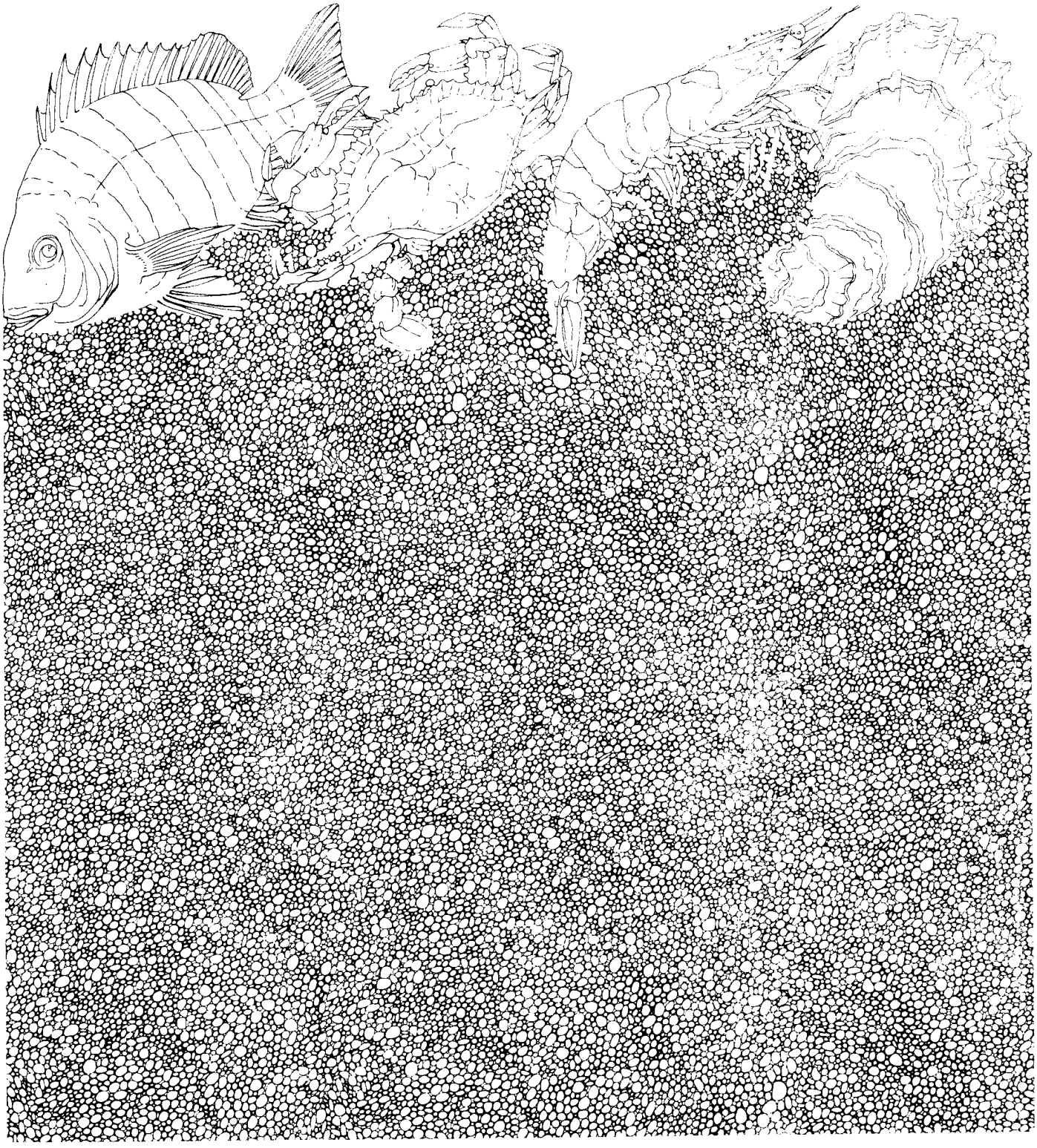

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EXECUTIVE SUMMARY

Weekend bay sport boat fishermen and weekday commercial fishermen were surveyed in Galveston, Matagorda (including East Matagorda), San Antonio, Aransas and Corpus Christi Bays, upper Laguna Madre and lower Laguna Madre from September 1978 through August 1979. Additionally, Gulf boat anglers and jetty and pass anglers were surveyed in all areas.

A roving clerk traveled through each bay system at a constant rate on randomly selected weekend days and counted boat trailers to obtain fishing pressure estimates. Department personnel were stationed at boat ramps on randomly selected weekend days to collect catch data by interviewing fishing parties that had completed a trip. Creel personnel interviewed commercial fishermen at fish houses and in the field on randomly selected weekdays.

During the year 2,360,800 man-h were expended by weekend boat fishermen to catch 2,254,888 lb of finfish. Black drum (982,380 lb) constituted 44% of the landings, spotted seatrout (460,550 lb) constituted 20% and sand seatrout (276,240 lb) constituted 12%; all other species each constituted $\leq$ 5% of the landings.

Annual catch rates for all fishes combined ranged from 0.35 to 0.53 fish/man-h in all bays except in Galveston Bay where the catch rate was 0.83 fish/man-h. On an annual basis catch rates for spotted seatrout were higher (0.15-0.31 fish/man-h) than for any other species except in Galveston Bay where sand seatrout and Atlantic croaker had higher catch rates.

Commercial fishermen in the bays landed 4,408,363 lb of finfish from September 1978 through August 1979. Red drum comprised 18% of the total landings, spotted seatrout 23% and black drum 37%. Almost all of these fish were taken by trotlines, gill nets and trammel nets.

Boat fishermen in the pass and jetty areas had annual catch rates ranging from 0.71 lb/man-h in the Galveston area to 1.70 lb man-h in the Aransas-Corpus Christi area. Spotted seatrout, sheepshead and "other fishes" were the major fishes landed.

Boat fishermen in the Gulf of Mexico had annual catch rates ranging from 0.99 lb/man-h to 1.43 lb/man-h except for off lower Laguna Madre where the catch rate was 3.84 lb/man-h. King mackerel and red snapper dominated the Gulf catches.

RECREATIONAL AND COMMERCIAL FINFISH CATCH STATISTICS FOR TEXAS BAY SYSTEMS, SEPTEMBER 1978-AUGUST 1979

ABSTRACT

Weekend sport boat fishermen were surveyed in Galveston, Matagorda (including East Matagorda), San Antonio, Aransas and Corpus Christi Bays, upper Laguna Madre and lower Laguna Madre from 1 September 1978 to 31 August 1979. These fishermen expended 2,360,800 man-h to catch an estimated 1,022,800 kg of fish. Black drum (Pogonias cromis), spotted seatrout (Cynoscion nebulosus) and sand seatrout (C. arenarius) constituted over 76% of all fish landed.

Annual catch rates for all fishes combined ranged from 0.18 to 0.39 kg/man-h in all bays except in Galveston Bay where the catch rate was 0.64 kg/man-h. The smallest fishes landed were Atlantic croaker (Micropogon undulatus) (0.19-0.35 kg) and sand seatrout (0.20-0.38 kg); the largest fishes were black drum (0.45-13.18 kg) and gafftopsail catfish (Bagre marinus) (0.95-1.45 kg).

Red drum (Sciaenops ocellata), spotted seatrout and black drum constituted 79% of the 1,999,600 kg of fish landed by commercial fishermen. Almost all of these fish were taken by trotlines, gill nets and trammel nets.

Boat fishermen in the pass and jetty areas had annual catch rates ranging from 0.32 kg/man-h in the Galveston area to 0.77 kg/man-h in the Aransas-Corpus Christi area. Spotted seatrout, sheepshead (Archosargus probatocephalus) and "other" fishes dominated the landings.

Boat fishermen in the Gulf of Mexico had annual catch rates ranging from 0.45 kg/man-h to 0.65 kg/man-h except for off the lower Laguna Madre where the catch rate was 1.74 kg/man-h. King mackerel (Scomberomorus cavalla) and red snapper (Lutjanus campechanus) dominated the Gulf catches.

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INTRODUCTION

The second year of a 5-yr project entitled "Survey of Finfish Harvest in Texas Bays" was conducted from September 1978 through August 1979. This report presents the results of the second year's study.

The objectives of this study were:

1) To determine the total harvest of commercially important finfishes by species and method of capture in eight Texas bay systems.

2) To determine the species, size and catch per effort of commercially important finfishes caught in bay waters by weekend sport boat fishermen using private boats.

3) To determine the species, size and catch per effort of commercially important finfishes caught in Gulf waters by sport fishermen using private boats.

MATERIALS AND METHODS

From September 1978 through August 1979 boat ramps were surveyed in the Galveston, Matagorda (including East Matagorda), San Antonio, Aransas, Corpus Christi, upper Laguna Madre and lower Laguna Madre Bay systems (Appendix A and B). Area descriptions for each bay (Matlock and Weaver 1979) are presented in Appendix C.

The year was divided into four quarters--fall (September-November), winter (December-February), spring (March-May) and summer (June-August). Interviews were conducted in each bay on 8 weekend days per quarter except in Galveston Bay where interviews occurred on 16 weekend days and in Matagorda Bay where interviews occurred on 12 weekend days. Additionally, boat ramps used by Gulf boat anglers were surveyed in Galveston Bay and in Corpus Christi Bay on each of 2 weekend days and 2 weekdays per quarter. Roving counts were made on 4 randomly selected weekend days per quarter in each bay except in Galveston Bay where 8 roves were conducted.

The same sampling design for sport fishermen described by Heffernan et al. (1976) and modified by Green et al. (1978) was used in this study. A roving clerk traveled through each bay system at a constant rate on randomly selected weekend days and counted boat trailers to obtain fishing pressure estimates. Department personnel were stationed at boat ramps on randomly selected weekend days to collect catch data by interviewing fishing parties that had completed a trip. Interviewers recorded species, number and weights of all fish brought back by fishing parties as well as number of persons in the party, fishing location, gear used and trip length.

Interview sites were selected at random but were weighted according to mean boat trailer counts obtained during the 1974-77 creel surveys (TPWD unpublished data). This resulted in boat ramps with high mean trailer counts being visited more often than boat ramps with low mean trailer counts. Sampling was done on 272 weekend days and 32 weekdays during 1978-79. Roving counts were made from 0800 to 1600 CST and interviews were conducted from 1000 to 1600 CST. Evaluation of data obtained during the first 2-yr study (Heffernan et al. 1976 and Breuer et al. 1977) indicated that sampling during these time periods would increase the amount of data collected per unit of sampling effort.

Harvest estimates were reported as the product of the mean catch rate (no of fish/man-h), mean pressure (mean no of fishermen at an access point at any time), total access points, total daylight hours and an estimate of the percent of boaters engaged in fishing. The correction for boats engaged in fishing is needed because it is impossible for the rover to identify "fishing" boats by looking at a trailer parked at a ramp. Harvest estimates using this procedure were made for the daylight period only. Since the roving clerk is counting trailers during a high use period (0800-1400 CST) a correction factor is also needed to adjust for the upward bias caused by counting during that period. Green et al. (1978) described the correction factor procedure as follows:

> "The change in the roving count procedure required modifications to the pressure estimate calculation. A correction factor for adjusting the bias caused by having the roving counter survey during the high use period was estimated by conducting trailer count diurnals at randomly picked sites. The correction factor was calculated by dividing the sum of the hourly counts from dawn to dusk by the sum of the hourly counts made from 1000 to 1800 CST from all surveyed ramps. The product of this factor, the 8-h sample period and the mean trailer counts yielded pressure estimates comparable to estimates that would have been obtained had the survey period been from dawn to dusk."

The variance for the harvest was computed as the variance of a product (Goodman 1960) and the variance of the sums (Snedecor and Cochran 1967). Because total fish and total weight data were collected from parties by weighing all fish of the same species in mass and not individually, the variance for the mean weight of a species was computed as the variance of a ratio (Cochran 1967). Formulae used in the estimating procedures (Heffernan et al. 1976) are found in Appendix D.

Data collected from this survey are comparable to previous survey data. However, two assumptions must be made when comparing catch rate data from year to year. The first is that the mean catch rate and mean fish size for parties returning before or after the interview period are the same as those found for parties returning during the interview period. The second is that neither mean rate nor mean fish size is correlated with the use experienced at the boat ramp.

Commercial landings were obtained from Texas Parks and Wildlife Project No. 2-311-R which was jointly funded by the National Marine Fisheries Service and TPWD. The landings stated in this report came from the same areas as those where weekend boat fishermen were surveyed.

Creel personnel interviewed commercial fishermen at fish houses (Appendix E) and in the field to obtain catch per effort, size of fish and species composition of commercial catches. Surveys were conducted on 26 weekdays per quarter each in Galveston Bay, Matagorda-San Antonio Bays, Aransas Bay, Corpus Christi-upper Laguna Madre Bays and in lower Laguna Madre. Sampling was done on 520 weekdays during 1978-1979. Interviews were conducted from 0800 to 1700 CST at randomly selected sites. Because so few commercial fishermen were intercepted at Galveston and Matagorda-San Antonio Bay fish houses in fall, winter and spring, interviewers were allowed to intercept commercial fishermen at known boat-launching areas during the 0800-1700 CST period. This would, hopefully, increase the number of interviews in these areas. Data collected from each commercial interview consisted of gear used, size of gear (m), effort expended, species landed and total gutted weight for each species landed.

Sport and commercially caught fish were measured (total length) to the nearest mm in order to compare fish caught by the two fisheries. All measurements were taken in the field during scheduled sample periods.

RESULTS

Bay Fishery

Sport Harvest

During 1978-79, 2,360,800 man-h (Table 1) were expended by weekend sport boat fishermen to catch an estimated 1,022,800 kg (Table 2) of finfish. Total landings ranged from 22,000 kg in Aransas Bay to 655,500 kg in Galveston Bay. Estimated landings were lowest during winter in all bay systems except San Antonio Bay. Black drum (Pogonias cromis) consituted over 44% of the landings, spotted seatrout (Cynoscion nebulosus) over 20% and sand seatrout (C. arenarius) over 12%; all other species each constituted $\leq$ 5% of the total landings.

The annual catch rate (by weight) for all species combined was 0.64 kg/man-h in Galveston Bay (Table 3); in the other bay systems catch rates ranged from 0.18 to 0.39 kg/man-h. Catch rates for all species varied between bay systems but fishes of the family Sciaenidae dominated the landings.

The highest catch rate (by number) of 0.83 fish/man-h was reported in Galveston Bay (Table 4); all other bay systems catch rates ranged from 0.35 to 0.53 fish/man-h. On an annual basis catch rates (no/man-h) for spotted seatrout were higher than for any other species except for Galveston Bay where sand seatrout and Atlantic croaker (Micropogon undulatus) had higher catch rates.

Atlantic croaker and sand seatrout had the lowest average weight/fish (kg) of all fishes landed by sportsmen in all bay systems except in upper Laguna Madre (Table 5). Black drum was the heaviest fish recorded in all bay systems except in Aransas Bay where gafftopsail catfish (Bagre marinus) was the heaviest fish landed.

Commercial Harvest

Commercial fishermen landed 1,999,600 kg of finfish from September 1978 through August 1979 (Table 6). Black drum, spotted seatrout and red drum (Sciaenops ocellata) dominated the coastwide landings. Highest landings were reported from lower Laguna Madre and lowest landings from San Antonio Bay.

Generally, commercial fishermen caught larger spotted seatrout, red drum and southern flounder (Paralichthys lethostigma) than sport fishermen (Table 7). Sport fishermen generally caught black drum and sheepshead (Archosargus probatocephalus) that were as large as or larger than those caught by commercial fishermen.

Gill nets, strike-trammel nets, set-trammel nets, trotlines and rods and reels were the gear types most commonly used by commercial fishermen in Texas (Tables 8-14). Spotted seatrout were most often caught with gill nets, set-trammel nets, strike-trammel nets and rods and reels. Red drum were caught most often with trotlines, gill nets, strike-trammel nets and set-trammel nets. Black drum were most often caught with gill nets, trammel nets and trotlines. Southern flounder were most often caught with gigs. Sheepshead were most often caught with gill nets, set-trammel nets, strike-trammel nets and rods and reels.

Pass, Jetty and Gulf of Mexico Sport Fisheries

Pass and Jetty

Annual catch rates (kg/man-h) for sport boat fishermen fishing the jetty and pass areas ranged from 0.32 kg/man-h in the Galveston area to 0.77 in the Aransas-Corpus Christi area (Tables 15-17). On an annual basis spotted seatrout dominated the catches in the Galveston area, "other" fishes dominated the catches in the Matagorda-San Antonio area and "other" fishes and sheepshead dominated the catches in the Aransas-Corpus Christi area.

The annual catch rates (no/man-h) for all species combined ranged from 0.26 fish/man-h in the Matagorda-San Antonio pass and jetty area to 0.85 in the Aransas-Corpus Christi pass and jetty area (Tables 15-17). Spotted seatrout and sand seatrout were the dominant fishes caught in the Galveston area, sheepshead and spotted seatrout in the Matagorda-San Antonio area and sheepshead in the Aransas-Corpus Christi area.

Generally, red drum, black drum and "other" fishes were the heaviest fishes caught by pass and jetty fishermen on an annual basis (Tables 15-17). Atlantic croaker was the smallest fish landed by sport fishermen in all areas.

Gulf of Mexico

The annual catch rate for all species combined was 1.74 kg/man-h for boat fishermen fishing in the Gulf of Mexico off lower Laguna Madre; all other Gulf catch rates ranged from 0.45 to 0.65 kg/man-h (Tables 18-21). King mackerel (Scomberomorus cavalla) accounted for the highest annual catch rates for Gulf fishermen in all areas except in Galveston Bay and lower Laguna Madre where "other" fishes had the highest catch rates.

On an annual basis catch rates (no/man-h) for Gulf fishes ranged from 0.20 fish/man-h off the Aransas-Corpus Christi area to 0.44 off the Matagorda-San Antonio area (Tables 18-21). Red snapper (Lutjanus campechanus) was the dominant fish caught in the Gulf off Galveston Bay and lower Laguna Madre; king mackerel was the dominant fish taken in the Gulf off the Matagorda-San Antonio and Aransas-Corpus Christi areas.

The largest king mackerel were caught in the Gulf off the Galveston area, the largest red drum and cobia (Rachycentron canadum) off the Aransas-Corpus Christi area and the largest Spanish mackerel (Scomberomorus maculatus) and red snapper off the Matagorda-San Antonio and Aransas-Corpus Christi area (Tables 18-21). The smallest fishes reported from all Gulf areas were Atlantic croaker and sand seatrout.

Weekend Bay Boat Fisherman 5-yr Catch Rate Summary

From September 1974 through August 1979 the mean annual catch rates for all species combined ranged from 0.25 to 0.43 kg/man-h (Table 22). Generally, the annual catch rates declined from 0.37-0.39 in 1975-76 and 1976-77 to 0.22 in 1978-79 in Matagorda Bay, from 0.45 in 1974-75 to 0.25 in 1978-79 in San Antonio Bay, from 0.28 in 1974-75 to 0.18 in 1978-79 in Aransas Bay, from 0.45 in 1975-76 to 0.28 in 1978-79 in Corpus Christi Bay and from 0.41 in 1974-75 to 0.24 in 1978-79 in upper Laguna Madre. Galveston Bay and lower Laguna Madre had increases in catch rates from 0.28 in 1974-75 to 0.64 in 1978-79 and 0.30 in 1975-76 to 0.39 in 1978-79, respectively.

The spotted seatrout coastwide annual mean catch rates declined from 0.14-0.15 kg/man-h in 1974-77 to 0.09 in 1977-79. The coastwide catch rates of red drum declined from 0.03-0.05 in 1974-77 to 0.02 in 1977-79. Annual catch rates of spotted seatrout and red drum for each bay system declined from 1974 through 1979. With the exception of black drum, which showed an increase in mean annual catch rates from 0.02 in 1974-75 to 0.20 in 1978-79, and sand seatrout which increased from 0.02-0.04 in 1974-78 to 0.07 in 1978-79, all other species catch rates declined or remained the same.

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Table 1 . Total pressure estimates in man-h (x 1000) for weekend boat fishing by season and year in seven Texas bay systems (Sept. 1978-Aug. 1979).

Bay System	Fall	Winter	Spring	Summer	Total
Galveston	500.7	11.9	231.3	280.4	1024.3
Matagorda	60.7	3.7	42.9	86.1	193.4
San Antonio	62.9	13.5	25.6	43.5	145.5
Aransas	37.8	10.0	15.0	58.0	120.8
Corpus Christi	107.8	10.0	60.5	35.9	214.2
Upper Laguna Madre	89.3	16.7	102.5	123.0	331.5
Lower Laguna Madre	79.3	12.4	121.9	117.5	331.1
Grand Total	938.5	78.2	599.7	744.4	2360.8

Table 2 . Weekend sport boat finfish landings (kg x 1000) estimated for seven Texas bays by species and season (Sept. 1978-Aug. 1979). Blanks = no data; 0.0 = <0.1.

Bay system	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Galveston										
Fall	16.5	16.2	46.4	6.4	7.9	18.2	97.3	0.4	21.1	230.3
Winter				0.0	2.2				0.3	2.5
Spring	4.9	0.7	318.9	1.3	1.2	0.7	0.7	16.5	2.1	347.0
Summer	22.0	2.4	7.2	2.1	1.9	17.8	15.2	1.0	6.2	75.7
Annual	43.4	19.3	372.5	9.8	13.2	36.7	113.2	17.9	29.7	655.5
Matagorda										
Fall	6.5	2.3	4.4	1.3	1.6	0.8	0.7	0.1	0.5	18.2
Winter					1.9					1.9
Spring	0.3	1.2	0.2	1.2	2.2		0.1	0.5	0.3	6.0
Summer	5.3	1.5	0.5	0.2	1.1	0.2	1.4	1.7	3.7	15.5
Annual	12.1	5.0	5.1	2.7	6.8	1.0	2.2	2.3	4.5	41.6
San Antonio										
Fall	3.4	2.6	0.7	0.6	0.1	0.7	0.0	0.4	0.3	8.8
Winter	0.5	11.1	0.3	0.0	0.3				0.0	12.6
Spring	0.3	0.5	5.2	0.1	0.2			0.4	0.1	6.9
Summer	5.6	2.0	0.0	0.3	0.2	0.0	0.1	0.1	0.3	8.7
Annual	9.8	16.2	6.2	1.0	0.8	0.7	0.1	0.9	0.7	36.6
Aransas										
Fall	5.1	0.4	0.1	2.4	0.2	0.0	0.1	0.4	0.0	8.7
Winter	0.2	0.7	0.0	0.1	0.2					1.3
Spring	1.7	0.1	0.1	0.0	0.2		0.3	0.8	0.1	3.3
Summer	7.7	0.2	0.1	0.4	0.2	0.0	0.0			8.7
Annual	14.7	1.4	0.3	2.9	0.8	0.0	0.4	1.2	0.1	22.0

Table 2. (Cont'd).

Bay system	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Corpus Christi										
Fall	15.1	4.5	1.9	1.8	2.8	3.1	4.1		0.1	33.3
Winter	0.6	0.1	0.0	0.1	0.3		0.1			1.2
Spring	5.8	0.1	1.6	0.7	0.8		0.4	1.4	1.4	12.1
Summer	5.6	1.9	0.1	0.2	0.7	0.2	1.5	1.6	0.5	12.2
Annual	27.1	6.6	3.6	2.8	4.7	3.3	6.1	3.0	2.0	58.8
Upper Laguna Madre										
Fall	5.0	0.7	2.9	1.0	0.6	14.0	0.8			25.0
Winter	0.1	0.2	1.3	0.0	0.3	0.0				2.0
Spring	13.4	0.1	7.4	1.2	1.8	0.3	0.4			24.6
Summer	24.4	0.4		1.6	0.8	0.3	0.7	0.1	0.1	28.3
Annual	42.9	1.4	11.6	3.8	3.5	14.6	1.9	0.1	0.1	79.9
Lower Laguna Madre										
Fall	14.4	1.7	0.7	0.7	1.3	1.6	0.6		0.4	21.3
Winter	0.9	0.3	0.1	0.0	0.8	0.0	0.0		0.0	2.1
Spring	22.1	2.2	45.5	2.1	3.2	0.3	0.6		0.9	76.8
Summer	21.5	1.3		3.9	0.5	0.4	0.2		0.3	28.2
Annual	59.9	5.5	46.3	6.7	5.8	2.3	1.4		1.6	128.4
Coastwide total										
Fall	66.0	28.5	57.1	14.2	14.5	38.4	103.6	1.3	22.4	345.8
Winter	2.3	12.4	1.7	0.2	6.0	0.0	0.1		0.3	23.3
Spring	48.5	4.9	378.9	6.6	9.6	1.3	2.5	19.6	4.9	476.7
Summer	92.1	9.7	7.9	8.7	5.4	18.9	19.1	4.5	11.1	177.3
Grand total	208.9	55.4	445.6	29.7	35.5	58.6	125.3	25.4	38.7	1022.8

[a]Due to rounding of numbers these totals may not exactly equal individual species totals

Table 3. Catch rates (kg/man-h) estimated for weekend sport boat fishermen in seven Texas bays by species and season (Sept. 1978-Aug. 1979). Blanks = no data; 0.00 = catch rates <0.01.

Bay system	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Galveston										
Fall	0.03	0.03	0.09	0.01	0.02	0.04	0.19	0.00	0.04	0.46
Winter				0.00	0.19				0.03	0.21
Spring	0.02	0.00	1.38	0.01	0.01	0.00	0.00	0.07	0.01	1.50
Summer	0.09	0.01	0.02	0.01	0.01	0.06	0.05	0.00	0.02	0.27
Annual	0.04	0.02	0.37	0.01	0.02	0.04	0.11	0.02	0.03	0.64
Matagorda										
Fall	0.10	0.06	0.07	0.02	0.02	0.01	0.01	0.00	0.01	0.30
Winter					0.51					0.51
Spring	0.01	0.03	0.00	0.03	0.05		0.00	0.01	0.01	0.14
Summer	0.06	0.02	0.01	0.00	0.01	0.00	0.02	0.02	0.04	0.18
Annual	0.06	0.04	0.03	0.01	0.03	0.00	0.01	0.01	0.02	0.22
San Antonio										
Fall	0.05	0.04	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.14
Winter	0.06	0.81	0.02	0.00	0.02				0.00	0.91
Spring	0.02	0.02	0.20	0.00	0.01			0.02	0.00	0.27
Summer	0.13	0.05	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.20
Annual	0.07	0.11	0.04	0.01	0.01	0.01	0.00	0.01	0.00	0.25
Aransas										
Fall	0.13	0.01	0.00	0.06	0.01	0.00	0.00	0.01	0.00	0.23
Winter	0.03	0.07	0.00	0.01	0.02					0.13
Spring	0.11	0.00	0.01	0.00	0.01		0.02	0.05	0.01	0.22
Summer	0.14	0.00	0.00	0.01	0.00	0.00	0.00			0.15
Annual	0.12	0.01	0.00	0.02	0.01	0.00	0.00	0.02	0.00	0.18

Table 3 . (Cont'd).

Bay system	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Corpus Christi										
Fall	0.14	0.04	0.02	0.02	0.03	0.03	0.04		0.00	0.31
Winter	0.06	0.01	0.00	0.01	0.03		0.01			0.12
Spring	0.10	0.00	0.02	0.01	0.01		0.01	0.02	0.02	0.20
Summer	0.15	0.05	0.00	0.00	0.02	0.01	0.04	0.05	0.01	0.34
Annual	0.13	0.03	0.02	0.01	0.02	0.03	0.03	0.03	0.01	0.28
Upper Laguna Madre										
Fall	0.06	0.01	0.03	0.01	0.01	0.15	0.01			0.28
Winter	0.01	0.01	0.08	0.00	0.02	0.00				0.12
Spring	0.13	0.00	0.07	0.01	0.02	0.00	0.00			0.24
Summer	0.19	0.00		0.01	0.01	0.00	0.01	0.00	0.00	0.23
Annual	0.13	0.00	0.05	0.01	0.01	0.04	0.01	0.00	0.00	0.24
Lower Laguna Madre										
Fall	0.18	0.02	0.01	0.01	0.02	0.02	0.01		0.00	0.27
Winter	0.07	0.03	0.01	0.00	0.06	0.00	0.00		0.00	0.17
Spring	0.17	0.02	0.35	0.02	0.02	0.00	0.00		0.05	0.63
Summer	0.18	0.01		0.03	0.00	0.00	0.00		0.00	0.24
Annual	0.17	0.02	0.20	0.02	0.01	0.00	0.00		0.02	0.39

[a]Due to rounding of numbers these totals may not exactly equal individual species totals

Table 4 . Catch rates (no/man-h) estimated for weekend sport boat fishermen in seven Texas bays by species and season (Sept. 1978-Aug. 1979). Blanks = no data; 0.00 = <0.01.

Bay system	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Galveston										
Fall	0.05	0.01	0.07	0.02	0.02	0.15	0.63	0.00	0.03	0.98
Winter			0.01	0.01	0.24				0.08	0.33
Spring	0.04	0.00	0.18	0.01	0.01	0.02	0.01	0.06	0.04	0.37
Summer	0.22	0.01	0.06	0.01	0.01	0.31	0.25	0.00	0.08	0.95
Annual	0.09	0.01	0.09	0.01	0.02	0.16	0.38	0.01	0.05	0.83
Matagorda										
Fall	0.23	0.06	0.04	0.05	0.04	0.05	0.03	0.00	0.02	0.52
Winter					0.43					0.43
Spring	0.02	0.01	0.01	0.07	0.09		0.01	0.01	0.01	0.22
Summer	0.19	0.02	0.00	0.00	0.02	0.01	0.07	0.02	0.06	0.39
Annual	0.16	0.03	0.02	0.03	0.05	0.03	0.04	0.01	0.04	0.39
San Antonio										
Fall	0.12	0.03	0.01	0.02	0.00	0.05	0.00	0.00	0.00	0.24
Winter	0.08	1.19	0.03	0.00	0.03				0.00	1.35
Spring	0.04	0.03	0.01	0.00	0.01			0.02	0.01	0.12
Summer	0.28	0.02	0.00	0.01	0.01	0.00	0.02	0.00	0.01	0.35
Annual	0.15	0.13	0.01	0.01	0.01	0.03	0.01	0.00	0.00	0.35
Aransas										
Fall	0.39	0.02	0.01	0.07	0.01	0.00	0.02	0.02	0.00	0.53
Winter	0.05	0.10	0.00	0.02	0.04					0.22
Spring	0.25	0.01	0.01	0.00	0.02		0.08	0.04	0.04	0.45
Summer	0.37	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.40
Annual	0.33	0.02	0.00	0.03	0.01	0.00	0.02	0.01	0.01	0.43

Table 4 . (Cont'd).

Bay system	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Corpus Christi										
Fall	0.33	0.04	0.01	0.04	0.03	0.10	0.12		0.01	0.67
Winter	0.10	0.01	0.00	0.01	0.03		0.01			0.17
Spring	0.16	0.00	0.01	0.02	0.01	0.02	0.02	0.02	0.05	0.29
Summer	0.32	0.04	0.00	0.01	0.02	0.03	0.14	0.02	0.03	0.61
Annual	0.27	0.03	0.01	0.03	0.02	0.06	0.09	0.02	0.03	0.53
Upper Laguna Madre										
Fall	0.09	0.01	0.01	0.01	0.01	0.44	0.02			0.61
Winter	0.01	0.01	0.04	0.00	0.02	0.00				0.09
Spring	0.25	0.00	0.02	0.02	0.02	0.01	0.01			0.33
Summer	0.37	0.00		0.01	0.01	0.01	0.01	0.00	0.00	0.41
Annual	0.24	0.00	0.02	0.01	0.01	0.13	0.01	0.00	0.00	0.42
Lower Laguna Madre										
Fall	0.37	0.01	0.01	0.01	0.02	0.07	0.04		0.01	0.54
Winter	0.12	0.03	0.02	0.01	0.06	0.00	0.00		0.00	0.24
Spring	0.27	0.01	0.03	0.03	0.03	0.01	0.01		0.01	0.41
Summer	0.39	0.01	0.00	0.05	0.01	0.02	0.01		0.01	0.49
Annual	0.31	0.01	0.01	0.03	0.02	0.03	0.02		0.01	0.46

[a]Due to rounding of numbers these totals may not exactly equal individual species totals.

Table 5. Average weight (kg) of sport caught finfish by species and season for weekend boat fishermen in seven Texas Bays (Sept. 1978-Aug. 1979). Blanks = no data.

Bay system	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other
Galveston									
Fall	0.62	2.26	1.41	0.59	0.96	0.25	0.31	1.70	1.32
Winter				0.17	0.77				0.34
Spring	0.55	1.20	7.64	0.63	0.81	0.15	0.22	1.25	0.24
Summer	0.43	0.70	0.41	0.49	0.86	0.18	0.20	0.72	0.24
Annual Average	0.50	1.73	4.03	0.57	0.89	0.21	0.29	1.21	0.58
Matagorda									
Fall	0.42	0.97	1.72	0.51	0.60	0.23	0.33	0.91	0.30
Winter					1.20				
Spring	0.43	2.64	0.28	0.38	0.58		0.28	1.30	0.70
Summer	0.33	1.04	2.56	0.68	0.64	0.23	0.22	1.24	0.79
Annual Average	0.38	1.16	1.49	0.45	0.69	0.23	0.25	1.24	0.67
San Antonio									
Fall	0.44	1.31	1.08	0.50	0.84	0.24	0.15	1.82	2.21
Winter	0.72	0.68	0.72	0.72	0.61				0.40
Spring	0.47	0.72	14.47	0.58	0.76			1.00	0.39
Summer	0.45	2.68	0.34	0.56	1.01	0.12	0.21	0.51	0.66
Annual Average	0.46	0.82	13.18	0.53	0.76	0.23	0.20	1.05	0.74
Aransas									
Fall	0.35	0.51	0.23	0.92	0.55	0.23	0.12	0.68	0.34
Winter	0.49	0.74	0.57	0.61	0.48				
Spring	0.44	0.72	0.53	0.70	0.65		0.28	1.22	0.19
Summer	0.37	1.53	0.53	0.49	0.53	0.17	0.25		
Annual Average	0.37	0.69	0.45	0.80	0.55	0.19	0.22	0.95	0.21

Table 5 . (Cont'd).

Bay system	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other
Corpus Christi									
Fall	0.43	1.15	1.52	0.45	0.77	0.29	0.32		0.15
Winter	0.63	0.72	1.14	0.71	0.95		0.63		
Spring	0.65	1.36	3.96	0.66	1.09		0.37	1.28	0.45
Summer	0.48	1.45	2.39	0.59	0.93	0.25	0.28	1.64	0.40
Annual Average	0.48	1.22	2.09	0.50	0.84	0.29	0.31	1.45	0.39
Upper Laguna Madre									
Fall	0.60	0.77	2.21	0.77	0.97	0.35	0.41		
Winter	0.66	1.36	1.88	0.57	0.94	0.23			
Spring	0.52	0.57	3.52	0.67	1.07	0.24	0.31		
Summer	0.54	1.67		0.91	0.95	0.31	0.42	1.02	0.20
Annual Average	0.54	0.93	2.82	0.78	1.01	0.35	0.38	1.02	0.20
Lower Laguna Madre									
Fall	0.50	1.48	1.34	0.63	0.82	0.29	0.20		0.39
Winter	0.58	0.96	0.52	0.24	0.98	0.34	0.34		0.51
Spring	0.63	1.31	11.76	0.60	0.70	0.26	0.34		6.78
Summer	0.47	0.95		0.73	0.68	0.19	0.23		0.37
Annual Average	0.53	1.22	10.14	0.67	0.75	0.26	0.25		2.24

Table 6. Commercial harvest (kg x 1000) by species in seven Texas bays (Sept. 1978-Aug. 1979). Blanks = no reported landings; 0.00 = catches < 0.1.

Species	Galveston	Matagorda	San Antonio	Aransas	Corpus Christi	Upper Laguna Madre	Lower Laguna Madre	Total
Spotted seatrout	54.1	18.0	10.7	51.2	76.1	71.9	179.0	461.0
Red drum	10.3	11.9	20.4	46.6	31.8	42.1	205.9	369.0
Black drum	38.2	12.3	7.2	17.6	183.7	286.7	195.3	741.0
Southern flounder	24.7	7.8	3.5	17.5	17.7	1.8	5.8	78.8
Sheepshead	35.6	2.6	4.0	10.0	79.2	14.1	22.4	167.9
Atlantic croaker	4.8			1.3	7.8	0.1	2.2	16.2
Sand seatrout	1.6	0.2		1.1	0.6	0.5	2.1	6.1
Gafftopsail catfish	10.0	0.5	0.6	2.3	5.1	0.1	2.2	20.8
Other[a]	84.1	0.2	0.1	1.2	48.5	1.1	3.6	138.8
Total	263.4	53.5	46.5	148.8	450.5	418.4	618.5	1999.6

[a] These totals include unclassfied food and scrap fish

Table 7 . Mean total length (mm) of finfishes caught by weekend sport boat fishermen and commercial fishermen in eight Texas bays (Sept. 1978-Aug. 1979). Blanks = no data.

Species	Galveston	East Matagorda	Matagorda	San Antonio	Aransas	Corpus Christi	Upper Laguna Madre	Lower Laguna Madre
SPORT								
Spotted seatrout	353	338	354	358	327	360	392	366
Red drum	434	432	470	413	384	445	438	327
Black drum	486	364	418	478	456	462	478	360
Southern flounder	342	356	332	354	389	346	341	372
Sheepshead	377	249	388	341	367	353	393	333
Atlantic croaker	241	223	251	220		276	297	
Sand seatrout	281	293	286	289		315	326	
Gafftopsail catfish	493		506	439		564		
COMMERCIAL								
Spotted seatrout	492		449	473	434	443	440	441
Red drum	522		538	489	494	525	551	548
Black drum	430		433	395	428	456	470	470
Southern flounder	378		398	395	396	398	437	398
Sheepshead	333		364	381	388	369	369	360
Atlantic croaker	338		318		341	306		338
Sand seatrout	307							384
Gafftopsail catfish	524				559	522		

Table 8. Commercial catch by gill net (kg/100 ft of net/h), set-trammel net (kg/100 ft of net/h), trotline (kg/100 hook/h), rod and reel (kg/hook-h), gig (kg/gig-h) and trawl (kg/trawl-h) in Galveston Bay (Sept. 1978-Aug. 1979). Number in parenthesis = number of interviews conducted. Blanks = no data; 0.00 = catches < 0.01.

	Gill net					Set-trammel net					Trotline				
Species	Fall (1)	Winter (4)	Spring (3)	Summer (0)	Annual mean	Fall (8)	Winter (6)	Spring (4)	Summer (0)	Annual mean	Fall (5)	Winter (0)	Spring (0)	Summer (0)	Annual mean
Spotted seatrout	0.01	0.48	0.12		0.22	0.13	0.08	0.04		0.09	0.01				0.01
Red drum		0.06	0.02		0.02	0.03	0.01	0.03		0.01	0.22				0.22
Black drum	0.02	0.07	0.06		0.05	0.11	0.07	0.00		0.05	0.09				0.09
Southern flounder	0.01	0.01	0.00		0.00	0.02	0.00	0.01		0.01	0.05				0.05
Sheepshead	0.00	0.06	0.11		0.06	0.06	0.00	0.01		0.02					
Atlantic croaker			0.00		0.00	0.04	0.00			0.00	0.00				0.00
Sand seatrout	0.00				0.00	0.02	0.00			0.00	0.00				0.00
Gafftopsail catfish			0.64		0.06	0.52		0.23		0.04					
Other[a]		0.01			0.00	0.42	0.01	0.12		0.03					

	Rod and reel					Gig					Trawl				
Species	Fall (1)	Winter (0)	Spring (0)	Summer (0)	Annual mean	Fall (1)	Winter (0)	Spring (0)	Summer (0)	Annual mean	Fall (1)	Winter (0)	Spring (6)	Summer (2)	Annual mean
Spotted seatrout	2.95				2.95	0.68				0.68					
Red drum	1.02				1.02										
Black drum											0.11		0.27		0.04
Southern flounder	1.02				1.02	3.89				3.89			0.15	0.12	0.06
Sheepshead											0.80		0.46		0.20
Atlantic croaker															
Sand seatrout											0.05				0.00
Gafftopsail catfish															
Other[a]											0.05		0.51		0.07

[a] Includes fish that were unidentified

Table 9. Commercial catch by gill net (kg/100 ft of net/h), set-trammel net (kg/100 ft of net/h), trotline (kg/100 hook-h, rod and reel (kg/hook-h), gig (kg/gig-h), trawl (kg/trawl-h) and strike-trammel net (kg/100 ft of net) in Matagorda Bay (Sept. 1978-Aug. 1979). Number in parenthesis = number of interviews conducted. Blanks = no data; 0.00 = catches < 0.01.

	Gill net					Set-trammel net					Trotline				
Species	Fall (2)	Winter (3)	Spring (5)	Summer (2)	Annual mean	Fall (3)	Winter (3)	Spring (3)	Summer (0)	Annual mean	Fall (0)	Winter (2)	Spring (0)	Summer (0)	Annual mean
Spotted seatrout	0.02		0.04	0.16	0.03	0.00	0.10	0.16		0.08		0.09			0.09
Red drum	0.17	0.43	0.07	0.16	0.10	0.37	0.73	0.51		0.50					
Black drum	0.01		0.22	0.34	0.20	0.21	0.10	0.01		0.12		0.54			0.54
Southern flounder	0.01		0.04		0.03	0.21	0.05	0.00		0.10					
Sheepshead				0.06	0.00	0.07				0.03					
Other [a]				0.08	0.00							2.50			2.50

	Rod and Reel					Gig					Trawl				
Species	Fall (0)	Winter (1)	Spring (0)	Summer (0)	Annual mean	Fall (1)	Winter (0)	Spring (0)	Summer (0)	Annual mean	Fall (1)	Winter (0)	Spring (0)	Summer (0)	Annual mean
Spotted seatrout		6.27			6.27										
Red drum		0.47			0.47										
Black drum											0.02				0.02
Southern flounder						5.68				5.68	0.11				0.11
Sheepshead											0.15				0.15
Other [a]															

	Strike-trammel net				
Species	Fall (0)	Winter (0)	Spring (0)	Summer (1)	Annual mean
Spotted seatrout					
Red drum				0.25	0.25
Black drum				0.15	0.15
Southern flounder				0.02	0.02
Sheepshead					
Other [a]					

[a] Includes fish that were unidentified

Table 10. Commercial catch by gill net (kg/100 ft of net/h), trotline (kg/100 hook-h), set-trammel net (kg/100 ft of net-h), strike-trammel net (kg/100 ft of net), gig (kg/gig-h) and trawl (kg/trawl-h in San Antonio bay (Sept. 1978-Aug. 1979). Number in parenthesis = number of interviews conducted. Blanks = no data; 0.00 = catches < 0.01.

	Gill net					Trotline					Set-trammel net				
Species	Fall (11)	Winter (4)	Spring (4)	Summer (2)	Annual mean	Fall (1)	Winter (0)	Spring (4)	Summer (0)	Annual mean	Fall (0)	Winter (2)	Spring (0)	Summer (0)	Annual mean
Spotted seatrout	0.03	0.00	0.04	0.00	0.03			0.02		0.02		0.42			0.42
Red drum	0.11	0.05	0.05	0.16	0.09	0.34		0.74		0.66		0.31			0.31
Black drum	0.04	0.00	0.04	0.01	0.03			0.00		0.00		0.30			0.30
Southern flounder	0.01	0.00	0.02	0.00	0.01							0.00			0.00
Sheepshead	0.02		0.00	0.01	0.01										
Gafftopsail catfish	0.00				0.00										
Other[a]	0.00		0.02		0.01										

	Strike-trammel net					Trawl					Gig				
Species	Fall (0)	Winter (0)	Spring (0)	Summer (1)	Annual mean	Fall (1)	Winter (0)	Spring (0)	Summer (0)	Annual mean	Fall (1)	Winter (0)	Spring (0)	Summer (2)	Annual mean
Spotted seatrout				0.05	0.05									0.55	0.41
Red drum				0.14	0.14									0.39	0.29
Black drum				3.41	3.41									2.82	3.56
Southern flounder						0.08				0.08	5.64				
Sheepshead															
Gafftopsail catfish															
Other[a]															

[a] Includes fish that were unidentified

Table 11. Commercial catch by gill net (kg/100 ft of net/h), trotline (kg/100 hook-h), set-trammel net (kg/100 ft of net-h), strike trammel net (kg/100 ft of net), rod and reel (kg/hook-h), gig (kg/gig-h) and trawl (kg/trawl-h) in Aransas Bay (Sept. 1978-Aug. 1979). Number in parenthesis= number of interviews conducted. Blanks = no data; 0.00 = catches < 0.01.

	Gill net					Trotline					Set-trammel net				
Species	Fall (8)	Winter (4)	Spring (7)	Summer (3)	Annual mean	Fall (21)	Winter (20)	Spring (17)	Summer (9)	Annual mean	Fall (5)	Winter (1)	Spring (4)	Summer (11)	Annual mean
Spotted seatrout	0.08	0.02	0.05	0.02	0.02	0.25	0.05	0.76	0.35	0.18	0.00	0.15	0.70		0.22
Red drum	0.27	0.02	0.05	0.06	0.03	0.42	0.52	0.71	0.70	0.54	0.08	2.01	0.21	0.81	0.18
Black drum	0.21	0.04	0.17	0.01	0.04	0.08	0.15	0.05	0.08	0.10	0.08	0.09	0.37	0.07	0.17
Southern flounder	0.05	0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.10		0.02		0.07
Sheepshead	0.02	0.00	0.04	0.01	0.01	0.00	0.00	0.03	0.01	0.01	0.01			0.14	0.01
Atlantic croaker	0.00				0.00										
Gafftopsail catfish			0.01		0.00			0.04	0.01	0.00					
Other [a]											0.00				0.00

	Strike-trammel net					Rod and reel					Gig				
Species	Fall (0)	Winter (3)	Spring (9)	Summer (6)	Annual mean	Fall (8)	Winter (2)	Spring (7)	Summer (9)	Annual mean	Fall (3)	Winter (0)	Spring (0)	Summer (2)	Annual mean
Spotted seatrout		0.16	1.09	0.58	0.80	1.06	0.94	2.79	5.10	2.57					
Red drum		1.26	0.09	0.21	0.25	0.18		0.22		0.12				0.23	0.04
Black drum		0.55	0.02	0.09	0.10			0.09	0.04	0.03					
Southern flounder		0.03	0.00	0.04	0.02	0.07		0.06	0.02	0.05	5.38			6.44	5.58
Sheepshead			0.01	0.05	0.03	0.17		0.01		0.07	0.05				0.04
Atlantic croaker															
Gafftopsail catfish															
Other [a]		0.24			0.02										

	Trawl				
Species	Fall (5)	Winter (1)	Spring (1)	Summer (2)	Annual mean
Spotted seatrout	0.01				0.00
Red drum					
Black drum	0.05				0.01
Southern flounder	0.46	0.10			0.18
Sheepshead	0.06		1.51		0.05
Atlantic croaker					
Gafftopsail catfish				5.45	0.59

[a] Includes fish that were unidentified

Table 12. Commercial catch by gill net (kg/100 ft of net/h), Trotline (kg/100 hook-h), strike-trammel net (kg/100 ft of net), set-trammel net (kg/100 ft of net/h), rod and reel (kg/hook-h) and gig (kg/gig-h) in Corpus Christi Bay (Sept. 1978-Aug. 1979). Number in parenthesis = number of interviews conducted. Blanks = no data; 0.00 = catches < 0.01.

	Gill net					Trotline					Strike-trammel net				
Species	Fall (46)	Winter (24)	Spring (19)	Summer (8)	Annual mean	Fall (3)	Winter (4)	Spring (2)	Summer (2)	Annual mean	Fall (1)	Winter (2)	Spring (6)	Summer (4)	Annual mean
Spotted seatrout	0.01	0.02	0.04	0.01	0.02	0.02	0.07	0.06	0.21	0.07	2.18	0.53	0.74	0.60	0.71
Red drum	0.02	0.02	0.00	0.03	0.02	0.32	0.06	0.06	0.34	0.12	0.29	0.04	0.01	0.11	0.05
Black drum	0.11	0.10	0.13	0.10	0.11	0.05	0.15		0.04	0.09	0.24			0.04	0.02
Southern flounder	0.02	0.00		0.00	0.01		0.01			0.00	1.00	0.04	0.00	0.06	0.05
Sheepshead	0.02	0.02	0.12	0.00	0.04		0.01		0.00	0.00	0.90	7.76	0.11	0.06	0.82
Gafftopsail catfish	0.00				0.00						0.14				0.00
Atlantic croaker	0.00				0.00						0.29				0.00

	Set-trammel net					Rod and reel					Gig				
Species	Fall (4)	Winter (3)	Spring (0)	Summer (0)	Annual mean	Fall (3)	Winter (2)	Spring (7)	Summer (6)	Annual mean	Fall (0)	Winter (0)	Spring (0)	Summer (1)	Annual mean
Spotted seatrout	0.13	0.04			0.09	1.46	2.88	1.49	0.94	1.36				0.30	
Red drum	0.00	0.01			0.01		0.30	0.02		0.03					
Black drum	0.01	0.11			0.06	0.09		0.10		0.05					
Southern flounder	0.21	0.12			0.17	0.93		0.20	0.19	0.32				0.91	
Sheepshead	0.00	0.01			0.00	0.81		0.07		0.18					
Gafftopsail catfish	0.00				0.00										
Atlantic croaker	0.01				0.00										

	Trawl				
Species	Fall (1)	Winter (0)	Spring (1)	Summer (0)	Annual mean
Spotted seatrout			0.04		0.03
Red drum					
Black drum			2.08		1.39
Southern flounder	0.30		1.50		0.56
Sheepshead					
Gafftopsail catfish					
Atlantic croaker					

Table 13. Commercial catch by trotline (kg/100 hook-h), gill net (kg/100 ft of net-h) and rod and reel (kg/hook-h) in upper Laguna Madre (Sept. 1978-Aug. 1979). Number in parenthesis = number of interveiws conducted. Blanks = no data· 0.00 = catches < 0.01.

	Trotlines					Gill net					Rod and reel				
Species	Fall (20)	Winter (15)	Spring (35)	Summer (36)	Annual mean	Fall (3)	Winter (0)	Spring (3)	Summer (0)	Annual mean	Fall (0)	Winter (0)	Spring (6)	Summer (5)	Annual mean
Spotted seatrout	0.19	0.08	0.05	0.29	0.10	0.06		0.09		0.03			2.04	3.16	2.68
Red drum	0.18	0.09	0.01	0.10	0.06										
Black drum	0.23	0.29	0.15	0.05	0.19	0.24		0.24		0.24					
Southern flounder	0.00	0.00	0.00	0.00	0.00										
Sheepshead	0.00		0.01	0.01	0.00	0.09		0.03		0.05					

Table 14. Commercial catch by trotline (kg/100 hook-h) and rod and reel (kg/hook-h) in lower Laguna Madre (Sept. 1978-Aug. 1979). Number in parenthesis = number of interviews conducted. Blanks = no data; 0.00 = catches < 0.01.

	Trotline					Rod and reel				
Species	Fall (73)	Winter (40)	Spring (64)	Summer (63)	Annual mean	Fall (17)	Winter (1)	Spring (15)	Summer (17)	Annual mean
Spotted seatrout	0.12	0.09	0.10	0.10	0.10	1.24	2.59	1.28	1.06	1.22
Red drum	0.20	0.29	0.13	0.09	0.15	0.00	0.00	0.10	0.00	0.03
Black drum	0.11	0.57	0.02	0.04	0.11					
Southern flounder	0.00	0.00	0.00	0.00	0.00	0.02		0.11	0.07	0.06
Sheepshead	0.00	0.09	0.00	0.00	0.01					

Table 15. Catch rates (kg/man-h and no/man-h) and mean size of fishes (kg) caught by sport boat fishermen in the pass and jetty areas of Galveston Bay by species and season (Sept. 1978-Aug. 1979). Blanks = no data; 0.00 = catches < 0.01.

	kg/man-h									
Season	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Fall	0.00	0.08	0.01	0.12	0.00	0.04	0.11		0.01	0.37
Winter	0.00				0.03				0.00	0.04
Spring	0.12	0.05	0.00	0.00	0.05	0.00	0.02	0.00	0.01	0.28
Summer	0.14	0.05	0.00	0.02	0.02	0.00	0.03	0.00	0.06	0.33
Annual	0.12	0.05	0.00	0.03	0.03	0.01	0.04	0.00	0.04	0.32

	No/man-h									
Season	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Fall	0.00	0.01	0.00	0.14	0.01	0.16	0.51		0.01	0.83
Winter	0.21				0.03				0.01	0.25
Spring	0.18	0.01	0.00	0.01	0.08	0.01	0.09	0.00	0.03	0.41
Summer	0.18	0.01	0.00	0.05	0.03	0.03	0.13	0.00	0.11	0.55
Annual	0.16	0.01	0.00	0.05	0.04	0.04	0.17	0.00	0.07	0.55

	Mean Size (kg)								
Season	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other
Fall	0.97	6.60	1.82	0.85	0.66	0.27	0.23		1.40
Winter					1.03				0.57
Spring	0.71	3.34	5.75	0.48	0.65	0.17	0.26	1.87	0.47
Summer	0.78	4.00	1.12	0.40	0.70	0.15	0.26	0.75	0.57
Annual	0.76	4.63	4.02	0.57	0.72	0.21	0.25	1.72	0.59

[a] Due to rounding of numbers these totals may not exactly equal individual species totals. Kg/man-h are shown only when mean weights were available.

Table 16 . Catch rates (kg/man-h and no/man-h) and mean size of fishes (kg) caught by sport boat fishermen in the pass and jetty areas of Matagorda-San Antonio Bays by species and season (Sept. 1978-Aug. 1979). Blanks = no data; 0.00 = catches <0.01.

kg/man-h

Season	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Fall	0.02	0.02	0.00	0.01	0.06	0.00		0.03	0.29	0.43
Winter										
Spring	0.08	0.06			0.04			0.15		0.33
Summer	0.23	0.06	0.04	0.02	0.00		0.01		0.04	0.40
Annual	0.06	0.03	0.01	0.01	0.05	0.00	0.01	0.05	0.25	0.41

No/man-h

Season	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Fall	0.03	0.01	0.00	0.01	0.12	0.00	0.01	0.03	0.02	0.23
Winter										
Spring	0.02	0.02		0.01	0.05			0.03	0.02	0.15
Summer	0.40	0.02	0.03	0.01	0.01		0.03		0.04	0.54
Annual	0.08	0.01	0.00	0.01	0.10	0.00	0.01	0.03	0.02	0.26

Mean Size (kg)

Season	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other
Fall	0.70	1.96	3.32	0.49	0.50	0.14		0.91	6.94
Winter									
Spring	1.15	4.77			0.80			1.48	
Summer	0.61	3.04	0.39	0.79	0.43		0.28		0.97
Annual	0.65	3.19	2.91	0.66	0.53	0.14	0.28	1.00	3.77

[a] Due to rounding of numbers these totals may not exactly equal individual species totals. Kg/man-h are shown only when mean weights were available.

Table 17. Catch rates (kg/man-h and no/man-h) and mean size of fishes (kg) caught by sport boat fishermen in the pass and jetty areas of Aransas-Corpus Christi Bays by species and season (Sept. 1978-Aug. 1979). Blanks = no data; 0.00 = catches < 0.01.

kg/man-h

Season	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Fall						0.01	0.12		0.01	0.14
Winter					0.49					0.49
Spring		0.03			0.44			0.04	0.55	1.06
Summer		0.04							0.11	0.15
Annual		0.03			0.46	0.01	0.12	0.04	0.45	0.77

No/man-h

Season	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other	All[a] species combined
Fall						0.03	0.30		0.00	0.33
Winter					0.87					0.87
Spring		0.03			0.82			0.05	0.09	0.99
Summer		0.07							0.24	0.31
Annual		0.03			0.84	0.03	0.30	0.05	0.10	0.85

Mean Size (kg)

Season	Spotted seatrout	Red drum	Black drum	Southern flounder	Sheepshead	Atlantic croaker	Sand seatrout	Gafftopsail catfish	Other
Fall						0.23	0.40		0.23
Winter					0.57				
Spring		0.96			0.54			0.70	6.24
Summer		0.54							0.34
Annual		0.86			0.55	0.23	0.40	0.70	4.61

[a] Due to rounding of numbers these totals may not exactly equal individual species totals. Kg/man-h are shown only when mean weights were available.

Table 18. Catch rates (kg/man-h and no/man-h) and mean size of fishes (kg) caught in the Gulf of Mexico by sport boat fishermen in the vicinity of Galveston Bay by species and season (Sept. 1978-Aug. 1979). Blanks = no data; 0.00 = catches < 0.01.

	kg/man-h								
Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other	All[a] species combined
Fall		0.12			0.15		0.01	0.00	0.12	0.40
Winter										
Spring		0.00			0.05	0.00	0.04	0.03	0.15	0.27
Summer		0.00	0.14	0.01	0.04		0.00	0.04	0.20	0.43
Annual		0.01	0.14	0.01	0.05	0.00	0.01	0.04	0.19	0.45
	No/man-h									
Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other	All[a] species combined
Fall		0.01		0.00	0.53		0.01	0.00	0.09	0.64
Winter										
Spring		0.00	0.00		0.11	0.01	0.15	0.02	0.15	0.44
Summer		0.00	0.02	0.03	0.08	0.01	0.00	0.01	0.05	0.20
Annual		0.00	0.02	0.03	0.14	0.01	0.02	0.01	0.07	0.30
	Mean Size (kg)									
Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other	
Fall		12.30			0.29		0.63	7.27	1.35	
Winter										
Spring		8.90			0.42	0.13	0.30	1.34	0.98	
Summer		0.86	6.76	0.45	0.50		0.68	4.06	4.02	
Annual		6.08	6.76	0.45	0.42	0.13	0.31	3.48	2.78	

[a] Due to rounding of numbers these totals may not exactly equal individual species totals. Kg/man-h are shown only when mean weights were available.

Table 19. Catch rates (kg/man-h and no/man-h) and mean size of fishes (kg) caught in the Gulf of Mexico by sport boat fishermen in the vicinity of Matagorda-San Antonio Bays by species and season (Sept. 1978-Aug. 1979). Blanks = no data; 0.00 = catches < 0.01.

kg/man-h

Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other	All[a] species combined
Fall	0.00	0.00	0.24	0.00					0.58	0.82
Winter										
Spring	0.01	0.00	0.00		0.06			0.02	0.15	0.24
Summer	0.00	0.00	0.52	0.01	0.01		0.01	0.00	0.16	0.71
Annual	0.00	0.00	0.44	0.01	0.02		0.01	0.00	0.10	0.58

No/man-h

Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other	All[a] species combined
Fall	0.00	0.00	0.05	0.00			0.07		0.05	0.17
Winter										
Spring	0.01	0.00	0.00		0.07	0.01	0.14	0.01	0.06	0.30
Summer	0.00	0.00	0.10	0.01	0.02		0.02	0.00	0.06	0.21
Annual	0.00	0.00	0.08	0.01	0.03	0.01	0.04	0.00	0.06	0.44

Mean Size (kg)

Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other
Fall	0.91	0.80	4.89	0.54					11.66
Winter									
Spring	0.80	8.58	6.59		0.81			1.55	2.47
Summer	0.34	8.95	5.24	0.97	0.66		0.40	7.14	2.63
Annual	0.73	7.17	5.24	0.96	0.70		0.40	7.74	3.05

[a] Due to rounding of numbers these totals may not exactly equal individual species totals. Kg/man-h are shown only when mean weights were available.

Table 20. Catch rates (kg/man-h and no/man-h) and mean size of fishes (kg) caught in the Gulf of Mexico by sport boat fishermen in the vicinity of Aransas-Corpus Christi Bays by species and season (Sept. 1978-Aus. 1979). Blanks = no data; 0.00 = catches < 0.01.

kg/man-h

Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other	All[a] species combined
Fall		0.09							0.08	0.17
Winter										
Spring		0.10	0.36	0.06				0.00	0.36	0.88
Summer	0.01		0.40	0.03	0.00	0.00	0.01	0.00	0.08	0.53
Annual	0.01	0.10	0.40	0.03	0.00	0.00	0.01	0.00	0.10	0.65

No/man-h

Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other	All[a] species combined
Fall		0.01							0.01	0.02
Winter										
Spring		0.01	0.04	0.14				0.00	0.14	0.33
Summer	0.02	0.00	0.07	0.02	0.00	0.00	0.04	0.00	0.03	0.18
Annual	0.02	0.00	0.07	0.03	0.00	0.00	0.04	0.00	0.04	0.20

Mean Size (kg)

Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other
Fall		9.32							8.41
Winter									
Spring		9.77	9.05	0.44				11.36	2.60
Summer	0.40		5.77	1.40	0.71	0.20	0.28	9.91	2.65
Annual	0.40	9.62	5.92	0.95	0.71	0.20	0.28	10.12	2.65

[a] Due to rounding of numbers these totals may not exactly equal individual species totals. Kg/man-h are shown only when mean weights were available.

Table 21. Catch rates (kg/man-h and no/man-h) and mean size of fishes (kg) caught in the Gulf of Mexico by sport boat fishermen in the vicinity of lower Laguna Madre by species and season (Sept. 1978-Aug. 1979). Blanks = no data; 0.00 = no catches < 0.01.

kg/man-h

Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other	All[a] species combined
Fall					0.03				0.13	0.16
Winter										
Spring	0.00		0.30						2.25	2.25
Summer			0.42		0.13				0.78	1.33
Annual	0.00		0.36		0.10				1.28	1.74

No/man-h

Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other	All[a] species combined
Fall					0.11				0.06	0.17
Winter										
Spring	0.00		0.07						0.15	0.22
Summer			0.10		0.24				0.05	0.39
Annual	0.00		0.09		0.21				0.09	0.39

Mean Size (kg)

Season	Spotted seatrout	Red drum	King mackerel	Spanish mackerel	Red snapper	Atlantic croaker	Sand seatrout	Cobia	Other
Fall					0.26				2.14
Winter									
Spring	0.45		4.22						14.97
Summer			4.15		0.55				15.61
Annual	0.45		4.19		0.51				13.33

[a] Due to rounding of numbers these totals may not exactly equal individual species totals. Kg/man-h are shown only when mean weights were available.

Table 22. Mean annual catch rate (kg/man-h) by species and bay system of fishes caught by weekend sport boat fishermen in Texas marine waters (Sept. 1974-Aug. 1979). Blanks = no data.

Year	Bay system							
	Galveston	Matagorda[a]	San Antonio	Aransas	Corpus Christi	Upper Laguna Madre	Lower Laguna Madre	Coastwide total
Spotted seatrout								
Sept. 1974-Aug. 1975	0.08		0.26	0.13		0.25		0.14
Sept. 1975-Aug. 1976		0.10			0.16		0.18	0.15
Sept. 1976-Aug. 1977	0.10	0.14	0.12	0.12	0.14	0.19	0.22	0.14
Sept. 1977-Aug. 1978	0.05	0.10	0.06	0.09	0.12	0.10	0.15	0.09
Sept. 1978-Aug. 1979	0.04	0.06	0.07	0.12	0.13	0.13	0.17	0.09
Red drum								
Sept. 1974-Aug. 1975	0.01		0.10	0.08		0.04		0.03
Sept. 1975-Aug. 1976		0.06			0.05		0.05	0.05
Sept. 1976-Aug. 1977	0.02	0.09	0.10	0.05	0.02	0.03	0.04	0.05
Sept. 1977-Aug. 1978	0.02	0.03	0.06	0.05	0.02	0.01	0.02	0.02
Sept. 1978-Aug. 1979	0.02	0.04	0.11	0.01	0.03	0.00	0.02	0.02
Black drum								
Sept. 1974-Aug. 1975	0.02		0.01	0.01	0.04			0.02
Sept. 1975-Aug. 1976		0.01			0.02		0.02	0.01
Sept. 1976-Aug. 1977	0.03	0.01	0.06	0.01	0.06	0.02	0.11	0.04
Sept. 1977-Aug. 1978	0.05	0.02	0.01	0.00	0.10	0.01	0.06	0.04
Sept. 1978-Aug. 1979	0.37	0.03	0.04	0.00	0.02	0.05	0.20	0.20

Table 22. (Cont'd).

Year	Bay system							
	Galveston	Matagorda[a]	San Antonio	Aransas	Corpus Christi	Upper Laguna Madre	Lower Laguna Madre	Coastwide total
Southern flounder								
Sept. 1974-Aug. 1975	0.01		0.02	0.03		0.03		0.02
Sept. 1975-Aug. 1976		0.01			0.01		0.01	0.01
Sept. 1976-Aug. 1977	0.02	0.02	0.02	0.01	0.02	0.00	0.01	0.01
Sept. 1977-Aug. 1978	0.02	0.01	0.02	0.01	0.02	0.00	0.01	0.01
Sept. 1978-Aug. 1979	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01
Sheepshead								
Sept. 1974-Aug. 1975	0.01		0.01	0.01		0.01		0.01
Sept. 1975-Aug. 1976		0.00			0.01		0.01	0.01
Sept. 1976-Aug. 1977	0.03	0.05	0.00	0.01	0.01	0.00	0.01	0.02
Sept. 1977-Aug. 1978	0.02	0.02	0.02	0.01	0.01	0.00	0.00	0.01
Sept. 1978-Aug. 1979	0.02	0.03	0.01	0.01	0.02	0.01	0.01	0.02
Atlantic croaker								
Sept. 1974-Aug. 1975	0.07		0.00	0.00		0.03		0.05
Sept. 1975-Aug. 1976		0.00			0.03		0.00	0.01
Sept. 1976-Aug. 1977	0.09	0.01	0.00	0.00	0.03	0.01	0.01	0.03
Sept. 1977-Aug. 1978	0.07	0.00	0.00	0.00	0.01	0.02	0.00	0.03
Sept. 1978-Aug. 1979	0.04	0.00	0.01	0.00	0.03	0.04	0.00	0.02

Table 22. (Cont'd).

Year	Bay system							
	Galveston	Matagorda[a]	San Antonio	Aransas	Corpus Christi	Upper Laguna Madre	Lower Laguna Madre	Coastwide total
Sand seatrout								
Sept. 1974-Aug. 1975	0.05		0.00	0.01		0.01		0.04
Sept. 1975-Aug. 1976		0.01			0.10		0.01	0.03
Sept. 1976-Aug. 1977	0.06	0.02	0.00	0.01	0.07	0.00	0.01	0.03
Sept. 1977-Aug. 1978	0.05	0.01	0.00	0.00	0.08	0.00	0.01	0.02
Sept. 1978-Aug. 1979	0.11	0.01	0.00	0.00	0.03	0.01		0.07
Gafftopsail catfish								
Sept. 1974-Aug. 1975	0.00		0.02	0.00		0.00		0.00
Sept. 1975-Aug. 1976		0.14			0.05		0.00	0.08
Sept. 1976-Aug. 1977	0.01	0.08	0.03	0.00	0.01	0.00	0.00	0.01
Sept. 1977-Aug. 1978	0.00	0.05	0.01	0.01	0.01	0.00	0.00	0.01
Sept. 1978-Aug. 1979	0.02	0.01	0.01	0.02	0.03	0.00		0.02
All species combined								
Sept. 1974-Aug. 1975	0.28		0.45	0.28		0.41		0.32
Sept. 1975-Aug. 1976		0.37			0.45		0.30	0.36
Sept. 1976-Aug. 1977	0.36	0.39	0.35	0.23	0.41	0.27	0.41	0.34
Sept. 1977-Aug. 1978	0.30	0.27	0.19	0.18	0.38	0.16	0.28	0.25
Sept. 1978-Aug. 1979	0.64	0.22	0.25	0.18	0.28	0.24	0.39	0.43

[a] Matagorda and East Matagorda bays combined.

Appendix A. Area maps of boat ramp access points.

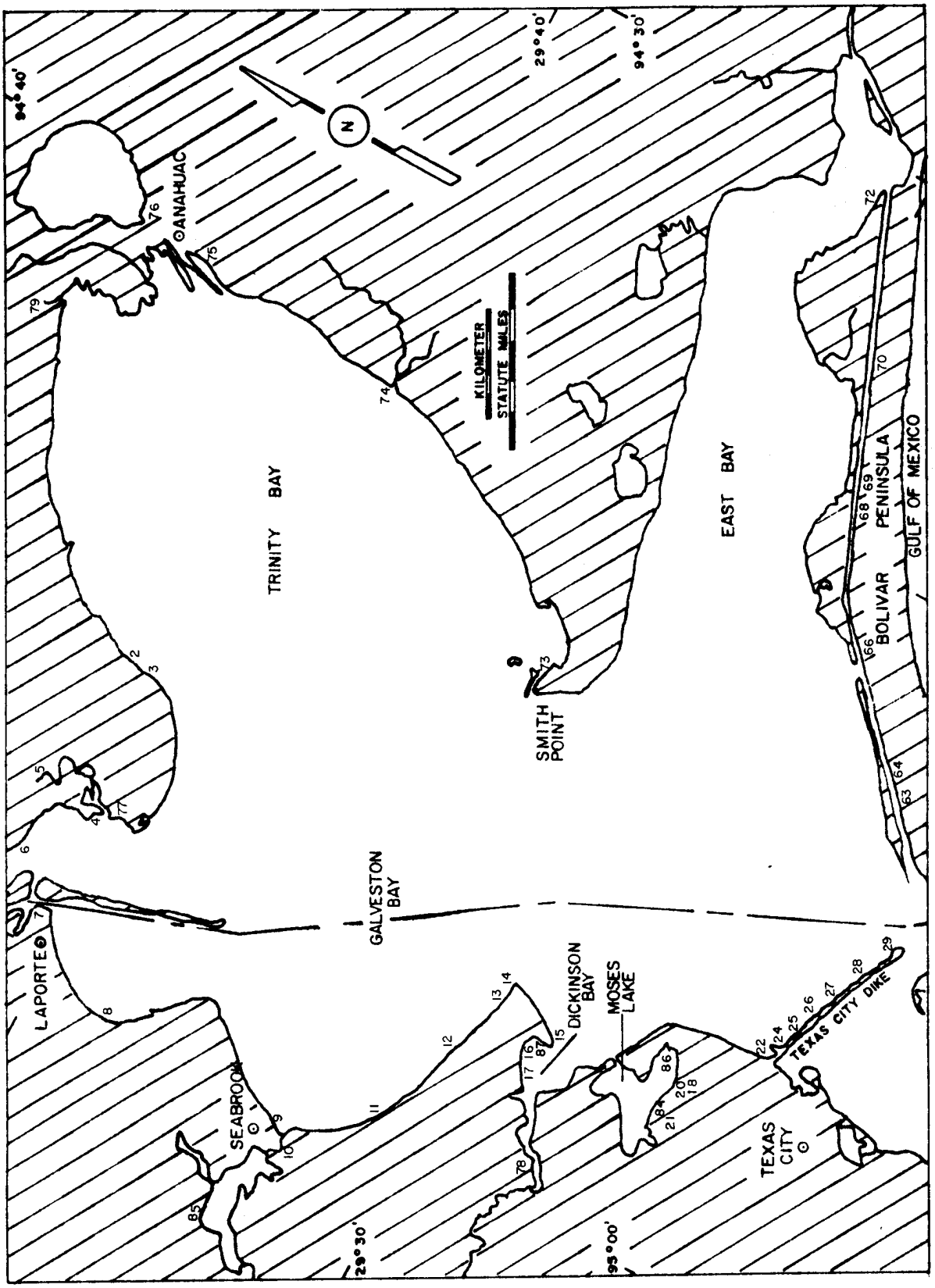

Figure 1 . Boat ramp access points in the Galveston Bay system (Sept. 1978-Aug. 1979).

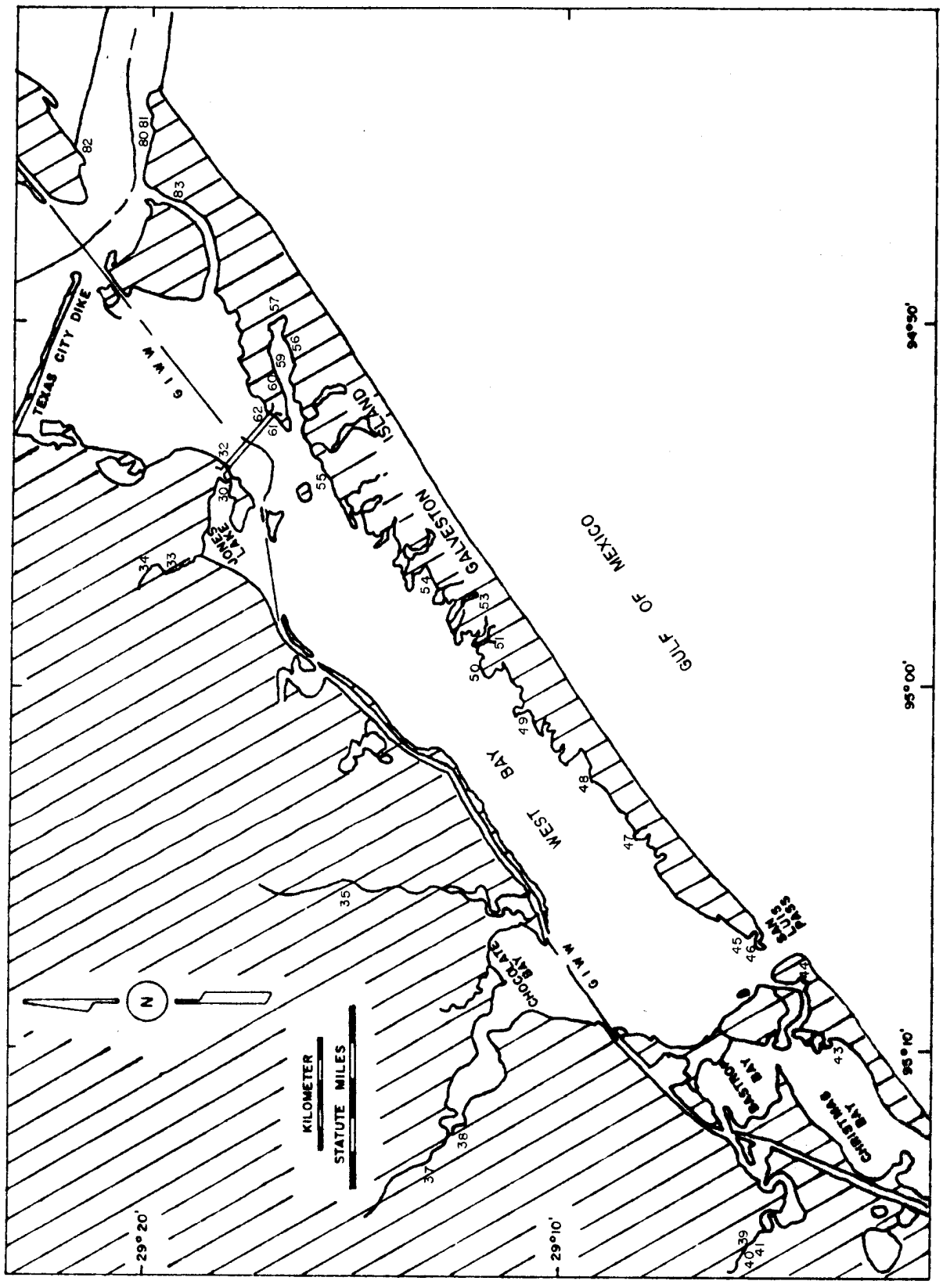

Figure 2. Boat ramp access points in the Galveston Bay system (Sept. 1978-Aug. 1979).

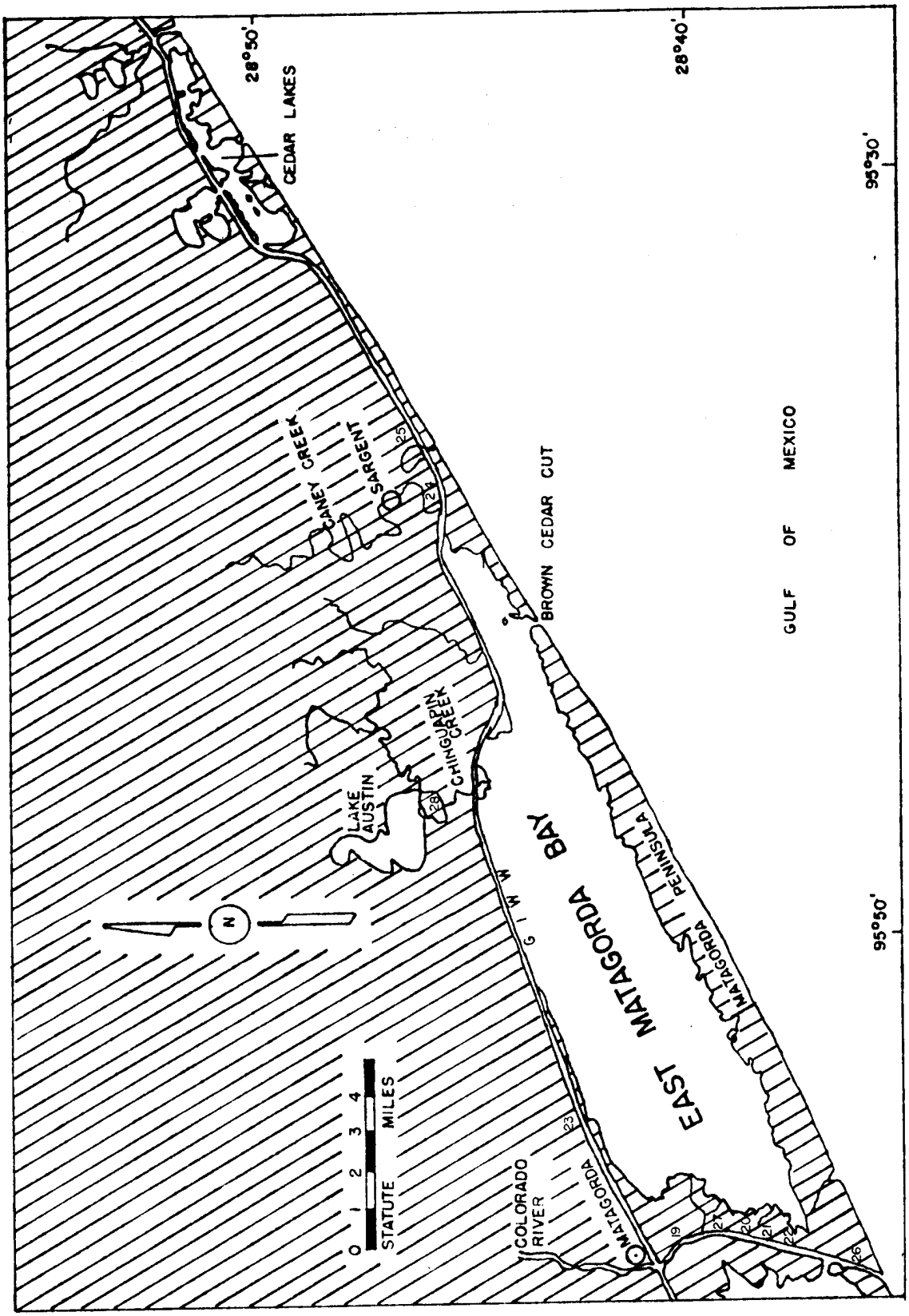

Figure 3. Boat ramp access points in the Matagorda Bay system (Sept. 1978-Aug. 1979).

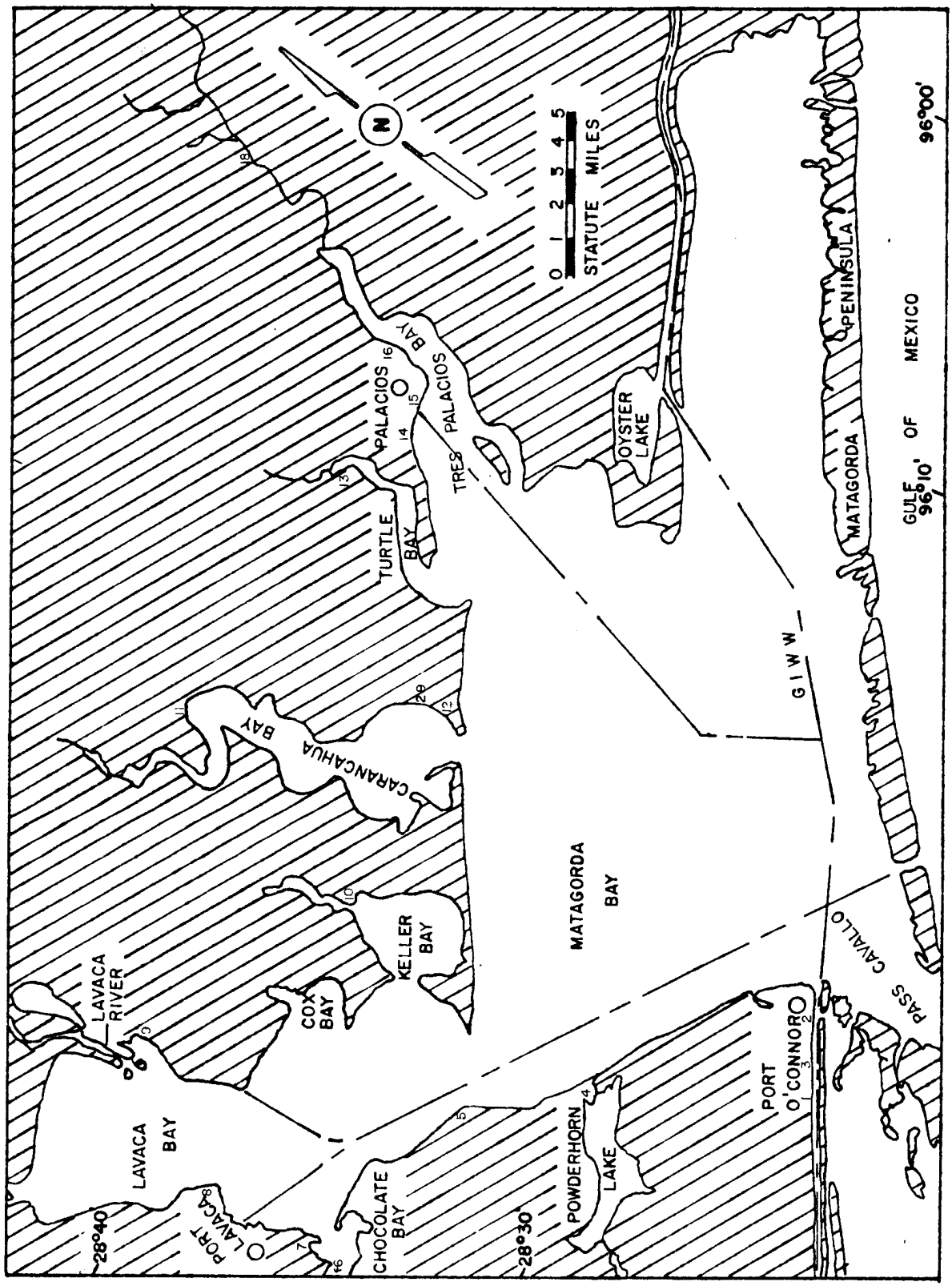

Figure 4. Boat ramp access points in the Matagorda Bay system (Sept. 1978-Aug. 1979).

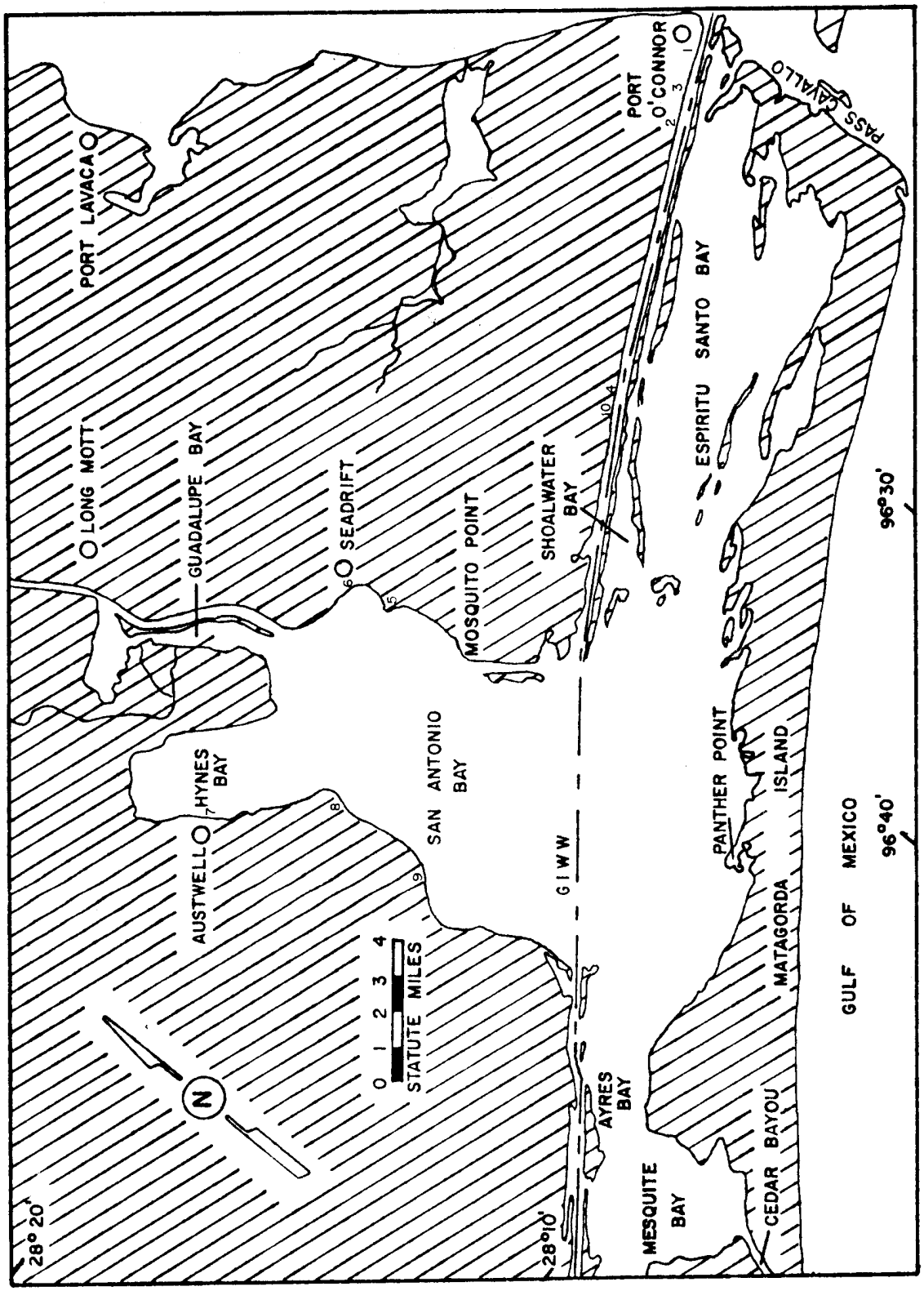

Figure 5. Boat ramp access points in the San Antonio Bay system (Sept. 1978-Aug. 1979).

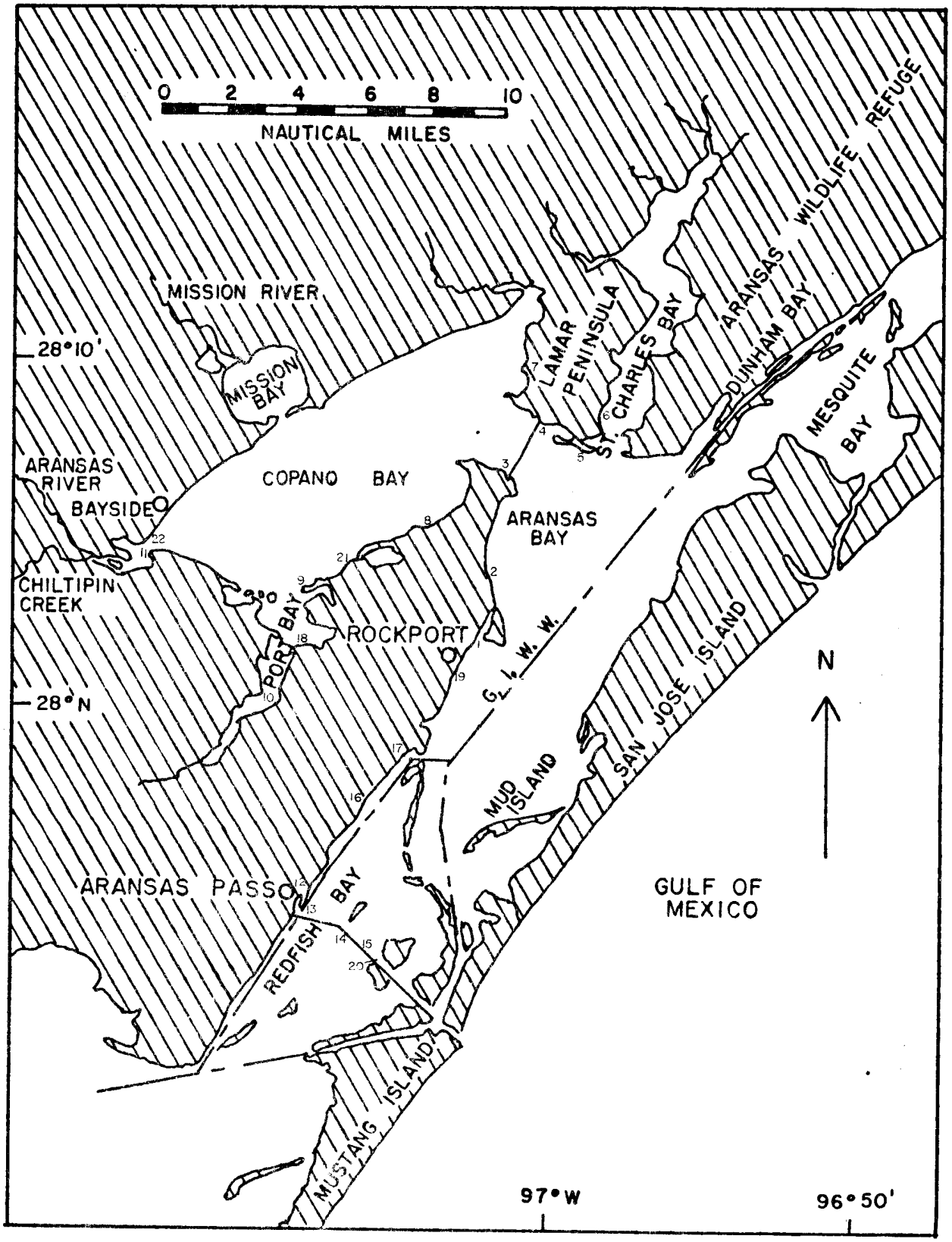

Figure 6. Boat ramp access points in the Aransas Bay system (Sept. 1978-Aug. 1979)

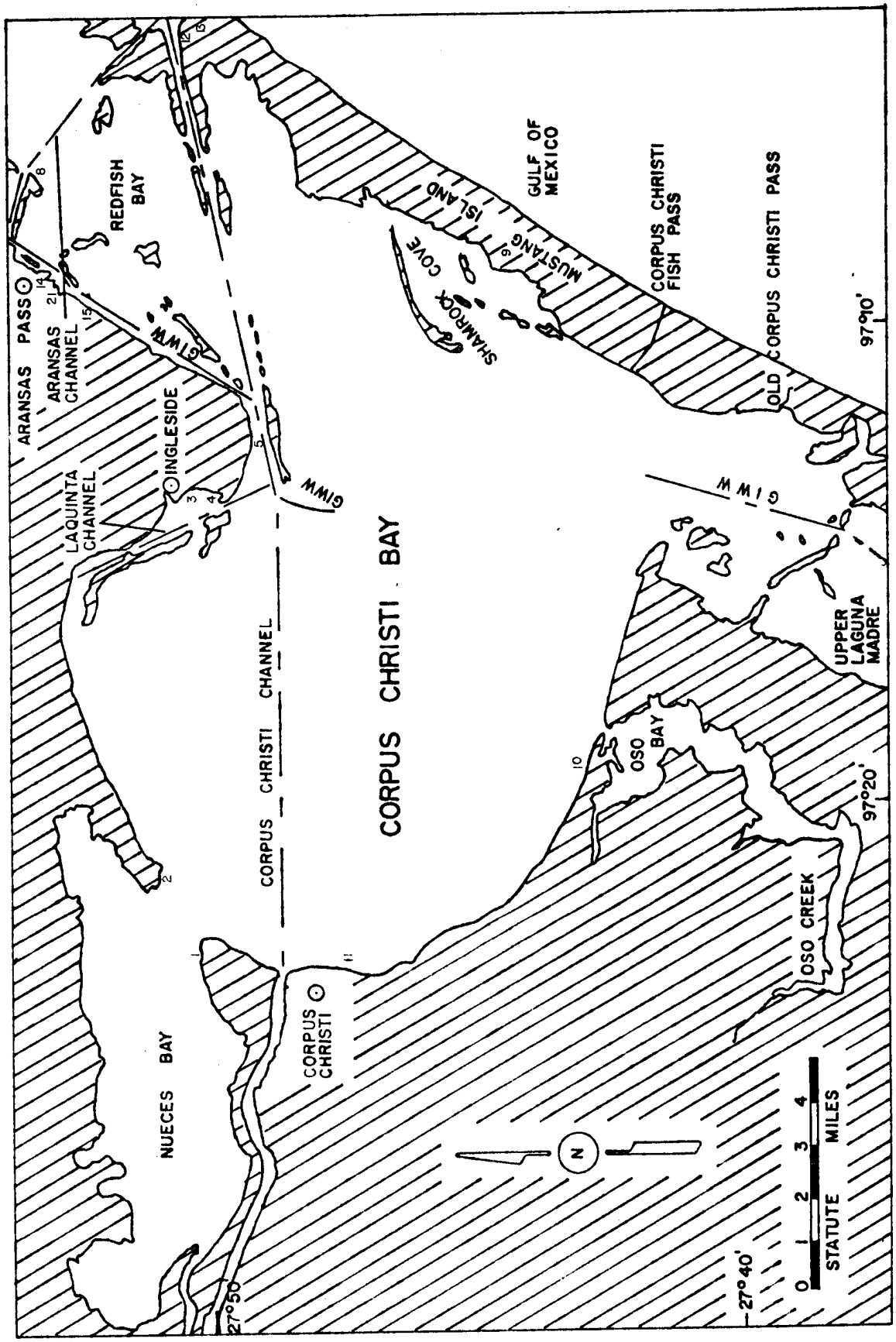

Figure 7. Boat ramp access points in the Corpus Christi Bay system (Sept. 1978-Aug. 1979).

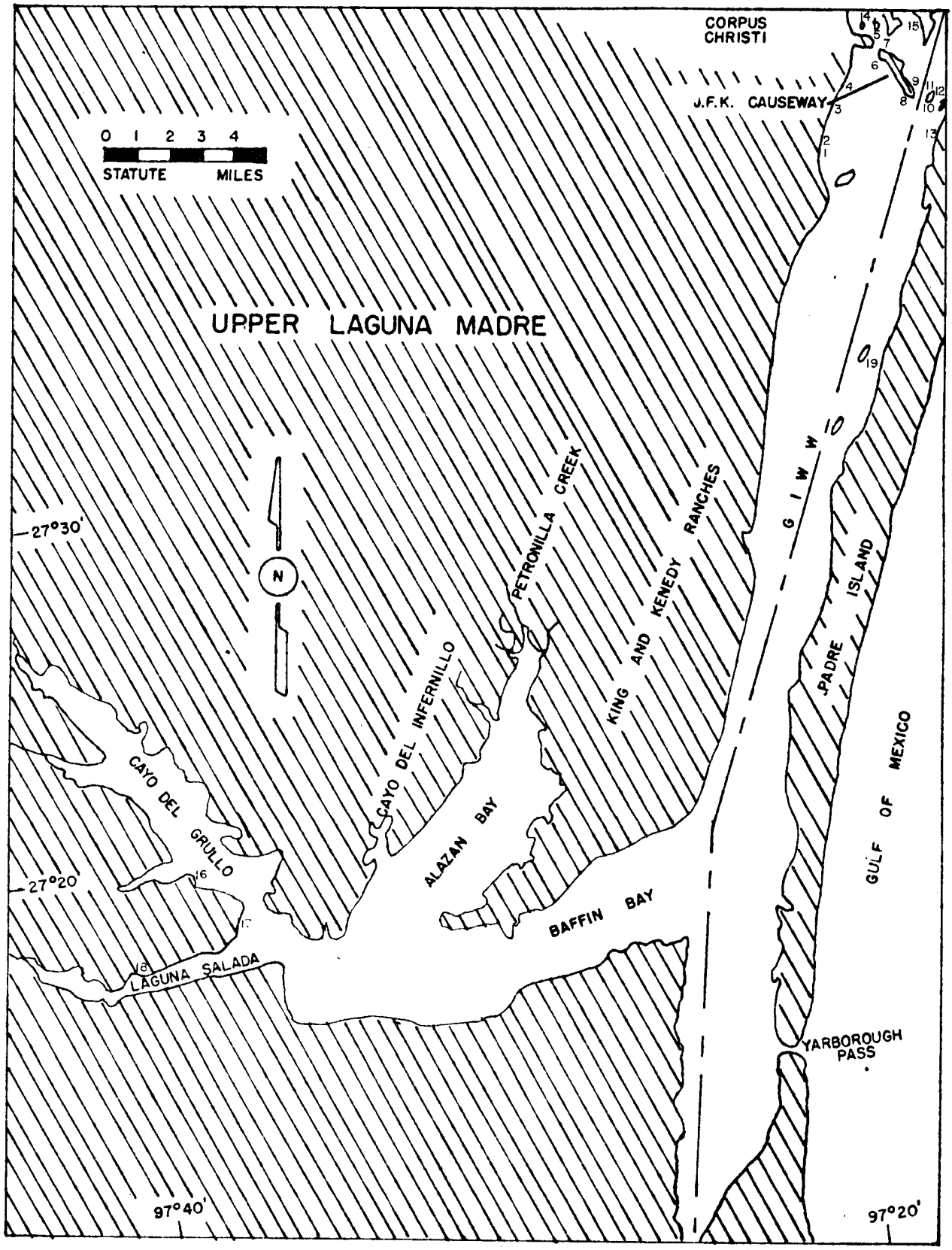

Figure 8. Boat ramp access points in the upper Laguna Madre bay system (Sept. 1978-Aug. 1979).

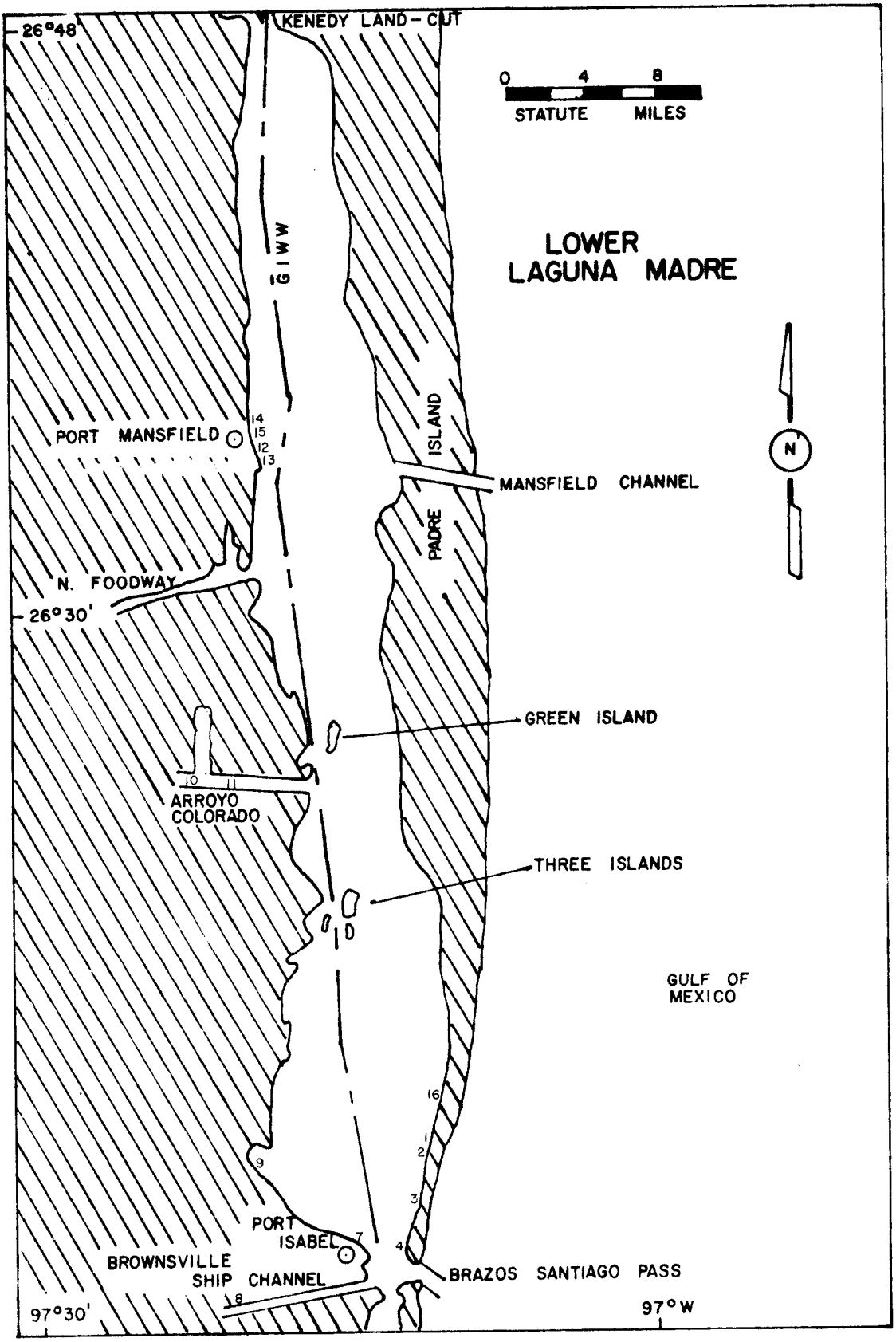

Figure 9. Boat ramp access points in the lower Laguna Madre bay system (Sept. 1978-Aug. 1979).

Appendix B. Boat ramp access points.

Table 1. Boat ramp access points in each bay system (Sept. 1978-Aug. 1979)

Bay system	Boat ramp[a] code number	Boat ramp identification
Galveston	79	Cotton Lake Park (Chambers County)
	2	Woodall's Bait Camp
	3	Crawley's Bait Camp
	77	Will's Fish Camp
	4	Thompson's / Dusty's Fish Net
	5	Roseland City Park
	6	State Boat Ramp (Tabb's Bay)
	7	Morgan's Point Camp
	8	Sylvan Beach
	85	Clear Lake Boat Ramp
	9	Oddo's Boat Ramp
	10	State Boat Ramp (Clear Lake Channel)
	11	Galveston County Park (Bacliff)
	12	HL&P Galveston County Park
	13	San Leon Marina
	14	Eagle Point Camp
	15	April Fool Point
	87	Cotton's Bait Camp
	16	Marge's Bait Camp
	17	Fiesta Marina
	78	Dickinson Bayou Public Ramp
	18	Swede's Camp / Simpson's
	20	Reeve's Reef
	84	The Fish Spot
	21	Mowle's
	86	Dollar Bay
	22	C.C. Camp
	24	Ritlat's / Dub's
	25	Curl's
	26	Public Ramp (Texas City Dike)
	27	Public Ramp (Texas City Dike)
	28	Public Ramp (Texas City Dike)
	29	Texas City Dike Marina
	30	State Ramp (Jones Lake)
	32	Terry's Lucky 7
	33	Chris Delesandri's
	34	Louis Fishing Camp
	35	Hall's Bayou Camp

Table 1. (Cont'd).

Bay system	Boat ramp code number	Boat ramp identification
	37	Lute's Marina
	38	State Boat Ramp (Chocolate Bay)
	39	Marlin Marina
	40	Under Bridge on CR-227A (Both sides)
	41	Jack Booth's (Bastrop Marina)
	43	Shell Ramp (Christmas Bay)
	44	KOA Campground
	45	Public Launching from Shoreline
	46	Rooster Collins Bait Camp
	47	Bay Harbor
	48	Teramar Beach
	49	Sea Isle
	50	Jamaica Beach Marina
	51	Jamaica Beach Boat Ramp
	53	Pirate's Beach Marina
	54	Pirate's Beach Ramp
	55	Andy's Bait Camp Public Ramp
	56	Public Ramp (73rd St.)
	57	Washington Park (61st St.)
	58	Bayou Bay Marina
	59	Newell Marina
	60	M&M Camp
	61	Marina
	62	Pleasure Isle
	83	Galveston Yacht Basin
	80	South Jetty (End Ramp)
	81	Wilsons Waddell's Best
	82	North Jetty Ramp
	63	Jim Reid
	64	Shirley's Cafeteria
	66	Robin Seafood
	68	B&P Camp
	69	Bob's Camp
	70	Stingaree Marina
	72	Ramp at Rollover Pass
	73	Vingt-et-un (Smith Point) Robin's Park (Smith Point)
	74	Oak Island County Ramp
	75	Fort Anahuac Park

Table 1. (Cont'd).

Bay system	Boat ramp code number	Boat ramp identification
Matagorda	1	Captn's Fishing Camp (Pt. O'Connor)
	2	Port O'Connor Fishing Center
	3	Uncle Bill's (Pt. O'Connor)
	4	Indianola
	5	Magnolia
	6	Chocolate Bay
	7	Harbor Refuge
	8	Port Lavaca (State Park)
	9	Point Comfort
	10	Olivia
	11	Crescent V
	29	The Wharf
	12	Last Chance Marina
	13	Turtle Bridge
	14	Hill Ramp
	15	Palacios Bait Camp
	16	East Bay
	18	Palacios River
	19	River Bend
	20	Al's
	21	Henson
	22	Rawlings
	26	Bailey's
	27	Bulkhead Marina
	23	UFO
	24	Bill & Effie's
	25	Beachcomber
	28	Chinquapin
San Antonio	1	Port O'Connor Fishing Center
	2	Captn's Fishing Camp
	3	Uncle Bill's (Port O'Connor)
	4	Fulgrum's
	5	Swan Point (Seadrift)
	6	Seadrift Boat Ramp
	8	Hopper's Landing (Austwell)
Aransas	1	Little Bay
	2	Fulton Harbor
	3	Copano Causeway
	4	Sea Gun
	5	Goose Island State Park
	6	St. Charles Bay Marina
	7	Holiday Beach
	8	Joe's Boat Basin
	9	Klein's (Rattlesnake Point)
	10	Redfish Camp (Port Bay)

Table 1. (Cont'd).

Bay system	Boat ramp code number	Boat ramp identification
Aransas (cont.)	11	Gene's Resort (Bayside)
	12	Aransas Pass Boat Basin
	13	Aransas Basin Bait Stand
	14	Fin and Feather (Cummins Cut)
	20	Bait Hut
	15	Bill & Gene's
	16	Palm Harbor
	17	Cove Harbor
	18	Port Bay Club
	19	Rockport Turning Basin
	21	Pouzee's Marina
	22	Bayside Public Boat Ramp
Corpus Christi	1	S. Nueces Causeway
	2	N. Nueces Causeway
	3	Ingleside Cove
	4	Bahia Mar
	5	Channel View
	7	Aransas Airport
	8	Fin & Feather
	12	Port Aransas Public Ramp
	13	Woody's Boat Basin
	9	Wilson's Cut
	10	Oso Bridge Ramp
	11	T-Head Ramp
	14	Causeway
	15	Sun Oil Co.
Upper Laguna Madre	1	Red's Place (Hap's Marina)
	2	Jerry's
	3	Colburn's
	4	Toll Gate
	5	Marina Madre
	6	Witt's
	7	Fisherman's Folly
	8	Graham's
	9	B.G.'s
	10	Rainbow
	11	Black's
	12	Billings
	13	P.I.V.
	19	Bird Island Ramp
	14	Boat Hole Ramp
	15	Naval Ramp

Table 1. (Cont'd).

Bay system	Boat ramp code number	Boat ramp identification
	16	Kaufer Park
	17	Krat's
	18	Williamson's
Lower Laguna Madre	1	Wiley's
	2	Jim's
	3	Sea Ranch
	4	Jetties
	7	White Sands
	8	San Martin
	9	Laguna Vista
	10	Arroyo Colorado (State Ramp)
	11	Sanchez
	12	Al's Place
	13	Marlin Marina
	14	Port Mansfield (State Ramp)
	15	Redfish
	16	South Padre Marina

[a] boat ramp code numbers that have been deleted from the master list are not included.

Appendix C. Area descriptions.

AREA DESCRIPTIONS

Descriptions of each bay system were reproduced from Matlock and Weaver (1979).

Galveston Bay

The Galveston Bay system, which includes 353,768 acres, is the largest estuary on the Texas coast (Fisher et al. 1972) and consists of Galveston,

Trinity, East, West, Dickinson, Chocolate, Christmas, Bastrop, Dollar, Drum and Tabbs Bays and Clear, Moses and Jones Lakes (Fig. 1a-b).

The estuary is separated from the Gulf of Mexico by Bolivar Peninsula, Galveston Island and Follets Island. Two natural passes, Bolivar Roads and San Luis Pass, and one man-made pass, Rollover Pass, connect the estuary with the Gulf.

Bay depths average 6.9 ft or less except in dredged channels. Bolivar Roads, Houston, Texas City, Galveston and Bayport Ship Channels are dredged to 40 ft. The Intracoastal Waterway is dredged to 12.1 ft through East, lower Galveston, and West Bays (Diener 1975).

Bay substrates include mud, shell and clay; barrier island shorelines are predominately sand. Approximately 7,527 acres of oyster reefs lie in Galveston, Trinity, East, West and Dickinson Bays (Benefield and Hofstetter 1976). Numerous spoil "islands" occur along most dredged channels.

Shoreline marshes are present along portions of East, West, Trinity, Christimas, Bastrop, Drum and Chocolate Bays. Diener (1975) listed 231,342 acres of emergent vegetation--smooth cordgrass (Spartina alterniflora), salt meadow cordgrass (S. patens), bulrush (Scirpus olney), shoregrass (Monothochloe littoralis), rush (Juncus romerianus), seashore saltgrass (Distichlis spicata) and saltwort (Batis maritima)--and 18,095 acres of submergent seagrasses--widgeon grass (Ruppia maritima) and Holodule beaudettei--in Galveston Bay. McEachron, Shaw and Moffett (1977) reported Halophilia engelmanni and turtle grass (Thalassia testudinum) in Christmas and Bastrop Bays.

The bay receives an average 2642 billion gal of fresh water annually, 90% of which comes from the Trinity and San Jacinto Rivers (Environmental Protection Agency 1971). Diener (1975) reported salinities ranging from 5-15 o/oo in Trinity and upper Galveston Bays to 20-30 o/oo in the lower portions of Galveston Bay near the Gulf. From November 1975 through March 1976 bay salinities at gill net stations ranged from 2.2 to 28.9 o/oo, dissolved oxygen varied from 5 to 18 ppm and water temperatures ranged from 40.1 to 76.1 F (Texas Parks & Wildlife Dept., Seabrook, Texas).

The Galveston Bay complex is adjacent to the most populated and industrialized area of Texas. A population of 2,424,800 people reside in the eight counties bordering the bay (1974 Census Data, Houston--Galveston Area Council, personal communication). The highest concentrations of people and industrial complexes are on the western shores of Galveston Bay and the eastern shores of West Bay. From 1967 to 1969 the daily average flow of domestic wastewater into the Galveston Bay complex was at least 16.7 million gal and the industrial wastewater inflow at least 300 million gal (Diener 1975).

Sport fishermen caught an estimated 2,774,297 lb of fish in the bay from September 1974 through August 1975 (Heffernan et al. 1977). The commercial fishing industry harvested over 45.1 million lb of shrimp worth $38,000,000, 15.4 million lb of blue crabs worth $1,700,000, 6.6 million lb of finfish worth $1,200,000, 21.4 million lb of shelled oysters worth $11,700,000 and 9.3 million lb of small bait shrimp worth $11,100,000 (O. B. Lynam, Texas Parks & Wildlife Dept., Seabrook, Texas, Unpublished data).

East Matagorda Bay

East Matagorda Bay (Fig. 2) is a relatively shallow (3.4 ft average depth), medium to high salinity (15-30 o/oo), turbid bay with a surface area of 37,810 acres at mean low water (MLW) (Diener 1975).

The bay's only connection with the Gulf of Mexico has historically been Brown Cedar Cut at the east end. Caney Creek and the Colorado River delta mark the northeast and southwest boundaries, respectively. The Matagorda Peninsula forms the southern boundary while the Intracoastal Waterway borders the northern shoreline of East Matagorda Bay.

Extensive stands of emergent cordgrass (Spartina sp.) occur along both the southern and northern boundaries with rush found on the northern shoreline. Submergent grasses include widgeon grass and Halodule beaudettei.

Oyster reefs are located throughout the system but no estimate of the acreage was available.

East Matagorda Bay receives fresh water from rainfall and runoff entering the Intracoastal Waterway from Caney Creek, the Colorado River and Peyton Creek (via Lake Austin and Live Oak Bayou). No estimates of the amount of annual fresh water inflow were available.

Population centers are located at each end of the bay in Matagorda (population 700) and in Sargent (population unknown). Fishing comprises the major activity of residents in both towns; however, information concerning commercial and recreational landings has been combined with data from the Matagorda Bay system.

Matagorda Bay

The Matagorda Bay system (Fig. 3) encompasses an area of 244,430 acres and has an average depth of about 6.9 ft at MLW (Diener 1975). It includes Tres Palacios, Turtle, Carancahua, Lavaca, Cox, Keller and Chocolate Bays and Oyster, Redfish, Salt and Powderhorn Lakes.

Matagorda Bay is a large primary bay of 167,529 acres and 7.9 ft mean depth (Diener 1975). The southern boundary is the long, narrow Matagorda Peninsula with sand shoreline and extensive areas of submergent and emergent grasses; the eastern confine is the Colorado River delta and the western boundary is a shallow sand shoreline with limited submergent and emergent vegetation. The community of Port O'Connor (population 1,400) is in the southwest corner. Several secondary and tertiary bays associated with major and minor drainages into Matagorda Bay indent the northern perimeter.

Oyster Lake is a shallow muddy tertiary system of 2335 acres and 2.6 ft mean depth (Diener 1975) located along the northwestern shoreline of Matagorda Bay. Numerous oyster reefs are located throughout the system and the periphery is surrounded by emergent vegetation. Tres Palacios Bay is a secondary system of 9436 acres and 3.9 ft mean depth (Diener 1975) with oyster reefs and scattered shell throughout. The community of Palacios (3,500 people) is located on the northern shoreline. Turtle Bay, with 1280 acres and 2.6 ft mean depth (Diener 1975), is a muddy system with a moderate number of oyster reefs. The

shoreline is primarily clay bluffs with scattered emergent vegetation communities.

Carancahua Bay, along the north central shoreline of Matagorda Bay, covers 13,076 acres and has a 3.9-ft mean depth (Diener 1975). Several resort communities (Port Alto, Schicke Point and Cape Carancahua) are located along the bay. This bay has little marsh except in the southern portion where the tertiary systems of Redfish and Salt Lakes are located. Steep banks and sandy clay constitute the majority of the shore areas.

Lavaca Bay is a large secondary bay in the northwest corner of Matagorda Bay with 44,729 acres and 4.3-ft mean depth (Diener 1975). The shoreline is primarily clay bluffs. On the southeastern shoreline of Lavaca Bay are two smaller secondary areas: Cox Bay and Keller Bay. Cox Bay is a shallow muddy system with a clay bluff periphery and scattered oyster reefs throughout. Keller Bay is a deeper system and the southern perimeter has the largest submerged grass beds found in the Lavaca Bay comples. The community of Olivia (240 people) is located at the head of Keller Bay. On the western shoreline of Lavaca Bay is Chocolate Bay, a small, muddy bay of 699 acres and 2.6-ft mean depth with clay bank shoreline (Diener 1975). North of Chocolate Bay is the city of Port Lavaca (12,000 people). The area of central Lavaca Bay is the most heavily industrialized in the Matagorda Bay system.

South of Lavaca Bay, on the western shoreline of Matagorda Bay, is Powderhorn Lake. This is a moderately saline, shallow body of water of 2889 acres and 2.3-ft mean depth (Diener 1975). This "lake" connects with Matagorda Bay through Powderhorn Bayou on which the community of Indianola (200 people) is located. The periphery of this bay is surrounded by large emergent grass communities.

There are two direct exchanges with the Gulf of Mexico, Pass Cavallo and the Matagorda Ship Channel, both located in the southwest corner of Matagorda Bay, and one indirect connection, the Colorado River, on the eastern boundary. The western portion of Matagorda Bay and the southern two-thirds of Lavaca Bay are transected by the Matagorda Ship Channel, 35.4 ft deep (Diener 1975), with associated spoil banks. The channel originates at the ALCOA (Aluminum Company of America) plant on the eastern shoreline of Lavaca Bay and terminates at the Gulf of Mexico through the Matagorda jetties. Small channels branch off in Lavaca Bay to the Refuge Harbor at Port Lavaca and to the Lavaca River. The Intracoastal Waterway, dredged to 12.1 ft (Diener 1975), intersects the Matagorda Ship Channel near Port O'Connor. The Palacios Ship Channel branches from the Intracoastal Waterway in south central Matagorda Bay.

Diener (1975) listed 119,970 acres of emergent vegetation--smooth cordgrass, salt meadow cordgrass, saltwort, shoregrass and coastal dropseed (Sporobolus virginicus)--and 7037 acres of submergent vegetation (widgeon grass and Halodule beaudettei) in the Matagorda Bay system.

Between 1957 and 1968 Matagorda Bay received an average 713 billion gal of freshwater discharge annually (Diener 1975), mainly through the Tres Palacios, Carancahua, Lavaca and Navidad Rivers with partial flow entering the bay from the Colorado River. From November 1975 through March 1976, bay water salinities at gill net stations ranged from 10.0 to 28.0 o/oo, dissolved oxygen varied from 6.0 to 13.0 ppm and water temperatures ranged from 44.6 to 78.8 F (Texas Parks & Wildlife Dept., Palacios).

Sport fishermen caught an estimated 844,600 fish weighing 968,832 lb in Matagorda Bay from September 1975 through August 1976; during the same period commercial fishermen landed 176,370 lb of fish (Breuer et al. 1977).

San Antonio Bay

The San Antonio Bay system consists of the primary bays San Antonio and Espiritu Santo and the secondary bays Hynes, Guadalupe and Shoalwater (Fig. 4). Several large natural saltwater lakes occur along Matagorda Island and connect with the primary bays via sloughs and small passes. Two major passes, Cedar Bayou Pass to the west and Pass Cavallo to the east, provide circulation routes between the Gulf of Mexico and the bay system.

San Antonio, Hynes and Guadalupe Bays cover approximately 84,012 acres and Espiritu Santo Bay covers 34,099 acres for a total bay system area of 118,111 acres (Collier and Hedgpeth 1950). The average depths of the unaltered bay system are 3.9 ft in San Antonio Bay (maximum of 7.6 ft) and 4.9 ft in Espiritu Santo Bay (maximum of 7.9 ft) (Collier and Hedgpeth 1950).

Bottom substrates are generally silty clay and sand in the upper bay region which gradually change to sand clay and sand in the lower bay and Espiritu Santo bay regions (Texas Parks & Wildlife 1975). Approximately 3015 acres of spoil islands and 2001 acres of oyster reefs occur in the bay system (Burg 1974). One of the major oyster reefs is Panther Reef which extends from Panther Point north toward Mosquito Point.

The Guadalupe and San Antonio Rivers are the major sources of fresh water for the San Antonio Bay system, providing an average annual inflow of 449 billion gal from a drainage area of 6,559,920 acres (Childress et al. 1975). The amount of fresh water entering the system generally depends upon rainfall in the upland drainage rather than on local drainage. Local rainy periods usually occur during early summer and fall. The average annual rainfall for the area is 33.9 inches (Texas Parks & Wildlife 1975).

Salinity values for the bay system generally increase as the distance from the rivers increases. Out-flowing fresh water moves along the west shore of San Antonio Bay while incoming Gulf water moves along the east shore (Childress et al. 1975). Average surface salinities range from 0.0 o/oo in Guadalupe Bay to about 8.0 o/oo in lower San Antonio Bay and from 14.0 to 21.0 o/oo in Espiritu Santo Bay (Childress et al. 1975). No seasonal turbidity patterns are noted within the bay system; however, turbidities tend to increase toward the upper bay and river-influenced areas, as well as in areas disturbed by mud-shell and channel dredging operations (Childress et al. 1975). Dissolved oxygen concentrations increase during cold months and decrease during warm months. Between May 1972 and August 1973, average dissolved oxygen concentrations ranged from 7.0 to 12.4 ppm (Childress et al. 1975).

About 24,993 acres of emergent and 16,345 acres of submergent vegetation are found in the San Antonio Bay system (Diener 1975). Smooth cordgrass is the dominant emergent plant in all areas of the bay system except in upper San Antonio Bay where common reed, Phragmites communis, is dominant (Childress et al. 1975). Other species of emergent vegetation include saltwort, saltgrass, shoregrass and salt meadow cordgrass (Diener 1975). The dominant submergent vegetation of the San Antonio Bay system is shoal grass, Diplanthera wrightii.

This plant is located primarily in the low turbidity areas of lower San Antonio Bay and Espiritu Santo Bay and in the shallow lakes and sloughs found along the northern margin of Matagorda Island. Other species of submergent vegetation found in the bay system include widgeon grass, and the algae Polysiphona gorgoniae, Spyridia filimentosa, Gracilaria folifera, Ulva lactuca and U. fasciata (Childress et al. 1975). The algae are usually found attached to submerged solid objects such as oyster shells or pilings. However, some algae can be found in calm areas attached to mud or sand substrates.

Four small towns occur on the shoreline of the San Antonio Bay system: Austwell, Long Mott, Seadrift and Port O'Connor. Less than 4,000 inhabitants live in these four communities combined (1970 census). The primary businesses found in this area are farming, ranching and fishing, including shrimping and oystering. The majority of the bay shoreline as well as the San Antonio-Guadalupe River drainage occurs on or near ranchland and farmland. Two major industries exist on the San Antonio Bay system; Union Carbide Corporation at Long Mott and DuPont de Nemours E.I. & Company at Bloomington, a town on the Guadalupe River approximately 20 miles from the bay.

The tourist industry is not very extensive, but a few fishing centers at Seadrift and Port O'Connor furnish tackle, guides and access to the bay system. Most of the sport fishing occurs in Espiritu Santo Bay. Between September 1974 and August 1975, sport fishermen harvested an estimated 416,453 lb of fish from the entire bay system; commercial fishermen harvested an estimated 482,592 lb of fish (Heffernan et al. 1977). In addition, approximately 883,172 lb of shrimp, 1,125,239 lb of blue crabs and 196,873 lb of oysters were harvested commercially during the 1974 calendar year (O. B. Lynam, Texas Parks & Wildlife Dept., Seabrook Field Station, personal communication).

Aransas Bay

The Aransas Bay complex consists of primary, secondary and tertiary bays. The system extends from Aransas Pass, Texas, northeastward to Mesquite Bay, and from its eastern boundary of San Jose Island, westward across Copano Bay to the small community of Bayside, Texas (Fig. 5).

Aransas Bay is the primary bay with a surface area at MLW of 56,207 acres and an average depth of 7.9 ft (Diener 1975). A direct water circulation and marine life migration route from the Gulf of Mexico to the bay is provided by a deep water (45.0-46.9 ft) pass, 600 to 712 ft in width, between San Jose Island and Mustang Island at Port Aransas, Texas (Anonymous 1971). This accounts for the higher than average salinities in the southern region of the bay (approximately 30 o/oo). The middle of the bay is the deepest part with a maximum value of 13.1 ft at MLW (U. S. Dept. Commerce 1976a). Six major oyster (Crassostrea virginica) reefs ranging in area from 25 to 257 acres are concentrated in the northern portion of Aransas Bay, along with scattered smaller reefs (Heffernan 1961). There are no private oyster leases in the Aransas Bay system (Diener 1975).

Copano, St. Charles, Redfish and Dunham Bays are considerably shallower, secondary areas, supporting extensive growths of algae and "grasses", which provide valuable nursery grounds for juvenile fish and crustaceans (Heffernan 1972a). Nutrient circulation in these bays is generally affected by freshwater runoff as well as by tidal fluctuations.

Copano Bay is the largest secondary bay with 41,730 acres of surface water and an average depth of 3.6 ft with a maximum depth of 8.9 ft (Diener 1975). The Mission and Aransas Rivers flow into the bay with respective discharges of 733.3 and 65.0 gal/s (Diener 1975).

Copano Bay has five large oyster reefs, ranging in size from 22 to 42 acres, plus a compliment of smaller reefs (Heffernan 1961). The transverse position of a few of the reefs near the mouth of Copano Bay dampen tidal action in much of the bay (Collier and Hedgpeth (1950).

The narrow St. Charles Bay, extending between Lamar Peninsula and the Aransas National Wildlife Refuge, has a surface area of 8408 acres with a 3.6-ft average depth (Diener 1975). Freshwater flow from five creeks enters the bay along its northern reaches. Nearly the entire bay is considered prime nursery ground (Heffernan 1972a).

Redfish and Dunham Bays, at the southern and northern ends, respectively, of Aransas Bay, are also very shallow nursery areas but these bays do not receive direct freshwater flow. Redfish Bay is densely vegetated while Dunham Bay is a muddy, sparsely vegetated area.

Tertiary nursery grounds are located principally in the lower regions of creeks and streams which enter the secondary bays. Port Bay with 1651 acres extends southward from Copano Bay and receives freshwater from creek drainage at its southern tip (Diener 1975).

Mission Bay and lower Mission River with nearly 3939 acres and located off the northwest shore of Copano Bay are the most valuable nursery grounds of the tertiary areas (Heffernan 1972b).

Copano Creek harbors a small portion of nursery grounds in the northwest corner of Copano Bay (Heffernan 1972a).

Tertiary regions of Chiltipin Creek and the Aransas River system are located along the western shore of Copano Bay (Heffernan 1972a).

The Aransas Bay system contains 137,514 acres of water (Heffernan 1972a) of which 44,989 acres are occupied by eight major species of emergent vegetation--saltwort, shoregrass, glassworts (Salicornia sp.), smooth cordgrass, salt meadow cordgrass, coastal dropseed, sea purselane (Sesurium portulacastrum) and seashore saltgrass--and 4,124 acres by three major species of submerged vegetation--(Halodule beaudettei), widgeon grass and turtle grass (Diener 1975; W. E. Mercer, TPWD, Personal Communication).

The climate of this area varies from semi-arid to dry sub-humid. Southeast winds are dominant most of the year but from December through February northerly winds associated with advancing cold fronts are common (Whitehouse and Williams 1953). Winters in the Aransas Bay system produce the lowest average monthly water temperatures (59.2 F) and rainfall (0.8 inch). Water temperatures increase through the spring (70.9 F), reach the highest values in the summer (83.7 F) and decline through the fall (73.6 F). Rainfall is greatest in the fall (6.4 inches). The amounts of rainfall in spring and summer average about 2.6 inches. Salinity values are inversely related to rainfall with the lowest salinity (14.1 o/oo) occurring in the fall. The highest salinity occurs in spring (26.8 o/oo). Dissolved oxygen, pH and

turbidity remain relatively constant throughout the year with average values of about 7.0 ppm, 8 and 50 Jackson Turmidity Units (JTU), respectively (Martinez 1970, 1971).

Water movement in the bay system is strongly influenced by wind action. Generally, however, the surface waters take a serpentine course, flowing during a falling tide from Copano Strait south toward Mud Island where there is a clockwise eddy which tends to return the bay water northward along the face of the more saline water from below Mud Island. On a strong rising tide this water is pushed east so that the eddy constricts into an ellipse (Collier and Hedgpeth 1950). The average tidal range for Aransas Bay is 0.49 ft (Diener 1975).

Mud is the predominant bottom sediment of the Aransas Bay system except along the sandy western shore of San Jose Island (Diener 1975).

The average total weight of finfish caught per year by commercial fishermen in the Aransas Bay system during the period 1969-1971 was 573,612 lb (Martinez 1970, 1971). The annual average harvest of commercially caught shrimp and crabs during the same period was 816,991 lb and 420,827 lb respectively.

Along the 230 miles of shoreline of the Aransas Bay system, the only communities of notable size are Lamar, Bayside, Fulton, Rockport and, the largest, Aransas Pass which has a population of about 6,000.

There are three domestic but no industrial waste outfalls in the bay system. Previous high discharges of toxic oilfield brine into Chiltipin Creek and the Mission River were ordered ceased in 1973 by the Texas Railroad Commission (Heffernan 1972b). A total of 14,796 acres in the Aransas Bay system are now closed to shellfishing by the Texas Board of Health (Diener 1975) because of domestic sewage problems.

Corpus Christi Bay

The Corpus Christi Bay system, composed of Corpus Christi, Nueces, lower Redfish and Oso Bays, is located on the lower third of the Texas Gulf coast between longitude 97° 02' and 97° 32' W and latitude 27° 41' and 27° 55' N (Fig. 6). It is bordered on the northeast by upper Redfish Bay, on the east by Mustang Island and on the south by the upper Laguna Madre. The city of Corpus Christi forms the western boundary of Corpus Christi Bay. Nueces Bay, the former coastal lagoon for the Nueces River basin, is positioned on an east-west axis, entering Corpus Christi Bay at the northwest corner, just north of Corpus Christi. The southern half of Redfish Bay separates Aransas from Corpus Christi Bay and enters Corpus Christi Bay in the northeast quadrant. Oso Bay, the semi-enclosed drainage area for Oso Creek, joins Corpus Christi Bay in the southwest quadrant.

The entire Corpus Christi Bay system has an area of 124,796 acres with 127 miles of shoreline. Corpus Christi Bay is the largest of the four bays in the system, having a total surface area of 95,997 acres. Nueces Bay has an area of 19,518 acres, Oso Bay covers approximately 17,095 acres and lower Redfish Bay covers approximately 5258 acres. The average depth of Corpus Christi Bay is 11.2 ft; Nueces, Oso and lower Redfish Bays average 2.0 ft in depth (Collier and Hedgpeth 1950, Hood 1953, Stevens 1959).

Sediment composition in Corpus Christi Bay ranges from fine sand to black mud. A mixture of gray clay and black mud is the dominant bottom type for the area. Brown silt occurs in areas of channelization while hard sand and fine shell can be found adjacent to Mustang Island.

Submergent vegetation is sparse in Corpus Christi Bay, except along its eastern shore where shoal grass and widgeon grass dominate. Emergent vegetation, found throughout the bay complex, consists primarily of saltwort, glassworts, shoregrass, smooth cordgrass, coastal dropseed, seablite, Suaeda linearis, sea oats, Uniola paniculata and saltmarsh bullrush, Scirpus maritimus. In Corpus Christi Bay, 19 oyster reefs total 563 acres and are confined primarily to the western and northern portions. Oysters occur throughout Nueces Bay (Stevens 1959, 1960; Diener 1975). The primary sources of freshwater inflow into the Corpus Christi Bay system are Oso Creek and the Nueces River. Prior to the construction of Wesley Seale Dam at Mathis, Texas, in 1958, the Nueces River averaged 20 billion gal of discharge per year. The reservoir furnishes the industrial and municipal freshwater needs for the city of Corpus Christi and surrounding towns. Freshwater inflow to Nueces and Corpus Christi Bays is now limited to periods of dam overflow and heavy land runoffs (Stevens 1959).

Prior to 1972, the primary source for water exchange between Corpus Christi Bay and the Gulf of Mexico was the Corpus Christi Channel. This ship channel extends approximately 18 miles from the Port of Corpus Christi to its intersection with the Aransas Ship Channel, which continues for approximately 1 mile to the Gulf of Mexico. The two channels are maintained at an average depth of 40.0 ft (U. S. Dept. Commerce 1974). Since its completion in 1972, the Corpus Christi Fish Pass has provided intermittent water exchange through the upper Laguna Madre, but in recent years this has only occurred in association with hurricane winds and tides. Water exchange for Corpus Christi Bay with lower Redfish Bay and the upper Laguna Madre takes place primarily through the Intracoastal Waterway and on a limited basis across the shallow flats during high tides.

The climate for the area is intermediate between the semi-arid regions to the west and southwest and the humid subtropical region to the northeast. For the period 1936-1975 the mean annual air temperature was 71.2 F and the mean annual rainfall was 28.5 inches (NOAA 1975).

The general water circulation pattern for the Corpus Christi Bay system is a counterclockwise movement along the shoreline (Stevens 1959). The predominant winds, generally from the southeast year-round with occasional "northers" in the winter, and the irregular lunar tides, have the greatest overall influence on the bay water movement. For the period 1968-1972, the mean salinity and the mean water temperature for the entire Corpus Christi Bay system was 26.1 o/oo and 73.4 F, respectively (Martinez 1968, 1969, 1970, 1971 and 1972). The mean turbidity for the same period was 43 JTU, although the mean for Nueces Bay during 1971 and 1972 was 107 JTU.

The entire system lies within Nueces County, Texas. The county, with an area of 536,301 acres, had a population of 237,544 persons as of the 1970 census. The City of Corpus Christi had a population estimate of 204,525 (Diener 1975). Extensive oil and gas exploration has resulted in numerous well platforms and submerged pipelines throughout Nueces and lower Redfish Bays and along the western shore of Corpus Christi Bay. Heavy industrialization

has occurred along the south shore of Nueces Bay and the north shore of Corpus Christi Bay in the area of La Quinta Channel.

Upper Laguna Madre

Located on the lower Texas coast between latitudes 27° 10' and 27° 41' the upper Laguna Madre system consists of the upper Laguna Madre and the Baffin Bay system (Fig. 7). The upper Laguna Madre is a long (approximately 41 miles), narrow (9.8 miles) and shallow (average depth 3.3 ft) lagoon extending from the Kenedy Land Cut to Corpus Christi Bay (Simmons 1957; Diener 1975; U. S. Dept. Commerce 1976b). Bordered on the east by Padre Island and on the west by the city of Corpus Christi and the King and Kenedy Ranches, the upper Laguna Madre covers approximately 47,228 acres at MLW (Diener 1975).

This long, narrow coastal lagoon is bisected imperfectly by the Intracoastal Waterway, which is 124.7 ft wide and 12.1 ft deep. Spoil banks from this canal form a dike 13 miles long effectively dividing the northern part of the bay. Beyond this point, spoil banks are staggered and the division is less effective (Simmons 1957). The northern end of the lagoon is restricted by a land fill causeway which has three openings totaling about 899 ft in width at MLW. The southern end is restricted by a land fill through which the Intracoastal Waterway extends.

The upper Laguna Madre is joined in the southern portion by the equally large Baffin Bay system--consisting of Baffin Bay, Alazan Bay, Laguna Salada, Cayo del Grullo and Cayo del Infernillo--which covers an estimated 54,117 acres. Baffin Bay, the central and largest bay of the group, is a narrow body of water, 19 miles long and 5 miles wide, bisected laterally by the demarcation line of Kleberg-Kenedy Counties (Breuer 1957). The average depth in Baffin Bay is 7.9 ft at MLW, with a maximum depth (MLW) of 12.1 ft near the entrance to the Laguna Madre (Breuer 1957, Diener 1975). There are approximately 31,861 acres of surface area (MLW) in Baffin Bay.

Alazan Bay, entirely within Kleberg County and the King Ranch, extends approximately 15 miles northeasterly to the mouth of Petronilla Creek (Breuer 1957, Diener 1975). The average water depth (MLW) in Alazan Bay is approximately 3.0 ft. The surface area of Alazan Bay is approximately 13,867 acres.

Cayo del Infernillo is a shallow slough (0.7 ft) extending westward from the west shore of Alazan Bay whose water surface at MLW covers 699 acres (Breuer 1957, Diener 1975).

Baffin Bay is joined by two small tertiary bays--Laguna Salada entering from the west and Cayo del Grullo from the northwest. Both bays have an average water depth (MLW) of 3.0 ft. Laguna Salada covers approximately 3227 acres and Cayo del Grullo about 4470 acres.

The upper Laguna Madre, with restricted openings at either end, no constant openings into the Gulf of Mexico and limited freshwater inflow, has been characterized as a hypersaline estuary (Simmons 1957, Breuer 1962a), with salinities of 50-60 o/oo common. The Intracoastal Waterway provides for limited water exchange at both ends of the lagoon. Since the dredging of the Intracoastal Waterway salinity "has neither risen above 80 o/oo in the lagoon nor in Baffin Bay (where 100 o/oo was formerly not uncommon), nor have waters of very low salinity remained in the area any length of time" (Simmons 1957).

The only substantial source of freshwater is runoff from the Kenedy, Kleberg, Jim Wells and Nueces County watersheds into the Baffin Bay system (Breuer 1957). The dry sand on Padre Island absorbs rain very rapidly and the very gradual slope of the lagoon's western shore makes these areas poor watersheds (Simmons 1957).

The upper Laguna Madre system lies in two climatic zones--north of Baffin Bay is sub-humid; south of that point is semi-arid (Simmons 1957). Rainfall in the area is highly variable but averages 27.0-29.1 inches annually (NOAA, Env. Data Svs., Natl. Climatological Center, Ashville, N. C. 1976). Annual average surface water temperatures for the period 1969-1972 ranged from 73.6 to 76.3 F in the upper lagoon (Martinez 1969, 1970, 1971 and 1972). No data concerning water temperature from Baffin Bay is available. Southeast or south-southeast winds are prevalent during most of the year and are directly responsible for the water circulation in the system (Simmons 1957). Water in the upper lagoon is generally clear (annual average turbidity during 1969-1972 ranged from 36.8 to 45.6 JTU) (Martinez 1969, 1970, 1971 and 1972); while water in Baffin Bay is often turbid and at times becomes a dark brown (Breuer 1957).

The bottom in the upper lagoon consists primarily of quartzose sand, silt and shell with come calcareous sand or mud in isolated areas (Simmons 1957). In the Baffin Bay system bottom types of soft mud, soft and hard clay, sand and concentrated shell (mostly Mulinia lateralis) can be found. Also, in Baffin Bay and near the junction of Baffin Bay and the upper Laguna Madre are extensive rock formations consisting of serpulid worm tubes, calcareous and quartzose material.

Simmons (1957) and Breuer (1957) reported dense vegetation--shoalgrass and widgeon grass--restricted to the northern one-third of the lagoon. They indicated that the remainder of the system has only sparse to moderate vegetation, with the exception of the area near the entrance to Baffin Bay and areas around spoil islands.

The only substantially populated center adjacent to the upper Laguna Madre is Corpus Christi, Texas, with a population of 204,525 (U. S. Dept. Commerce 1970a). An additional 33,166 people in Kleberg County (U. S. Dept. Commerce 1970b) are located near the Baffin Bay system.

Industrialization in the area has been held to a minimum because of limited access to the surrounding land. The only major industry in the system is a public utility (Central Power and Light Co.) which displaces approximately 3.3 million gal of water/min from the upper Laguna to Oso Bay (Mr. M. L. Sheperd, Central Power and Light Co., June 1976, Personal Communication). Most of the area surrounding Baffin Bay is private ranchland and consequently there is little urban development. There is considerable oil and gas development on these ranches, resulting in large quantities of oilfield brine production. In most cases the brine has been discharged into the bay or a creek which leads to the bay. Mackin (1971) reported that approximately 2,728,897 gal of oilfield brine is discharged each day into Petronilla Creek and thence into Alazan and Baffin Bays.

Lower Laguna Madre

The lower Laguna Madre is a long shallow bay that extends 55 miles northward from Port Isabel to the Kenedy Land Cut (Fig. 8). It varies from 3 miles

to 7.8 miles wide and is imperfectly bisected by the Intracoastal Waterway. The bay is bounded on the west by the Texas mainland and on the east by Padre Island and contains approximately 182,809 acres (Stokes 1974). Passes to the Gulf of Mexico are located near Port Isabel and east of Port Mansfield. Limited amounts of fresh water (average of 818.9 gal/s) enter lower Laguna Madre from the Arroyo Colorado and North Floodway (Bryan 1971).

Except for the Intracoastal Waterway with an average depth of 12.0 ft, the deepest areas are found in the northern and southern portions of the bay (Breuer 1962a). In the northern section, which extends from Port Mansfield to the Kenedy Land Cut, water depth is as much as 7.9 ft. From Port Mansfield south to Three Islands the water is shallow with most locations being < 3.0 ft deep. South of Three Islands the maximum water depth is 5.9 ft and water depths of 3.9-4.9 ft are prevalent.

Bottom types consist of sand, silty sand or a combination of sand, silt and clay (Shepard and Rusnak 1957). Shell is not commonly found in lower Laguna Madre. In general, sediments are coarser along the eastern or Padre Island side of the bay than along the western or mainland side of the bay.

Shoalgrass is the most common type of vegetation found in lower Laguna Madre (Stokes 1974). Dense stands of shoalgrass can be found in shallow water along most of the shoreline as well as in the entire middle portion (Port Mansfield to Three Island) of the bay. Light to dense stands of manatee grass (Cymodocea filiforme), turtle grass, widgeon grass, Halophila engelmannii and Acetabularia crenulata can be found scattered throughout the bay.

Hydrological parameters have been described by Stokes (1974). Average monthly salinities range from 16.0 to 41.0 o/oo. Excluding the Arroyo Colorado and North Floodway, salinities as low as 10.5 o/oo and as high as 44.9 o/oo are sometimes encountered. Average monthly bottom water temperatures range from 62.6 F during some winter months to 81.5 F in August. Turbidity values are generally highest from Port Mansfield to Three Islands (the shallowest portion of the bay). The average annual turbidity value in this region is 45 JTU. North of Port Mansfield the average turbidity is 28 JTU and south of Three Islands the average is 32 JTU.

The total population for the counties bordering lower Laguna Madre is 162,608 (Harlingen Chamber of Commerce). In 1973, 1,278,000 out-of-state residents visited the lower Rio Grande Valley. Although there are no figures available, it is probable that many of these people visited this area because of water related activities in lower Laguna Madre. Farming and ranching are the main industries along the bay. The only area of heavy industry is the Brownsville Ship Channel where several shrimp processing plants, a Union Carbide plant, a grain elevator, three ship dismanteling plants, two oil loading docks and an oil rig construction company are located.

Appendix D. Estimating equations.

Estimating Equations

I. The following definitions are required to state the estimating equations used in this survey. The definitions are presented in the order that they are encountered.

$\hat{P}_s$	Estimated fishing pressure in trip-hours for wade-bank and lighted pier strata.
D	Total number of hours that was subject to being surveyed during a quarter.
n	Total number of days that were surveyed in a quarter within a strata.
r	Total number of sample sites in a bay.
x_{ij}	Total persons or empty boat trailers at the ith site on the jth day at the time the roving clerk made his count.
$\hat{fb}$	Estimate of the proportion of boats that were actually fishing in the target bay.
tfp_j	Total number of boat parties encountered by the interviewers that were actually fishing in the target bay on the jth day.
tp_j	Total number of boat parties encountered by the interviewers on the jth day.
$\hat{P}_b$	Estimate of the total fishing pressure in trip-hours for boats.
$\bar{C}_s$	Estimate of the man catch rate for the sth strata.
t	Total number of interviews conducted in a quarter.
$\hat{P}_l$	Estimate of percent of the lth species in the total creel.

f_k Total fish caught by the kth party.

h_k Total fishing trip-hours expended by the kth party. This value is expanded by individuals in a party for wade-bank and lighted piers since the roving clerk counts persons and not parties.

n_j Total interviews conducted on the jth day.

$\hat{H}_s$ Estimate of the quarterly harvest in numbers or pounds for the sth strata.

$\hat{H}_c$ Estimate of the quarterly harvest in numbers or pounds for all strata combined.

II. Total pressure estimates in trip-hours for wade/bank and lighted piers.

A. Estimate of total pressure in trip-hours for a given strata ($\hat{P}_s$).

$$\hat{P}_s = D/n \cdot \sum_{i=1}^{r} \sum_{j=1}^{n} x_{ij}$$

B. Estimate of the variance and standard error of the pressure.

1) Variance of the mean for the ith site ($v(\bar{x}_i)$).

$$\bar{x}_i = 1/n \cdot \sum_{i=1}^{n} x_{ij}$$

$$v(\bar{x}_i) = \frac{1}{n(n-1)} \sum_{i=1}^{n} (x_{ij} - \bar{x}_i)^2$$

2) Variance of the mean site count for any site any day ($v(x)$).

$$\bar{\bar{x}} = 1/r \cdot \sum_{i=1}^{r} \bar{x}_i$$

$$v(\bar{\bar{x}}) = \sum_{i=1}^{r} v(\bar{x}_i)$$

3) Variance and standard error for total pressure.

$$v(\hat{P}_s) = D^2 v(\bar{\bar{x}})$$

$$s.e.(\hat{P}_s) = \sqrt{D^2 \, v(\bar{\bar{x}})}$$

III. Estimate of the proportion of boats that were fishing in the target bay.

A. Estimate of the proportion of fishing boats from the total number of empty trailers ($\hat{fb}$).

$$\hat{fb} = \left(\sum_{j=1}^{n} tfp_j \right) \Big/ \left(\sum_{j=1}^{n} tp_j \right)$$

B. Estimates of the variance and standard error of the proportion of boats fishing in the target area.

1) Estimate of the variance of the proportion ($v(\hat{fb})$).

$$v(\hat{fb}) = \frac{n\left(\sum_{j=1}^{n} tfp_j + \hat{fb}^2 \sum tp_j^2 - 2\hat{fb} \sum_{j=1}^{n} \left(tfp_j\right) \left(tp_j\right) \right)}{\left(\sum_{j=1}^{n} tp_j \right)^2 \left(n-1\right)}$$

2)

$$s.e.(\hat{fb}) = \sqrt{v(\hat{fb})}$$

IV. Estimate of the total fishing pressure for boats in trip-hours.

A. Estimate of total fishing pressure ($\hat{P}_b$).

$$\hat{P}_b = \left(D \cdot \hat{fb} / n \right) \sum_{i=1}^{r} \sum_{j=1}^{n} x_{ij}$$

B. Estimate of the variance and standard error of boat pressure ($v(\hat{P}_b)$).

1) $v(\hat{P}_b) = D^2(\bar{x}^2 \cdot v(\hat{fb}) + \hat{fb}^2 \cdot v(\bar{x}) - v(\hat{fb})\, v(\bar{x}))$

2) $s.e.(\hat{P}_b) = \sqrt{v(\hat{P}_b)}$

Estimates of the catch rates for each strata as fish numbers or pounds per hour.

A. Estimate of the mean catch rate ($\bar{C}_s$).

$$\bar{C}_s = \sum_{k=1}^{t} f_k \Big/ \sum_{k=1}^{t} h_k$$

B. Estimate of the variance of the mean catch rate and its standard error.

1) Variance of the mean catch rate ($v(\bar{C}_s)$).

$$v(C_s) = \frac{n\left(\sum_{j=1}^{n}\left(\sum_{k=1}^{n_j} f_k\right)^2 + \bar{C}_s^2 \sum_{j=1}^{n}\left(\sum_{k=1}^{n_j} h_k\right)^2 - 2\bar{C}_s \sum_{j=1}^{n}\left(\sum_{k=1}^{n_j} f_k \cdot \sum_{k=1}^{n_j} h_k\right)\right)}{\left(\sum_{k=1}^{t} h_k\right)^2 \left(n-1\right)}$$

2) $$s.e.(\bar{C}_s) = \sqrt{v(\bar{C}_s)}$$

Estimate of the quarterly harvests for a bay system in numbers or pounds for each strata and the bay system total for a quarter.

A. Strata harvest estimate ($\hat{H}_s$).

$$\hat{H}_s = \hat{P}_s \bar{C}_s$$

B. Variance and standard error of the strata harvest ($v(\hat{H}_s)$).

1) $$v(\hat{H}_s) = \hat{P}_s^2 \cdot v(\bar{C}_s) + \bar{C}_s^2 \cdot v(\hat{P}_s) - v(\hat{P}_s)\, v(\bar{C}_s)$$

2) $$s.e.(\hat{H}_s) = \sqrt{v(\hat{H}_s)}$$

C. Quarterly harvest estimate within a bay.

$$\hat{H}_c = \sum_{s=1}^{3} \hat{H}_s$$

D. Variance and standard error of the strata harvest ($v(\hat{H}_c)$).

1) $$v(\hat{H}_c) = \sum_{s=1}^{3} v(\hat{H}_s)$$

2) $$s.e.(\hat{H}_c) = \sqrt{v(\hat{H}_c)}$$

VII. Estimate of the percent the lth species contributes to the total creel in numbers or pounds.

A. Estimate of percent the lth species in the total creel ($\hat{P}_l$).

$$\hat{P}_L = \left(\sum_{k=1}^{t} f_{Lk} \right) \; 100 \Big/ \sum_{k=1}^{t} f_k$$

B. Estimate of the variance of the percent ($v(\bar{P}_l)$).

1) $$v(\hat{P}_L) = \frac{100^2 n \left(\sum_{j=1}^{n} \left(\sum_{k=1}^{n_j} f_{Ljk} \right)^2 + P_L^2 \sum_{j=1}^{n} \left(\sum_{k=1}^{n_j} f_{jk} \right)^2 - 2P_L \sum_{j=1}^{2n} \left(\sum_{k=1}^{n_j} f_{Ljk} \right) \left(\sum_{k=1}^{n_j} f_{jk} \right) \right)}{\left(\sum_{k=1}^{t} f_k \right)^2 \left(n-1 \right)}$$

2) $$s.e.(\hat{P}_L) = \sqrt{v(\bar{P}_L)}$$

Appendix E. Commercial fish houses.

Table 1. Commercial fish houses surveyed in each bay system (Sept. 1978-Aug. 1979).

Number	Name	Location
Galveston Bay		
1.	Bill's Fish Market	Houston
2.	Emmett's Seafood	Houston
3.	Mr. Seafood	Stafford
4.	L & L Seafood	Houston
5.	Magnolia Seafood	Houston
6.	S & L S Fish Market	Houston
7.	J & J Seafood Market	Houston
8.	Foreman's Fishery	Houston
9.	Pier Seven Seafood	Houston
10.	Chuck's Fish Market	Houston
11.	The Fishery	Houston
12.	A-1 Fish Market	Houston
13.	Fish Unlimited	Pasadena
14.	Miller's Fish Market	Houston
15.	The Shrimp Bucket	Houston
16.	Seafood Boutique	Houston
17.	Dimitri's	Galveston
18.	37th Street Fish Market	Galveston
19.	Gulf Fisheries	Galveston
20.	Hill's Fish & Oyster	Galveston
21.	Negrini's	Galveston
22.	Sampson and Son	Galveston

Table 1. (Cont'd).

Number	Name	Location
Galveston Bay		
23.	Southeast Packing Co.	Galveston
24.	Rayner's Fish Market	Hitchcock
25.	H & T Seafood	Baytown
26.	Dan's Seafood Market	Baytown
27.	Bay Area Seafood	Baytown
28.	Hisler Seafood	Oak Island
29.	Kreuzer's Oysters	Oak Island
30.	Jeri's Seafood	Smith Point
31.	Trinity River Fish Market	Liberty
32.	Burch's Fish Market	Liberty
33.	Milt's Seafood	Port Bolivar
34.	Grunwald Seafood	Crystal Beach
35.	Blume & Sons	Port Bolivar
36.	Texas Seafood Co.	Freeport
37.	Freeport Seafood	Freeport
38.	Mitchell's Seafood	Freeport
39.	Beach, Bait & Tackle	Freeport
40.	Miss Pat Seafood	San Bernard River
41.	Fiddler's Isle Seafood	San Bernard River
42.	Po Boy's	Angleton
43.	Henry's	Seabrook
44.	Emery's	Seabrook

Table 1. (Cont'd).

Number	Name	Location
Galveston Bay		
45.	International Seafood	Seabrook
46.	Wick's Seafood	Seabrook
47.	Boyd's Seafood	Seabrook
48.	The Shrimp Hut	Seabrook
49.	Blansfield's	Kemah
50.	League City Fish Market	League City
51.	Hillman's #1 Seafood Cafe	Dickinson
52.	Gulf Stream Seafoods	Dickinson
53.	Hillman's Fish & Oyster Co. #2	Dickinson
54.	Bill Newton (Smith Pt.)	Smith Pt.
55.	Fisherman Harvest (Nelson)	Smith Pt.
56.	LeBoeuf Seafood	Smith Pt.
57.		
58.	B & H Seafood	Crystal Beach
59.	Dusty's Fish	Baytown
60.	Pier 6 Seafood	Kemah
Matagorda and San Antonio Bays		
1.	Yeaman Seafood	Matagorda
2.	Texas Fish Company	Palacios
3.	Broadway Fish Market	Port Lavaca
4.	Evelyn's Fish Market	Port Lavaca

Table 1. (Cont'd).

Number	Name	Location
Matagorda and San Antonio Bays		
5.	Clark's Fish House	Port O'Connor
6.	Dierlam's Seafoods	Port Lavaca
7.	Cunningham's Seafoods	Seadrift (Indianola)
8.	Miller's Seafoods	Seadrift
9.	Gulfway Seafoods	Seadrift
Aransas Bay		
1.	D & T Seafoods	Fulton Beach
2.	Surfside Seafoods	Fulton Beach
3.	Pindley's Seafoods	Rockport
4.	Rockport Seafoods	Rockport
5.	Fisherman's Wharf	Port Aransas
6.	G & S Seafood	Port Aransas
7.	Coastal Seafoods	Port Aransas (deleted 10/10/78-closed)
8.	"Y" Fish Market	Aransas
9.	Coastal Freezers	Aransas Pass
10.	Beacon Seafood	Aransas Pass
11.	P. Menard Seafood	Aransas Pass
12.	Causeway Seafood	Aransas Pass
13.	Jim Warren's	Aransas Pass

Table 1. (Cont'd).

Number	Name	Location
Corpus Christi Bay and Upper Laguna Madre		
1.	Seven Seas	Corpus Christi
2.	Sam Rankin	Corpus Christi
3.	Mac's Seafood	Corpus Christi
4.	Laguna Fish & Seafood	Corpus Christi
5.	Bill's Fish Market	Flour Bluff
6.	Clyde's Fish Market	Flour Bluff
7.	Laguna Shrimp House	Flour Bluff
8.	Naylor's Fish Market	Loyola Beach
9.	Gene Ault	Flour Bluff
Lower Laguna Madre		
1.	D & V Seafood	Port Mansfield
2.	Pace Fish Company	Port Mansfield
3.	Ben and Rod's	Port Isabel
4.	B and A Seafood	Port Isabel
5.	Marchan Seafood	Port Isabel
6.	M & M Seafood	Port Isabel (deleted)
7.	Snodgrass	Port Isabel
8.	Don Coley	Arroyo City
9.	Al Rogusin	San Benito
10.	Traveler's Discount	Port Isabel

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