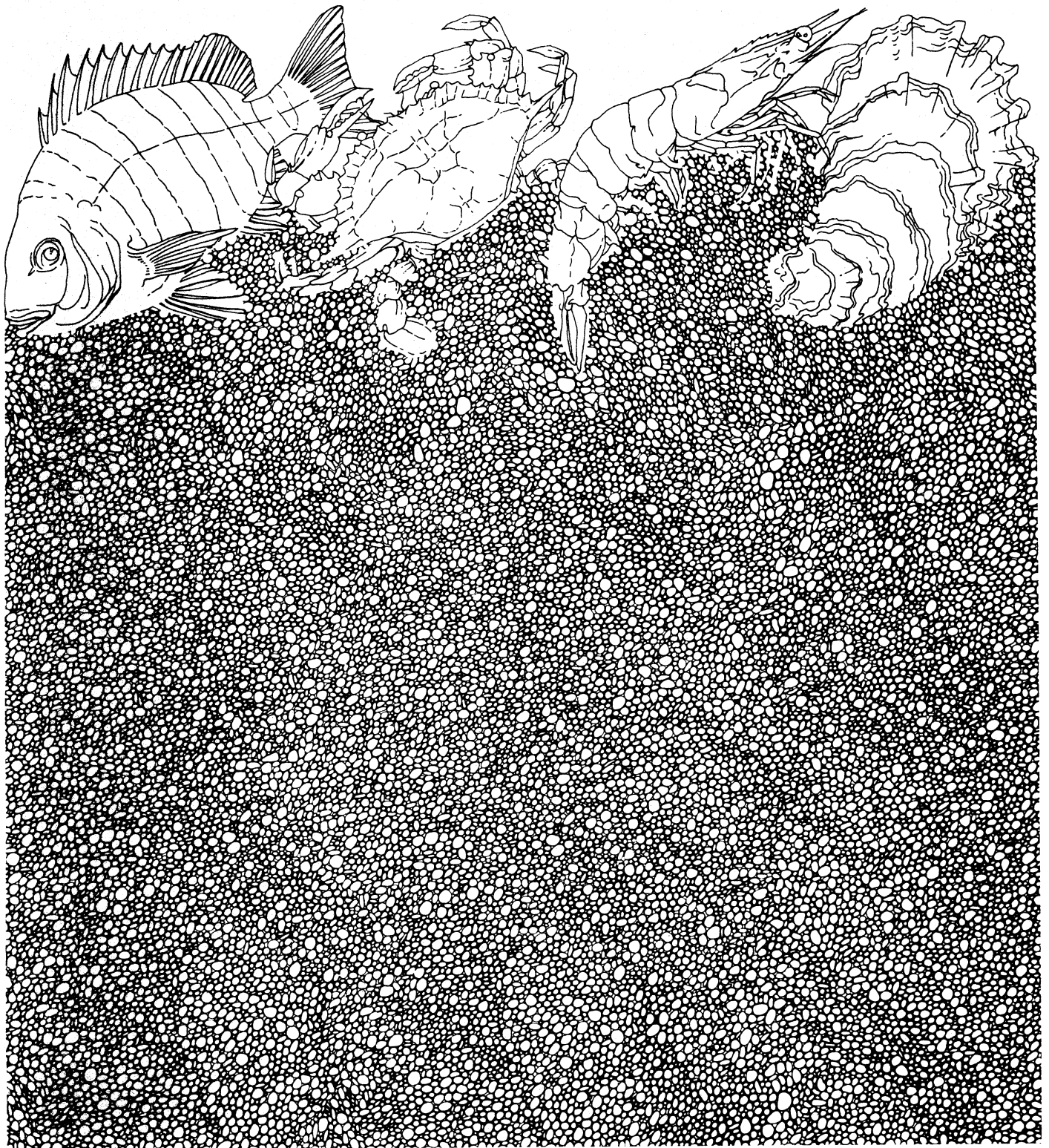


# Occurrence of Select Juvenile Fishes During Post Spawning Periods in Texas Bay-Gulf Passes

by J. H. Martin and L. W. McEachron

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## ABSTRACT

Utilization of bay-Gulf passes during post spawning periods by juvenile red drum (Sciaenops ocellatus), southern flounder (Paralichthys lethostigma) and to a lesser extent black drum (Pogonias cromis) is well documented. Bag seine catches in this study of juvenile red drum, spotted seatrout (Cynoscion nebulosus), black drum and southern flounder inside bay-Gulf passes and on the bayside of the passes correspond to reported post spawning periods. Catch rates inside bay-Gulf passes were similar to those on the bayside of the pass. It is recommended that these bay-Gulf passes be included in the routine Texas Parks and Wildlife Department bag seine monitoring program.

## INTRODUCTION

The Texas coast, characterized by barrier islands stretching from High Island to Port Isabel, has eight major bay-Gulf passes (Matlock and Weaver 1979). Approximately 1.1 million hectares of open water, coastal marshes and tidal flats are enclosed by the islands (Diener 1975). The life cycles of many marine organisms are dependent upon these coastal bay areas for growth and survival (Hedgpeth 1966).

The bay-Gulf passes provide juveniles spawned in the Gulf of Mexico access to nursery areas within the bays. Red drum (Sciaenops ocellatus) spawn from late summer through late fall in the Gulf near passes; juveniles are carried into the bays by flood tides (Pearson 1929, Miles 1950, Simmons and Breuer 1962). Southern flounder (Paralichthys lethostigma) spawn in the Gulf in late fall and early winter (Stokes 1973). Spawning of red drum and southern flounder is preceded by emigration of adults from the bay into the shallow Gulf and is followed by immigration of juveniles into the bays (King 1971, Stokes 1973). Black drum (Pogonias cromis) spawn in the Gulf, in or near bay-Gulf passes and in the bays in both spring and fall with peak spawning in February and March (Simmons and Breuer 1962, Cornelius 1984). Spotted seatrout (Cynoscion nebulosus) spawn from May to December (Miles 1950). Although gulfward movement of ripe spotted seatrout has been observed on the upper Texas coast (Baker et al. In press) spawning is generally confined to inland estuarine waters (Lorio and Perret 1980). Catastrophic events such as hurricanes or pollution (i.e. oil spills) affects juvenile survival by enhancing or hindering juvenile transport into bays.

The objectives of this study were to: 1) determine the utilization of passes by red drum, black drum, spotted seatrout and southern flounder during post spawning periods and 2) present mean lengths (mm  $\pm$  1SE) of these species caught during post spawning periods.

## MATERIALS AND METHODS

Bag seine samples were taken biweekly (1st-15th; 16th-end of month) during November 1979-October 1980 in each of eight Texas bay-Gulf passes (Figure 1). One sample was collected in the pass and one was collected on the bayside shoreline adjacent to the pass. Bag seines (18.3 m long; 1.8 m deep with 1.9 cm stretched nylon multifilament in the lateral wings and 1.3 cm stretched nylon multifilament mesh in the central bag) were pulled parallel to shore for a distance of 15.2-30.5 m. The area (ha) sampled was estimated using the distance pulled and the length of extension of the bag seine.

All red drum, spotted seatrout, black drum and southern flounder were identified and counted except in Pass Cavallo where only red drum were retained. No more than 20 randomly selected individuals of each species caught in each seine haul were measured (nearest 1 mm TL). Catch rates (No./ha) were calculated for each species by station type (pass, bayside) for each pass.

A two-way analysis of variance (Sokal and Rohlf 1981) was used to determine if there were significant differences ( $P \leq 0.05$ ) in mean catch rates among passes and between station types for red drum during November-March, for spotted seatrout during July-October and for southern flounder during February-May. A one-way analysis of variance was used to determine if there were significant differences in mean black drum catch rates during June-July between station types only for San Luis Pass. Seasons for each species were based on the findings of McEachron and Green (In press). Catch rates were transformed to common logarithms before analysis to reduce variance heterogeneity. Monthly mean lengths (mm  $\pm$  1SE) were determined for each species during each season for all passes combined.

Not all passes were tested for each species because of low catches and missing cells (Appendices A and B). Bolivar Roads and San Luis Pass were eliminated from the red drum analysis. San Luis Pass and Mansfield Pass were the only passes tested for spotted seatrout.

## RESULTS

No significant differences were found in mean catch rates between station types or among passes for red drum and spotted seatrout (Table 1). A significant interaction between station type and passes was found for southern flounder. The combined coastwide catch rate of red drum was  $44.00 \pm 13.03/\text{ha}$ ; catch rates ranged from  $5.25 \pm 2.55/\text{ha}$  in Cedar Bayou to  $128.34 \pm 64.48/\text{ha}$  in Mansfield Pass (Table 1). The combined coastwide spotted seatrout catch rate was  $23.70 \pm 16.01/\text{ha}$ ; catch rates were  $3.64 \pm 0.52/\text{ha}$  in Mansfield Pass and  $43.75 \pm 27.09/\text{ha}$  in San Luis Pass (Table 2). The combined coastwide southern flounder catch rate was  $41.07 \pm 30.73/\text{ha}$ ; catch rates ranged from  $1.25 \pm 1.25/\text{ha}$  in Cedar Bayou to  $239.58 \pm 197.92/\text{ha}$  in San Luis Pass (Table 2). Catches varied among passes and among species (Appendix A).

No significant difference was found in mean black drum catch rates between station types in San Luis Pass (Table 3). The combined catch rate was  $154.16 \pm 30.97/\text{ha}$  (Table 3).

The combined monthly coastwide mean lengths revealed growth for several species during each species respective season (Figure 2).

Red drum mean lengths increased from 38 mm in January to 88 mm in March. Spotted seatrout mean lengths decreased from 92 mm in July to 48 mm in October. Black drum mean lengths increased from 80 mm in June to 96 mm in July. Southern flounder mean lengths increased from 42 mm in February to 66 mm in March.

#### DISCUSSION

Bay-Gulf passes play a critical role in the life cycles of many marine organisms (Pearson 1929, Miles 1950, Simmons and Hoese 1959, Simmons and Breuer 1962, King 1971, Stokes 1973). Catches of juveniles in this study generally correspond to post spawning periods for each species (Pearson 1929, Simmons and Breuer 1962, King 1971, Stokes 1973, Mercer 1984). Impeding movement of juveniles through the passes could have an adverse impact on recruitment and subsequent adult population levels.

Organisms moving through a pass are not randomly distributed throughout the pass. Many organisms select specific areas based on tidal flow (King 1971). For example, southern flounder were found in greatest density along the channel sides of Cedar Bayou with a slightly greater concentration near the west bank than near the east bank (King 1971). If bag seines are used in estimating relative abundance of juveniles moving through passes then sites should be selected randomly from all possible areas.

Prior to September 1984, bay-Gulf passes were not routinely sampled by the Texas Parks and Wildlife Department in their routine bag seine monitoring program (McEachron and Green 1985). Because no significant differences were found between pass and bayside areas, it is recommended that the bay-Gulf passes be included in the routine monitoring program.

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Table 1. Summary of results of two-way analysis of variance of bay-Gulf pass bag seine catch rates (No./ha) for three species during November 1979-October 1980.

Group	Source of variation	Degrees of freedom	Mean square	F
Red drum	Total	119		
	Passes	5	1.813	1.582
	Stations	1	1.050	0.916
	Passes x Stations	5	1.146	1.510
	Error	108	0.759	
Spotted seatrout	Total	31		
	Passes	1	0.521	0.868
	Stations	1	0.221	0.368
	Passes x Stations	1	0.262	0.437
	Error	28	0.600	
Southern flounder	Total	111		
	Passes	6	2.658	5.381
	Stations	1	0.004	0.008
	Passes x Stations	6	1.373	2.779*
	Error	98	0.494	

\*  $P < 0.05$

Table 2. Seasonal mean catch rates (No./ha  $\pm$  1SE) of select species caught in bag seines by station type (pass; bayside) in eight passes on the Texas coast. Months in parenthesis indicate the season.

Species	Area	Station type			Combined
		Pass	Bay side	Combined	
<b>Black drum</b> (Jun-Jul)	San Luis Pass	108.32 $\pm$ 76.22	200.00 $\pm$ 126.65	154.16 $\pm$ 30.97	
<b>Red drum</b> (Nov-Mar)	Pass Cavallo	43.33 $\pm$ 26.78	49.99 $\pm$ 30.73	46.66 $\pm$ 19.85	
	Cedar Bayou	8.50 $\pm$ 4.60	2.00 $\pm$ 2.00	5.25 $\pm$ 2.55	
	Aransas Pass	14.00 $\pm$ 4.60	56.00 $\pm$ 26.47	35.00 $\pm$ 14.50	
	Water Exchange Pass	25.00 $\pm$ 12.36	0.00 $\pm$ 0.00	12.50 $\pm$ 6.66	
	Mansfield Pass	214.17 $\pm$ 123.73	42.50 $\pm$ 24.73	128.34 $\pm$ 64.48	
	Brazos Santiago Pass	7.50 $\pm$ 5.34	65.00 $\pm$ 65.00	36.25 $\pm$ 32.42	
	<b>Combined</b>	52.08 $\pm$ 22.50	35.92 $\pm$ 12.27	44.00 $\pm$ 13.03	
<b>Spotted seatrout</b> (Jul-Oct)	San Luis Pass	16.66 $\pm$ 16.66	70.84 $\pm$ 46.48	43.75 $\pm$ 27.09	
	Mansfield Pass	4.16 $\pm$ 4.16	3.12 $\pm$ 3.12	3.64 $\pm$ 0.52	
	<b>Combined</b>	10.38 $\pm$ 6.22	36.98 $\pm$ 33.86	23.70 $\pm$ 16.01	
<b>Southern flounder</b> (Feb-May)	Bolivar Roads	0.00 $\pm$ 0.00	8.32 $\pm$ 45.00	4.16 $\pm$ 4.15 <sup>a</sup>	
	San Luis Pass	437.51 $\pm$ 250.43	41.66 $\pm$ 24.19	239.58 $\pm$ 197.92 <sup>a</sup>	
	Cedar Bayou	2.50 $\pm$ 2.50	0.00 $\pm$ 0.00	1.25 $\pm$ 1.25 <sup>a</sup>	
	Aransas Pass	15.00 $\pm$ 7.34	7.50 $\pm$ 7.50	11.25 $\pm$ 3.75 <sup>a</sup>	
	Water Exchange Pass	15.62 $\pm$ 10.50	0.00 $\pm$ 0.00	7.81 $\pm$ 7.81 <sup>a</sup>	
	Mansfield Pass	0.00 $\pm$ 0.00	40.62 $\pm$ 21.1	20.31 $\pm$ 20.31 <sup>a</sup>	
	Brazos Santiago Pass	0.00 $\pm$ 0.00	6.25 $\pm$ 4.09	3.12 $\pm$ 3.12 <sup>a</sup>	
	<b>Combined</b>	67.16 $\pm$ 61.70 <sup>a</sup>	14.91 $\pm$ 6.89 <sup>a</sup>	41.07 $\pm$ 30.73 <sup>a</sup>	

<sup>a</sup>Weighted mean because of significant interaction in analyses.

Table 3. Summary of results of one-way analysis of variance of San Luis Pass bag seine catch rates (No./ha) for black drum (Pogonias cromis) during June-July 1980.

Source of variation	Degrees of freedom	Mean square	F
Total	7		
Stations	1	0.067	0.039
Error	6	1.683	

Figure 1. Texas bay-Gulf passes.

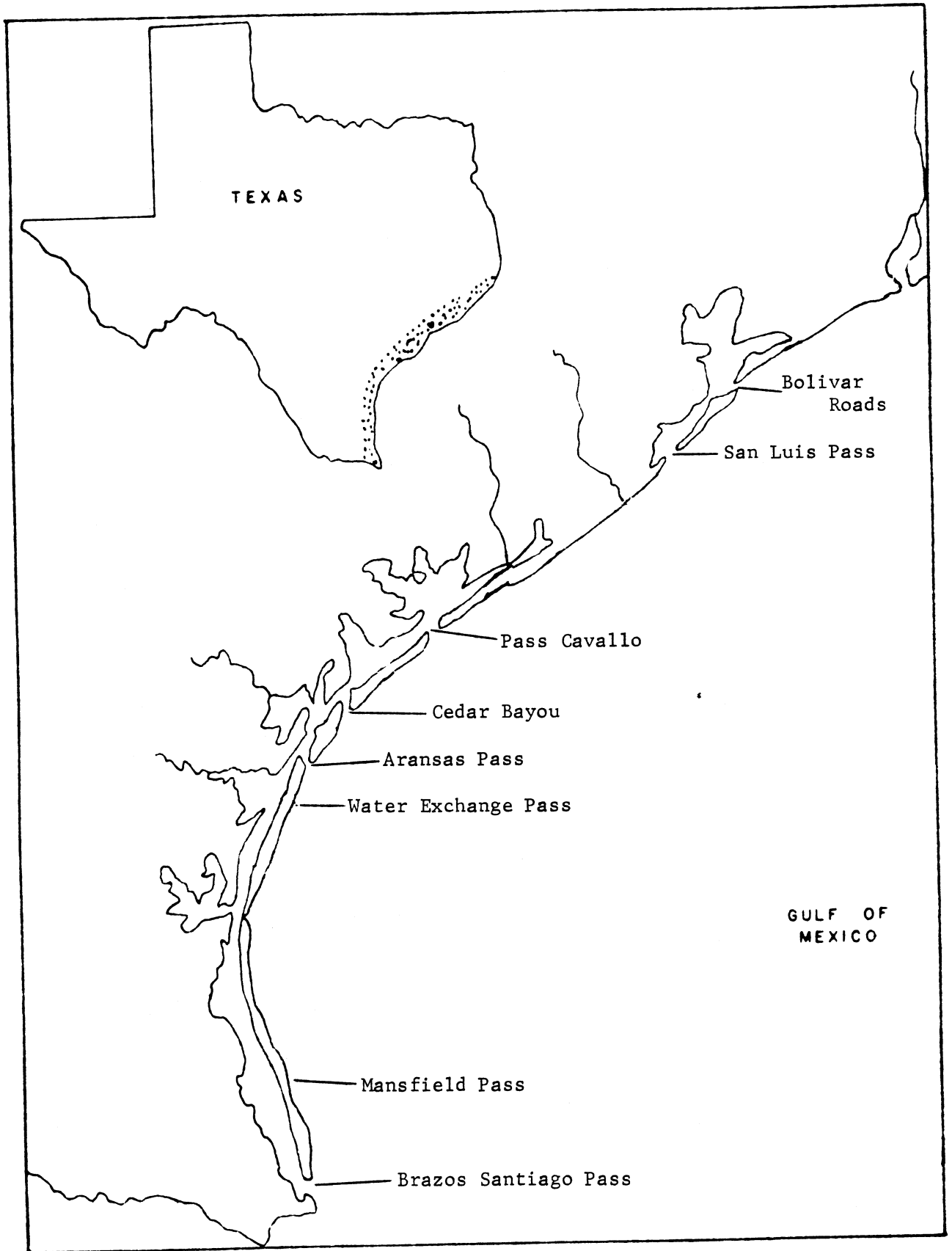
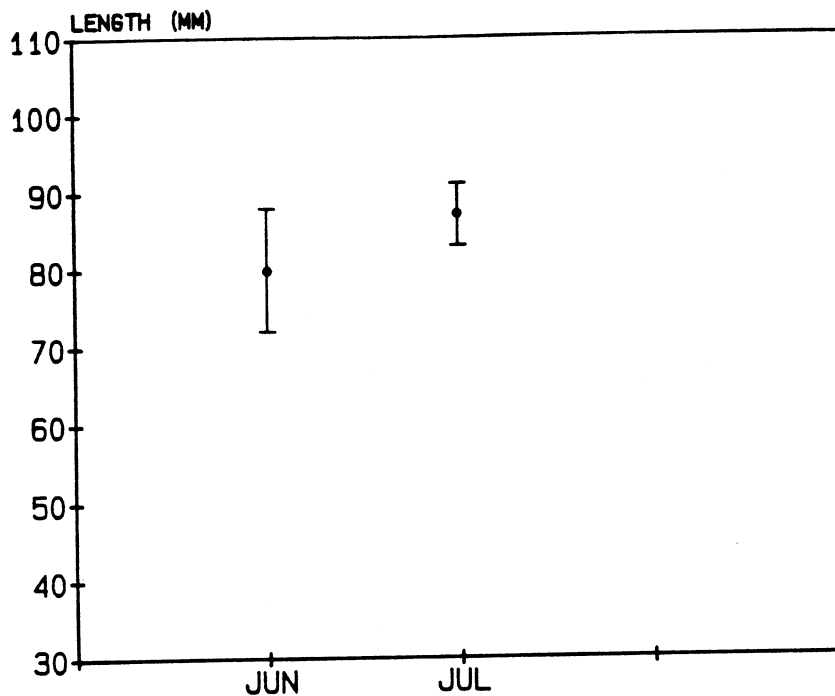
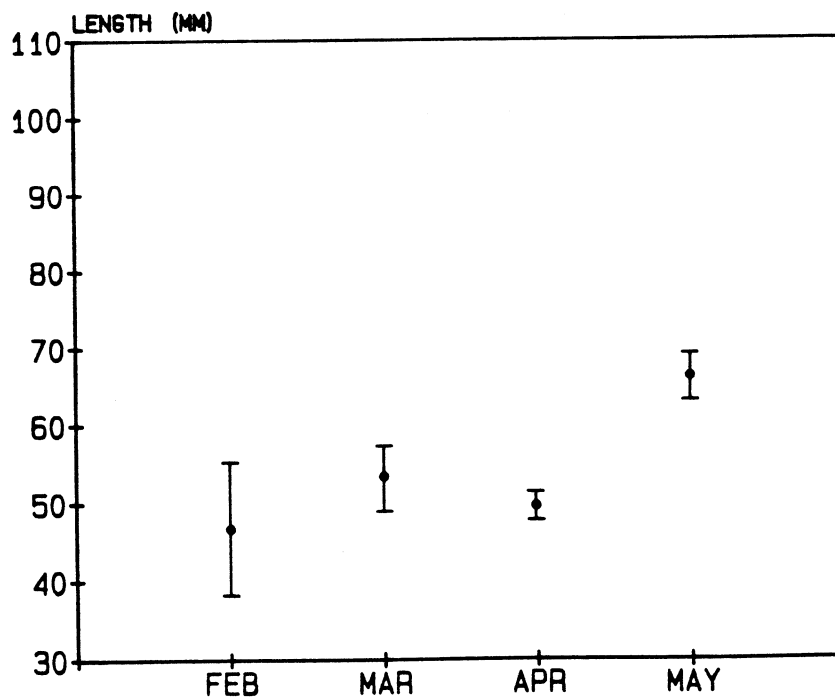


Figure 2. Monthly mean lengths ( $\pm$  1SE) during each respective season for red drum (Sciaenops ocellatus), black drum (Pogonias cromis), spotted seatrout (Cynoscion nebulosus) and southern flounder (Paralichthys lethostigma) caught in bag seines in eight bay-Gulf passes.

### BLACK DRUM

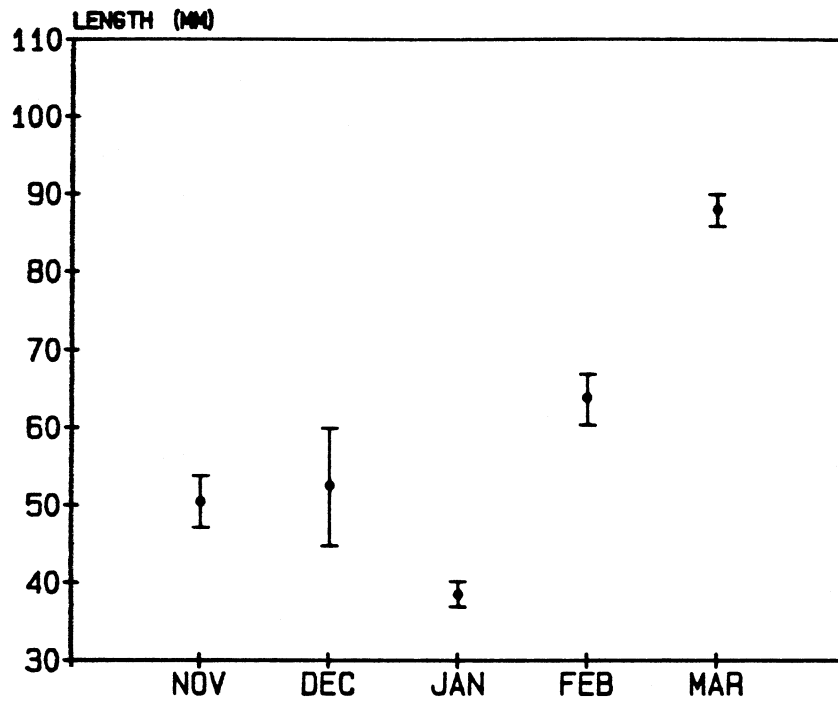


### SOUTHERN FLOUNDER

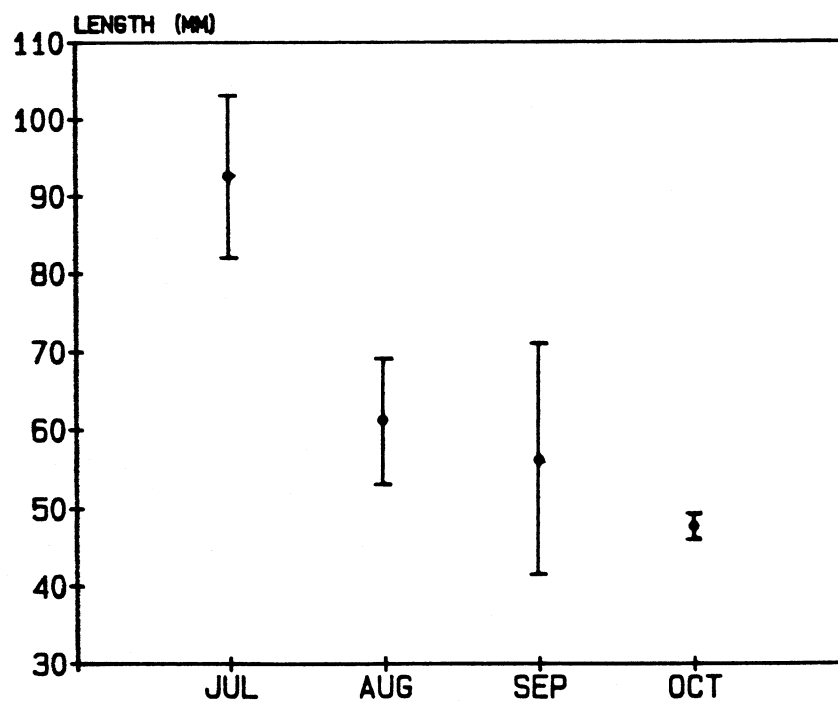




## RED DRUM



## SPOTTED SEATROUT



Appendix A. Bag seine catch (No.) of select species in eight Texas bay-Gulf passes during November 1979-October 1980.

Table A.1. Bag seine catch (No.) of select species in eight Texas bay-Gulf passes during November 1979-October 1980. I = inside passes; B = bayside of pass. ND indicates no data.

Species Location	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<b>Black drum</b>												
Bolivar Roads												
I	0 0	0 ND	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 0	0 0
B	0 0	0 ND	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 0
San Luis Pass												
I	0 0	0 ND	0 0	0 0	0 0	0 0	0 0	10 0	2 0	0 0	6 0	0 0
B	0 0	0 ND	0 0	0 0	0 0	0 0	0 0	1 8	16 0	2 4	0 0	0 0
Pass Cavallo												
I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cedar Bayou												
I	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 0	0 0	0 0	1 0	0 ND
B	0 0	0 0	1 0	1 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Aransas Pass												
I	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	2 0	0 0	0 0
B	1 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0

Table A.1. (Cont'd.).

Species Location	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<b>Black drum (Cont'd.).</b>												
Water Exchange Pass												
I	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
B	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 0	0 0	0 0	0 0
Mansfield Pass												
I	1 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	4 0
B	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Brazos Santiago Pass												
I	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	ND
B	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 ND	ND
<b>Red drum</b>												
Bolivar Roads												
I	0 0	0 ND	0 0	0 0	0 0	0 0	0 1	0 0	0 1	0 0	0 0	0 0
B	0 0	0 ND	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
San Luis Pass												
I	0 0	0 ND	0 0	0 0	1 5	0 0	0 0	3 0	1 0	0 0	0 0	0 0
B	0 0	0 ND	0 0	0 0	1 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Pass Cavallo												
I	7 0	0 0	1 0	5 0	0 ND	0 0	0 ND	0 0	0 0	0 0	0 0	0 0
B	4 0	1 0	1 0	9 0	0 ND	0 0	0 ND	0 0	1 0	0 0	0 0	1 0

Table A.1. (Cont'd.).

Species Location	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<b>Red drum (Cont'd).</b>												
Cedar Bayou												
I	1 0	0 0	1 0	0 0	0 0	2 0	0 0	0 0	0 0	0 0	0 0	0 ND
B	1 0	0 0	0 0	0 0	0 0	1 0	0 0	0 0	0 0	0 0	0 0	0 ND
Aransas Pass												
I	0 0	0 0	4 0	0 0	3 0	0 0	0 0	0 0	0 0	1 0	0 0	0 0
B	5 0	3 0	0 0	9 0	11 0	2 0	2 0	1 0	0 0	0 0	0 0	7 0
Water Exchange Pass												
I	5 2	0 1	0 0	0 1	0 1	0 0	0 0	0 1	0 0	0 0	0 0	0 0
B	0 0	0 0	0 0	0 0	0 0	0 0	1 0	0 0	0 0	0 0	0 0	0 0
Mansfield Pass												
I	0 0	0 2	51 0	0 6	11 14	3 10	2 7	0 1	0 0	0 0	0 0	0 1
B	0 0	3 0	10 0	2 0	2 0	0 0	27 0	0 0	0 0	0 0	0 0	0 0
Brazos Santiago Pass												
I	0 0	0 0	0 0	2 0	1 2	1 1	0 0	0 0	0 0	0 0	0 ND	ND
B	0 0	0 0	0 0	2 0	26 0	20 0	2 0	2 0	0 0	0 0	0 ND	ND

Table A.1. (Cont'd.).

Species Location	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<b>Spotted seatrout</b>												
<b>Bolivar Roads</b>												
I	0 0	0 ND	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
B	0 0	0 ND	1 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
<b>San Luis Pass</b>												
I	0 0	0 ND	0 0	0 0	0 0	0 0	0 0	1 0	4 0	1 0	0 0	0 0
B	0 0	0 ND	0 0	0 0	0 0	0 0	0 0	0 0	0 0	8 0	9 0	0 0
<b>Pass Cavallo</b>												
I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
<b>Cedar Bayou</b>												
I	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 0	3 0	0 0	1 0	2 ND
B	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 0	0 0	0 4	1 ND
<b>Aransas Pass</b>												
I	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 1	0 0	0 0	0 0
B	5 2	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0

Table A.1. (Cont'd.).

Species Location	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<b>Spotted seatrout (Cont'd.).</b>												
Water Exchange Pass												
I	1	0	1	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0	0
Mansfield Pass												
I	2	0	0	0	1	0	0	0	1	0	0	0
B	1	0	0	0	0	0	0	0	0	0	0	0
Brazos Santiago Pass												
I	0	0	0	0	0	0	0	0	0	0	0	ND
B	0	0	0	0	0	0	0	0	0	0	0	ND
<b>Southern flounder</b>												
Bolivar Roads												
I	0	0	0	0	0	0	0	0	0	1	0	0
B	1	0	0	0	0	1	1	0	0	0	0	0
San Luis Pass												
I	0	0	0	5	0	53	19	0	1	0	0	0
B	0	0	0	0	0	2	6	0	0	1	0	0

Table A.1. (Cont'd.).

Species Location	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<b>Southern flounder (Cont'd.).</b>												
Pass Cavallo												
I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cedar Bayou												
I	0 0	0 0	0 0	0 0	0 0	1 0	0 0	0 0	0 0	0 0	0 0	0 ND
B	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 ND
Aransas Pass												
I	0 0	0 0	1 0	0 0	2 0	2 2	0 0	0 0	0 0	0 0	1 0	0 0
B	0 0	0 0	0 0	0 0	3 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Water Exchange Pass												
I	0 0	0 0	0 0	0 0	0 0	2 3	1 0	0 0	0 0	0 0	0 0	0 0
B	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Mansfield Pass												
I	1 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
B	0 0	0 0	0 0	2 0	2 0	2 0	7 0	0 0	0 0	0 0	0 0	0 0
Brazos Santiago Pass												
I	0 0	0 0	0 0	0 0	0 0	1 0	0 0	0 0	0 0	0 0	0 ND	ND
B	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 0	0 0	0 0	0 ND	ND



Appendix B. Area covered (ha) by bag seine samples in eight bay-Gulf passes during November 1979-October 1980.

Table B.1. Area covered (ha) by bag seine samples in eight Texas bay-Gulf passes during November 1979-October 1980. I = inside pass; B = bayside of pass. ND indicates no data.

Location	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<b>Bolivar Roads</b>												
I	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
B	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
<b>San Luis Pass</b>												
I	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
B	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
<b>Pass Cavallo</b>												
I	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
B	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
<b>Cedar Bayou</b>												
I	.05	.04	.05	.04	.04	.04	.05	.04	.05	.04	.05	.04
B	.05	.04	.05	.04	.05	.04	.05	.04	.04	.04	.05	.04
<b>Aransas Pass</b>												
I	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
B	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
<b>Water Exchange Pass</b>												
I	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04
B	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04

Table B.1. (Cont'd.).

Location	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Mansfield Pass												
I	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04
B	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04
Brazos Santiago Pass												
I	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	ND
B	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	ND

