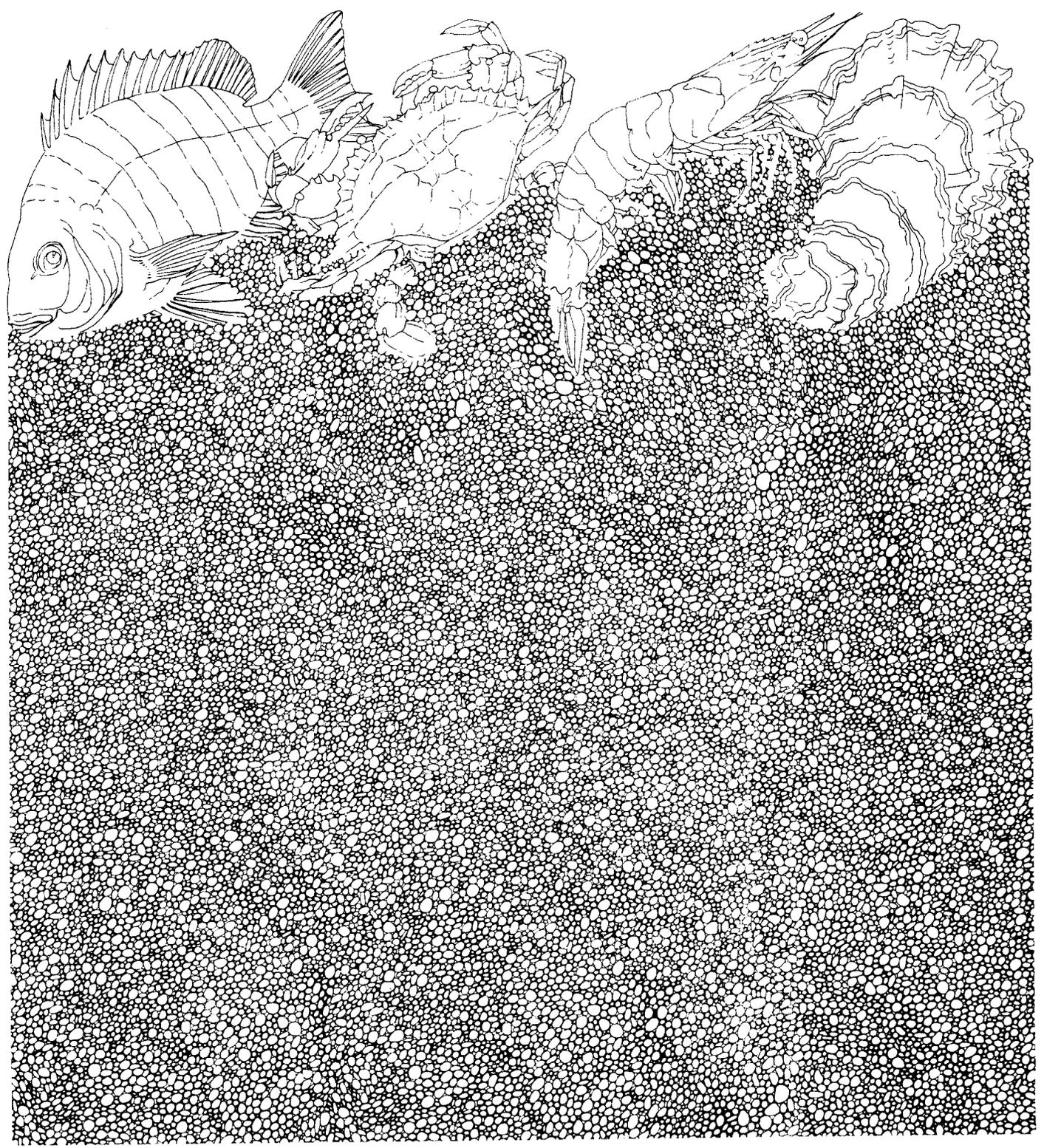


# Comparison of Trawl Catches in Two Passes

by Paul C. Hammerschmidt

Management Data Series Number 68  
1984

Texas Parks and Wildlife Department  
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Texas Parks and Wildlife Department  
Coastal Fisheries Branch  
4200 Smith School Road  
Austin, Texas 78744

## ACKNOWLEDGMENTS

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## ABSTRACT

The catch rates of selected species in 6.1-m trawl samples were compared between stations at Pass Cavallo and the Matagorda Ship Channel in the Matagorda Bay system. No significant ( $P \leq 0.05$ ) differences were found between stations at each pass nor were there any significant ( $P \leq 0.05$ ) differences found between the two passes. The comparable catch rate estimates found at each pass indicate that they may be sampled as one pass; thereby increasing sampling efficiency by reducing the number of areas required to sample.

## INTRODUCTION

The Texas Parks and Wildlife Department (TPWD), Coastal Fisheries Branch implemented a new trawl sampling program in January 1982 (Benefield et al. 1983). This program required weekly sampling in selected pass areas along the Texas coast in order to determine movements of organisms between the bays and the Gulf of Mexico (Figure 1).

Matagorda Bay has a natural pass (Pass Cavallo) and a man-made pass (the Matagorda Ship Channel) connecting the bay and Gulf. Pass Cavallo was initially selected as the pass to sample for the Matagorda Bay system. Four stations were established in the bay around this pass. Two sample stations were randomly selected each week during 1982. The importance of the Matagorda Ship Channel as an egress route for commercially valuable shrimp and crabs was not known. Therefore, in January 1983 two sample stations were established near the bayward portion of the Matagorda Ship Channel to determine movements of shrimp and crabs through this man-made pass. To maintain the amount of sampling at a sustainable level, the number of stations in Pass Cavallo was reduced to two. The two stations at each pass were sampled weekly through September 1983.

The objective of this study was to determine if there were significantly different catch rates of brown srhimp (Penaeus aztecus), white shrimp (P. setiferus), blue crabs (Callinectes sapidus) and all organisms combined among the existing pass stations or the two pass areas. The purpose was to make recommendations about future sampling designs based on these findings. If there was no difference in catch rates between the two pass areas, they could be treated as one area. Therefore, the same reliability could be obtained and sampling efficiency could be increased by reducing the number of areas sampled.

## MATERIALS AND METHODS

Samples were collected with trawls from stations in Pass Cavallo and the Matagorda Ship Channel during January-September 1983 (Figure 2). Stations were identified using grids on National Atmospheric Administration Nautical Chart No. 11319. Grids were based on 1-minute of longitude and latitude as follows:

Station Number	Pass Area	Latitude	Longitude
503	Pass Cavallo	28°24'30"	96°23'30"
504	Pass Cavallo	28°24'30"	96°22'30"
505	Matagorda Ship Channel	28°26'15"	96°20'45"
506	Matagorda Ship Channel	28°26'45"	96°20'15"

Trawls were of the same design described by Benefield et al. (1983). The 6.1-m trawls were towed linearly for 15 minutes in pass stations. In each pass area, trawls were towed Gulfward in one station and bayward in the other; one towed with the current and one towed against the current.

All organisms caught in each sample were counted and identified to species (when possible) using Williams (1965), Parker et al. (1972), Hoese and Moore (1977) and Andrews (1981). Total weekly catch rates were reported as number/tow, tabulated by station and transformed to  $\log_{10}(\log_{10}(x_i + 1))$ ,  $x_i$  = individual catch rate for sample  $i$ ). A single classification analysis of variance and an a priori comparison was used to find differences among means (Sokal and Rohlf 1969). The above analyses were completed for total catch of all species and for brown shrimp, white shrimp and blue crabs individually.

## RESULTS

### Total Catch

A total of 5366 organisms were caught from all pass stations during the 9-month sampling period with 90 species represented (Table 1). The cabbagehead jellyfish, Stomolophus meleagris, was the most abundant organism caught and made up 22.8% of the total organisms caught. The most abundant vertebrate was the spot, Leiostomus xanthurus, which made up 14.1% of the total organisms caught.

The total number of organisms caught ranged from 0 in stations 503, 504 and 506 to 446 organisms in station 506. The greatest number of organisms (978) were caught during the week of January 3-9. Smaller peaks occurred during March, April, July, and September (Table 2). The mean number of organisms caught per tow was  $34.4 \pm 5.2$ .

There were no significant differences ( $P \leq 0.05$ ) among catch rates for stations within each pass area or between Pass Cavallo and the Matagorda Ship Channel (Table 3).

### Brown Shrimp

A total of 57 brown shrimp were caught from all pass stations during the 9-month sampling period and represented 1.1% of all organisms caught (Table 1). The total number of brown shrimp caught each week ranged from 0 in all stations to 19 in station 503. The greatest number of brown shrimp were caught during the week of July 25-31, all from Pass Cavallo. Approximately 14.1% of the samples taken in Pass Cavallo and 6.4% of the samples taken in the Matagorda Ship Channel contained at least one brown shrimp (Table 2).

There were no significant ( $P \leq 0.05$ ) differences among brown shrimp mean catch rates for stations within each pass area or between Pass Cavallo and the Matagorda Ship Channel (Table 3).

### White Shrimp

A total of 46 white shrimp were caught from all pass stations during the 9-month sampling period and represented 0.9% of all organisms caught (Table 1). The total number of white shrimp caught each week ranged from 0 in all stations to 9 in station 506. The greatest number of white shrimp were caught during the week of January 17-23, with 85% caught in the Matagorda Ship Channel. Approximately 11.5% of the samples taken in Pass Cavallo and 10.3% of the samples taken in the Matagorda Ship Channel contained at least one white shrimp (Table 2).

There were no significant ( $P \leq 0.05$ ) differences in white shrimp mean catch rates among stations within each pass area or between Pass Cavallo and the Matagorda Ship Channel (Table 3).

### Blue Crabs

A total of 146 blue crabs were caught from all pass stations during the 9-month sampling period and represented 2.7% of all organisms caught (Table 1). The total number of blue crabs caught each week ranged from 0 in all stations to 60 in station 506. The greatest number of blue crabs were caught during the week of August 15-21 with 94% caught in station 506. Approximately 20.5% of the samples taken in Pass Cavallo and 30.8% of the samples taken in the Matagorda Ship Channel contained at least one blue crab (Table 2).

There were no significant ( $P \leq 0.05$ ) differences in blue crab mean catch rates among stations within each pass area or between Pass Cavallo and the Matagorda Ship Channel (Table 3).

### DISCUSSION

The data presented in this paper indicated abundances of organisms in trawls were seasonal in these pass areas. Brown shrimp are caught during mid-summer, white shrimp during early winter and blue crabs during late summer. This is consistent with the findings of Benefield (1982) for shrimp and of More (1969) for blue crabs.

Wide variation in the seasonal abundances of many species results in many consecutive weeks of zero catch. These data may reduce the power of an analysis of variance by overestimating the pooled variance. It would be better to restrict the analysis to those periods when the organisms tested are most abundant. The planned comparison, however, did not include a method for restricting the analysis to specific periods.

Since the present data indicate no significant differences in mean catch rates between Pass Cavallo and the Matagorda Ship Channel for the species tested, it would be more cost-effective to treat the two pass areas as one sampling area. Therefore it is recommended that the four current stations be maintained, but that two of the four stations be randomly selected and sampled each week.

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Table 1. Number (No.) of organisms (by species and station number) caught in 6.1-m trawls during January-September 1983.

Species	Pass Cavallo		Matagorda Ship Channel		Total
	503	504	505	506	
<u>Invertebrates</u>					
<u>Stomolophus meleagris</u>	113	468	315	326	1222
<u>Loliguncula brevis</u>	133	169	84	61	447
<u>Clibanarius vittatus</u>	86	16	21	31	153
<u>Callinectes sapidus</u>	23	14	23	86	146
<u>Paguris pollicaris</u>	22	12	25	24	83
<u>Penaeus aztecus</u>	22	26	2	7	57
<u>Portunus gibbesii</u>	0	3	23	24	50
<u>Penaeus setiferus</u>	4	11	15	16	46
<u>Penaeus duorarum</u>	4	11	3	10	28
<u>Trachypeneus similis</u>	0	18	4	5	27
<u>Callinectes similis</u>	9	4	5	3	21
<u>Libinia emarginata</u>	0	7	9	2	18
<u>Squilla empusa</u>	0	2	9	6	17
<u>Ovalipes guadalupensis</u>	4	0	5	7	16
<u>Thais haemastoma</u>	9	1	3	3	16
Order Actiniaria	0	5	1	1	7
<u>Libinia dubia</u>	3	1	1	0	5
<u>Paguris longicarpus</u>	1	0	0	3	4
Family Xanthidae	1	0	0	3	4
<u>Busycon perversum</u>	0	2	1	0	3
<u>Hepatus epheliticus</u>	0	0	2	0	2
<u>Menippe mercinaria</u>	1	0	1	0	2
Family Portunidae	0	0	0	2	2
<u>Xiphopeneus kroyeri</u>	1	0	0	1	2
<u>Alpheus sp.</u>	1	0	0	0	1
<u>Arenaeus cribrarius</u>	1	0	0	0	1
<u>Calappa sulcata</u>	0	0	1	0	1
<u>Mellita quinquesperforata</u>	0	1	0	0	1
<u>Neopanope texanae</u>	0	0	0	1	1
<u>Oliva sayana</u>	0	1	0	0	1
<u>Palaemonetes sp.</u>	1	0	0	0	1
<u>Trachycardium muricatum</u>	0	0	1	0	1
Family Paguridae	1	0	0	0	1
Subtotal	440	772	554	621	2387

Table 1. (Cont'd.).

Species	Pass Cavallo		Matagorda Ship Channel		Total
	503	504	505	506	
<u>Vertebrates</u>					
<u>Leiostomus xanthurus</u>	34	61	367	296	758
<u>Chloroscombrus chrysurus</u>	155	122	100	64	441
<u>Anchoa mitchilli</u>	26	125	76	29	256
<u>Bairdiella chrysura</u>	34	14	96	107	251
<u>Dasyatis sabina</u>	221	8	3	3	235
<u>Lagodon rhomboides</u>	27	52	36	39	154
<u>Vomer setapinnis</u>	50	73	3	11	137
<u>Orthopristis chrysoptera</u>	6	4	18	103	131
<u>Cynoscion arenarius</u>	7	60	13	20	100
<u>Micropogonias undulatus</u>	23	28	5	22	78
<u>Menticirrhus americanus</u>	11	1	28	29	69
<u>Arius felis</u>	16	11	20	13	60
<u>Peprilus burti</u>	10	15	11	8	44
<u>Brevoortia patronus</u>	2	24	7	8	41
<u>Citharichthys spilopterus</u>	5	2	1	14	22
<u>Peprilus alepidotus</u>	0	15	2	4	21
<u>Chilomycterus schoepfi</u>	4	4	5	6	19
Family Clupeidae	4	15	0	0	19
<u>Etropus crossotus</u>	3	3	6	6	18
<u>Anchoa hepsetus</u>	2	1	8	2	13
<u>Prionotus tribulus</u>	0	2	3	6	11
<u>Harengula pensacolatae</u>	7	1	0	0	8
<u>Polydactylus octonemus</u>	2	2	1	3	8
<u>Symphurus plagiusa</u>	0	0	6	2	8
<u>Cynoscion nothus</u>	0	7	0	0	7
<u>Selene vomer</u>	0	7	0	0	7
<u>Sphoeroides parvus</u>	2	2	0	3	7
<u>Larimus fasciatus</u>	0	1	1	3	5
<u>Trichiurus lepturus</u>	0	3	1	1	5
<u>Archosargus probatocephalus</u>	0	0	4	0	4
<u>Cynoscion nebulosus</u>	2	2	0	0	4
<u>Eucinostomus argenteus</u>	1	2	0	1	4
Family Carangidae	1	0	2	0	3
<u>Hemicaranx amblyrhynchus</u>	0	3	0	0	3
<u>Lutjanus synagris</u>	2	0	0	1	3
<u>Astroscopus y-graceum</u>	0	0	0	2	2
Family Gerreidae	0	2	0	0	2
<u>Paralichthys albigutta</u>	0	0	2	0	2
<u>Sphoeroides dorsalis</u>	0	2	0	0	2
<u>Aluterus schoepfi</u>	0	0	0	1	1
<u>Bagre marinus</u>	0	1	0	0	1
<u>Cantherhines pullus</u>	0	1	0	0	1
<u>Caranx crysos</u>	0	1	0	0	1
<u>Cahetodipterus faber</u>	0	0	0	1	1

Table 1. (Cont'd.).

Species	Pass Cavallo		Matagorda Ship Channel		Total
	503	504	505	506	
<u>Dorosoma cepedianum</u>	0	1	0	0	1
<u>Gobiesox strumosus</u>	0	0	0	1	1
Family Lutjanidae	1	0	0	0	1
<u>Menticirrhus littoralis</u>	0	0	0	1	1
<u>Monacanthus hispidus</u>	1	0	0	0	1
<u>Paralichthys lethostigma</u>	0	0	1	0	1
<u>Pomatomus saltatrix</u>	1	0	0	0	1
<u>Saurida brasiliensis</u>	1	0	0	0	1
<u>Sphyrna tiburo</u>	1	0	0	0	1
<u>Stellifer lanceolatus</u>	0	0	1	0	1
<u>Synodus foetens</u>	0	0	1	0	1
<u>Trinectes maculatus</u>	1	0	0	0	1
Subtotal	662	679	828	810	2979
Total	1102	1451	1382	1431	5366

Table 2. Summary of weekly catch (No.) of selected species (by station number) caught in 6.1-m trawls during January-September 1983.

Sample period Month/Day	Brown shrimp						White shrimp						Blue Crabs						All organisms						
	PC <sup>a</sup>			MSC <sup>b</sup>			PC			MSC			PC			MSC			PC			MSC			
	503	504	506	505	506	506	503	504	506	505	506	503	504	506	505	506	503	504	506	505	506	503	504	506	
Jan																									
3-9	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	71	436	446
10-16	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	103	26	19	24	
17-23	0	0	0	0	0	9	0	3	8	0	0	0	0	0	0	0	0	0	0	0	171	20	35	147	
24-30	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	16	25	72	0	
31-Feb 6	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	17	14	22	
Feb																									
7-13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	17	87	13	
14-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	15	10	19	
21-27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	33	9	9	
28-Mar 6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	6	8	9	7	
Mar																									
7-13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	376	121	143	
14-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	33	9	6	
21-27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	132	15	2	
28-Apr 3	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	22	5	13	18	
Apr																									
4-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	21	35	
11-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	11	9	
18-24	0	1	0	0	2	0	1	3	2	0	0	6	1	3	0	0	0	0	0	0	56	75	77	108	
25-May 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	11	21	33	
May																									
2-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	8	80	39	
9-15	0	1	0	1	1	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	9	30	33	39	
16-22	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	18	5	13	
23-29	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	3	4	
30-Jun 5	0	7	1	0	0	0	0	0	0	0	0	1	2	0	1	0	0	0	0	0	83	43	18	12	
Jun																									
6-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	9	10	6	
13-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	9	
20-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	3	
27-Jul 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	5	7	

Table 2. (Cont'd.).

Sample period Month/Day	Brown shrimp			White shrimp			Blue crabs			All organisms			
	PC		MSC	PC		MSC	PC		MSC	PC		MSC	
	502 <sup>c</sup>	504	505	503	504	505	503	504	505	503	504	505	
Jul													
4-10	1	0	0	1	0	0	1	0	3	24	27	7	
11-17	0	9	0	0	0	0	0	2	1	6	27	18	
18-24	0	0	0	0	0	0	1	0	0	10	25	69	
25-31	19	6	0	0	0	0	0	2	0	106	188	2	
Aug													
1-7	0	1	0	0	0	0	0	1	1	12	59	35	
8-14	0	0	0	0	0	0	0	0	0	11	0	36	
15-21	0	0	0	0	0	0	2	1	1	45	47	6	
22-28	0	0	0	0	0	0	0	0	5	5	13	18	
29-Sep 4	0	0	0	0	0	0	0	0	2	0	2	5	
Sep													
5-11	1	0	0	0	0	0	0	0	1	4	2	4	
12-18	0	0	0	0	0	0	0	0	0	19	34	2	
19-25	0	0	0	0	0	0	0	0	0	12	7	32	
26-Oct 2	0	0	1	0	0	0	2	0	0	146	28	11	
													66

<sup>a</sup>PC = Pass Cavallo

<sup>b</sup>MSC = Matagorda Ship Channel

<sup>c</sup>Station Number

Table 3. ANOVA table of catch rates ( $\log_{10}$  No./tow) by species with pass station sum of squares decomposed into planned comparisons (P = 0.05).

Species	Source of variation	SS	df	MS	F <sub>s</sub>
Brown shrimp	Among pass stations	0.156	3	0.052	1.500 NS
	PC vs MSC	0.107	1	0.107	3.078 NS
	503 vs 504	0.039	1	0.039	1.131 NS
	505 vs 506	0.010	1	0.010	0.283 NS
	Within	<u>5.245</u>	<u>152</u>	0.035	
	Total	5.410	155		
White shrimp	Among pass stations	0.063	3	0.021	0.647 NS
	PC vs MSC	0.023	1	0.023	0.694 NS
	503 vs 504	0.029	1	0.029	0.897 NS
	505 vs 506	0.011	1	0.011	0.349 NS
	Within	<u>4.923</u>	<u>152</u>	0.032	
	Total	4.986	155		
Blue crabs	Among pass stations	0.114	3	0.038	0.580 NS
	PC vs MSC	0.087	1	0.087	1.333 NS
	503 vs 504	0.000 <sup>a</sup>	1	0.000 <sup>a</sup>	0.002 NS
	505 vs 506	0.026	1	0.026	0.404 NS
	Within	<u>9.918</u>	<u>152</u>	0.065	
	Total	10.032	155		
All organisms caught	Among pass stations	0.481	3	0.160	0.502 NS
	PC vs MSC	0.023	1	0.023	0.071 NS
	503 vs 504	0.269	1	0.269	0.842 NS
	505 vs 506	0.190	1	0.190	0.594 NS
	Within	<u>48.550</u>	<u>152</u>	0.319	
	Total	49.031	155		

PC = Pass Cavallo

MSC = Matagorda Ship Channel

<sup>a</sup> values presented were  $\leq 0.001$

Figure 1. Bay systems of the Texas coast (study area circled).

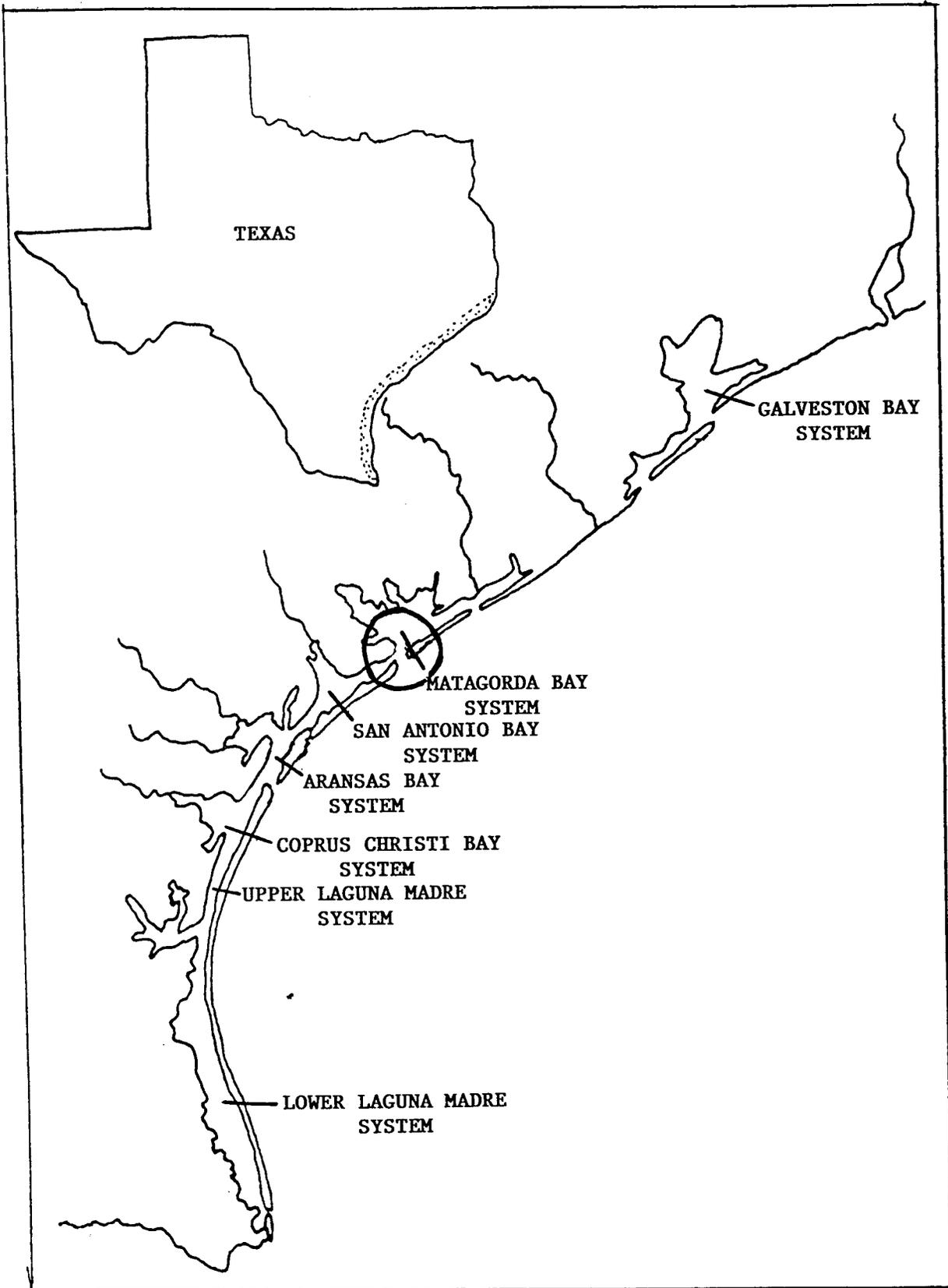
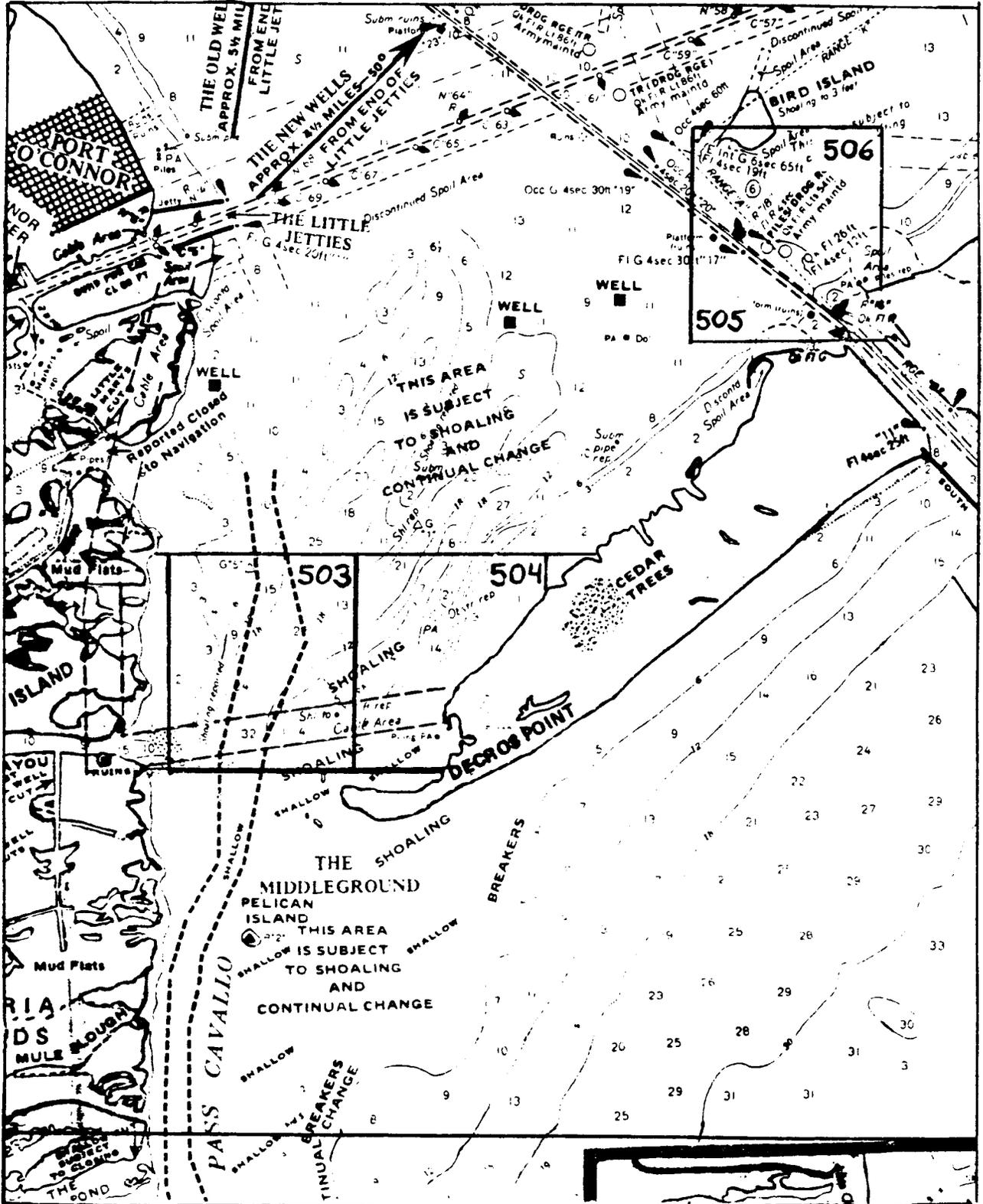


Figure 2. Pass station locations.



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