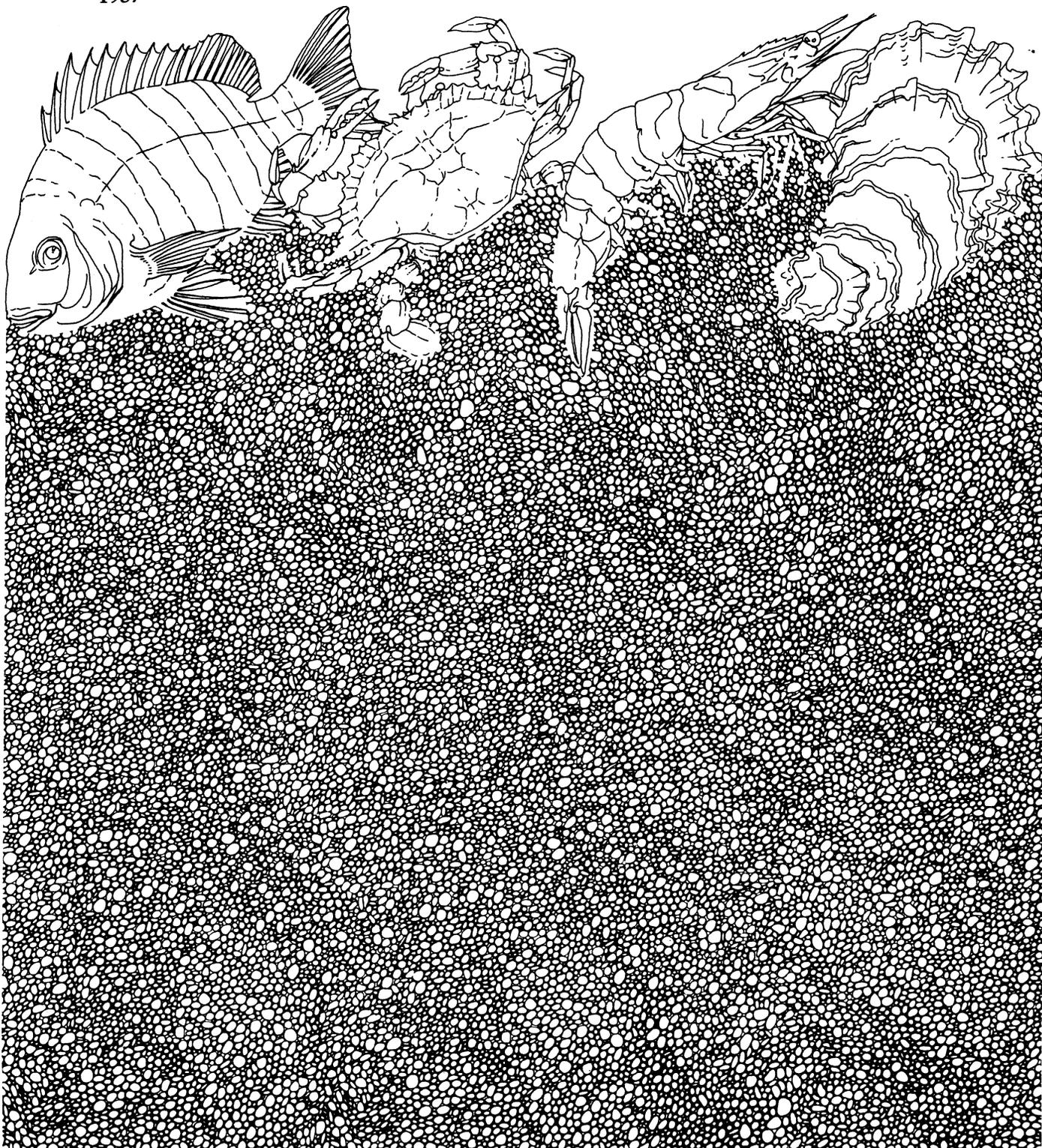


Abundance and Size of Brown Shrimp Within the Shallow (≤ 7.3 m) Waters Off Galveston, Texas

by William B. Kittrell, Jr., C.E. Bryan and Lawrence W. McEachron

Management Data Series
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ABSTRACT

Catch rates and mean lengths of brown shrimp (Penaeus aztecus) collected at various depths within the 7.3 m zone before, during and after the 1982 Gulf closure were analyzed. No difference in catch rates among the depths sampled were detected. Mean lengths of shrimp in all depths increased throughout the study. Movement from Galveston Bay corresponded closely with the 25 May-14 July coastwide closed season.

INTRODUCTION

The penaeid shrimp fishery is the most important commercial fishery in Texas. Penaeid shrimp were the primary species landed from the bays and the Gulf, constituting 80-91% of all shellfish landings during 1977-1983 (Hamilton and Saul 1984). Annual shrimp landings during this period averaged 36.0 million kg worth an average \$153.1 million (exvessel value). Brown shrimp (Penaeus aztecus) constituted 75% of total shrimp landings.

Texas enacts a 45-d early summer closed season in its outside waters (≤ 16.7 km from shore) to protect emigrating brown shrimp and to allow them to grow to a larger, more valuable size before harvest. The closure is from 1 June to 15 July. The Texas Parks and Wildlife Commission (or Executive Director) can alter the dates to provide for an earlier, later or longer closed season not exceeding 60 d based on estimates of when brown shrimp migrate from the bays. During the Gulf closure, white shrimp (P. setiferus) only can be harvested during daylight within the 7.3 m depth zone.

In 1981, the Gulf of Mexico Fishery Management Council complemented the Texas closure by implementing a management plan which called for closure of U.S. waters >16.7 km to 370.6 km (Bryan 1983). The management plan encouraged Texas to continue the seasonal closure of its Territorial Sea and to evaluate the effect on brown shrimp of allowing fishing for white shrimp during the closure.

Past shrimp studies have been conducted by the Texas Parks and Wildlife Department (TPWD) in Gulf waters ≥ 7.3 m (Fuls and Bryan 1986); however, little data exist on brown shrimp stocks within the 7.3 m zone, particularly during the closure. This study was conducted to determine 1) if brown shrimp were present within 7.3 m and 2) if there were differences in catch rate and mean length in varying depths within 7.3 m before, during and after the 25 May-14 July 1982 closure.

MATERIALS AND METHODS

The TPWD collected trawl samples approximately 3 km north-east of the north Galveston jetty during April-August 1982. The study area was located from latitude $29^{\circ}21'$ north, bounded by Bolivar Peninsula, and longitude $94^{\circ}40'$ west (Fig. 1); it included an area commonly known as Bolivar Flats.

An otter trawl, 6.1 m wide with 38 mm mesh and 0.5 x 1.2 m doors, was towed for 15 minutes at 4.8 km/h by either a 6.1-m outboard boat or a 8.5-m inboard boat. Tow direction at each station was alternated from east to west. Trawl samples were collected every 2 weeks in the 1.8-, 3.7-, 5.5- and 7.3-m (1, 2, 3 and 4 fm, respectively) depth zones. Each of the four stations was located by compass course, running-time and visual

alignment with landmarks. Depth zones were located using a Furuno FG-11 Mark II fathometer. The catch was sorted by species and counted; penaeid shrimp were measured (tip of rostrum to tip of telson) to the nearest mm.

Determination of significant differences ($P \leq 0.05$) in mean catches of brown shrimp among 2-week sample periods by depth zone was accomplished using a two-way analysis of variance without replication (Sokal and Rohlf 1981). Catch rates were transformed to $\log_{10}+1$ before analysis. A Duncan's multiple range test (SAS 1982) was used to compare mean catch rates by sample period.

Determination of significant differences in mean lengths was accomplished with a one-way analysis of variance. Individual shrimp lengths in the various depth zones were pooled because of numerous missing values. Standard deviations, standard errors and 95% confidence intervals were calculated for mean lengths following standard procedures (Sokal and Rohlf 1981).

RESULTS

Brown shrimp were present within 7.3 m before, during and after the 1982 closure. Catch rates varied significantly among sample periods but were similar among depth zones (Tables 1 and 2). Catch rates during the Gulf closure were different than those before and after the closure (Table 3). Catch rates increased from $<1 \pm <1/\text{tow}$ on 3 May to $15 \pm 6/\text{tow}$ on 2 August then declined to $<1 \pm <1/\text{tow}$ on 16 August.

The size of brown shrimp generally increased during the study period. Mean lengths before (from May) and during the closure (<111 mm) were significantly smaller than those after (≥ 120.0 mm) the closure (Tables 1 and 4).

DISCUSSION

This study will aid in evaluating the effect on brown shrimp of allowing fishing for white shrimp during the closure. Historically, brown shrimp within the 7.3 m zone have not been sampled by the TPWD because of vessel size and other restraints. However, trawl samples have been collected at or near the 7.3 m depth for many years (Fuls and Bryan 1986). They estimated 11 ± 4 million brown shrimp were caught within 7.3 m along the central coast by commercial shrimpers during the closure period. Our findings indicate there is no significant difference between brown shrimp catches at 7.3 m and catches <7.3 m. Therefore, data collected within this area are comparable to that collected at the 7.3 m depth.

The movement of shrimp from Galveston Bay corresponded closely with the coastwide Gulf closure dates (Bryan 1983). Shrimp were smaller at the beginning of the closure and increased in size through time. Trent (1967) also found that size of shrimp emigrating from Galveston Bay increased significantly as the season progressed.

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Table 1. Catch rate (No./tow \pm 1SE), mean length (mm \pm 1SE), and size range (mm) of brown shrimp caught within the 7.3-m depth zone during April-August 1982. Blank = no measurement. SE were only calculated for totals.

Date	Depth zone	Catch rate	Mean length	Size range
Apr 26	1.8	0		
	3.7	0		
	5.5	0		
	7.3	0		
	Total	0		
May 03	1.8	0		
	3.7	0		
	5.5	2	119	
	7.3	0		
	Total	<1 \pm <1	119 \pm 1	118-120
18	1.8	0		
	3.7	3	91	
	5.5	5	91	
	7.3	0		
	Total	2 \pm 1	91 \pm 5	68-113
Jun 02	1.8	6	81	
	3.7	6	100	
	5.5	7	95	
	7.3	1	98	
	Total	5 \pm 1	98 \pm 4	73-123
14	1.8	27	99	
	3.7	4	97	
	5.5	2	95	
	7.3	16	93	
	Total	12 \pm 6	97 \pm 1	68-118
Jul 06	1.8	0		
	3.7	20	111	
	5.5	13	116	
	7.3	14	104	
	Total	12 \pm 4	111 \pm 1	93-138
19	1.8	0		
	3.7	5	120	
	5.5	0		
	7.3	10	125	
	Total	4 \pm 2	123 \pm 3	93 \pm 143

Table 1. (Cont'd.)

<u>Date</u>	<u>Depth zone</u>	<u>Catch rate</u>	<u>Mean length</u>	<u>Size range</u>
Aug 02	1.8	0		
	3.7	28	119	
	5.5	20	122	
	7.3	12	116	
	Total	15 ± 6	120 ± 2	93-148
Aug 16	1.8	0		
	3.7	1	138	138
	5.5	0		
	7.3	1	113	113
	Total	<1 ± <1	130 ± 7	
Combined		6 ± 1		

Table 2. Results of two-way AOV for catches of brown shrimp by depth zone during April-August 1982.

Source of variation	df	Mean square	F
Total	35	0.966	
Sample periods	8	0.588	3.218*
Depth zones	3	0.195	1.065
Error	24	0.183	

* $P \leq 0.05$

Table 3. Mean catch rates (No./tow) by sample period. Means followed by the same letter are not significantly ($P > 0.05$) different.

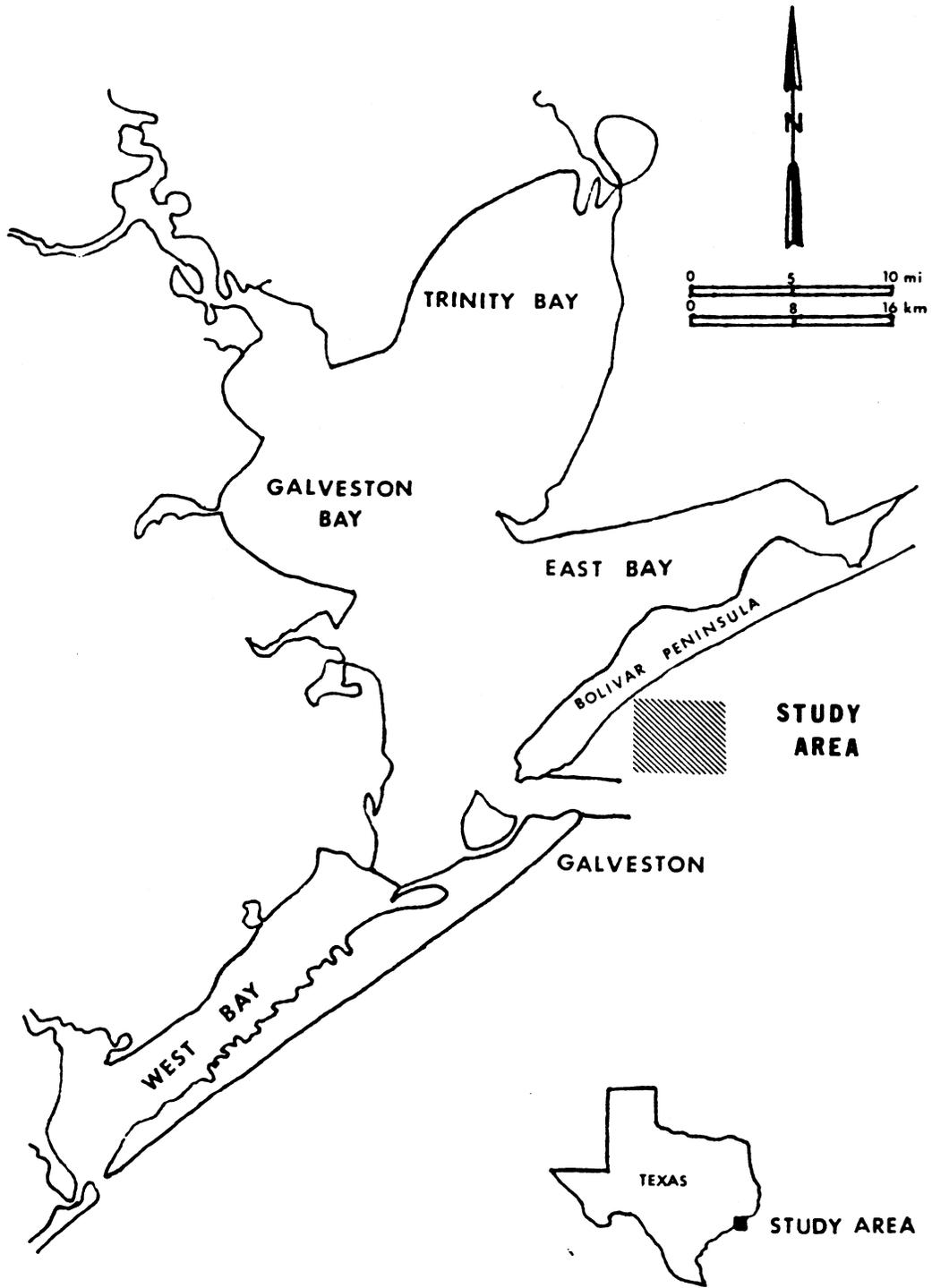
Date	Catch rate
Apr 26	0.0 A
May 03	0.5 A
18	2.0 A
Jun 02	5.0 B
14	12.2 C
Jul 06	11.7 C
19	3.7 B
Aug 02	15.0 C
16	0.5 A

Table 4. Results of one-way AOV of brown shrimp lengths during April-August 1982.

Source of variation	Degrees of freedom	Mean square	F
Total	203	3535.323	
Sample periods	7	3399.134	24.959*
Error	196	136.189	

* $P \leq 0.05$

Figure 1. Gulf of Mexico study area.



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