

## Job Report

A. W. Moffett  
Marine Biologist

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A Study of the Juvenile Shrimp Populations of the  
Galveston Bay System

**Abstract:** Penaeus aztecus, brown shrimp, arrived at the tertiary bays early in April, but grew slowly. In May growth accelerated and emigration from the bay began in June when the shrimp were less than 90 mm long. A second wave of brown shrimp arrived in August.

White shrimp, P. setiferus, arrived at the tertiary bays in June. This group of shrimp was followed by two smaller groups in August and October.

Brown shrimp were found in Sabine Lake in May. The 1964 white shrimp were found in mid-June. In the fall a second wave of white shrimp was observed.

Commercial brown shrimp landings reached a peak in July and August, but fell sharply after September. White shrimp production was high.

**Objectives:** To determine the seasonal abundance, growth rates and sizes of juvenile shrimp in the Galveston Bay system.

**Procedures:** Shrimp were sampled semi-monthly in tertiary, secondary and primary areas of the Galveston and Sabine Lake bay systems. To enhance this year's data new stations were added and Galveston Bay stations were sampled weekly in April.

A six-foot bar-seine of one-fourth inch bar mesh was used to sample tertiary bay and shoreline stations. A sample was taken by pulling the seine for 500 feet. Secondary and primary bay stations were sampled with a 10-foot trawl of one and one-fourth inch stretched mesh with a one-fourth inch bar mesh liner in the cod-end. The trawl was towed for 15 minutes to collect a sample.

Samples were collected on the Galveston Bay shrimping grounds during the commercial season with a 20-foot trawl of one and one-half inch stretched mesh. The trawl was towed for 15 minutes. After samplings a biologist boarded one of the trawlers in the area and measured a sub-sample of the unsorted commercial catch. At night, and in the same area, a second 20-foot trawl shrimp sample was taken.

Shrimp were measured in total length (tip of rostrum to end of telson) to the nearest millimeter. In some cases lack of time and damage to the shrimp prevented measuring all shrimp in the samples. Shrimp not measured were identified and counted. Total sample weights, by species, were recorded in grams.

Bottom salinities were determined by the Mohr titration method and temperatures were recorded in degrees Centigrade.

Findings and  
Discussion:

Introduction

Earlier shrimp studies in Galveston Bay (Pullen 1963, Moffett 1964) have shown that post-larval brown shrimp (Penaeus aztecus) arrive at the back bay nursery areas in April, while small white shrimp (P. setiferus) are usually found in late May or early June. Brown shrimp usually begin leaving the bay system in early June (before they are 90 mm long) and support a large Gulf fishery. White shrimp reach a larger size, remain in the bay longer and support a large bay and inshore Gulf fishery.

This report discusses the results of shrimp sampling in Galveston Bay and Sabine Lake in 1964. Shrimp have been sampled in Galveston Bay using the same methods since 1961. Sampling began in Sabine Lake in June of 1963.

The Study Area

The Galveston Bay system includes West Bay, East Bay, Lower and Upper Galveston Bay, Trinity Bay, Clear Lake and all connecting secondary and tertiary bays (Figure 1). Seven tertiary, one secondary and two primary bay stations were sampled. Each is described below.

TERTIARY STATIONS:

Jones Lake

Fed by Highland Bayou; empties into West Bay; bottom sandy clay; shoreline bordered by marsh grasses; salinity range 20.1 to 31.8 ppt; water temperature range 18.3°C in April to 31.8°C in August; important nursery for brown and white shrimp.

Moses Lake

Fed by Moses Bayou; empties into Lower Galveston Bay; shoreline bordered by marsh grass; bottom soft sandy clay and scattered shell; sewage discharge plant near-by; salinity range 11.3 to 21.7 ppt; water temperature range 18.7°C in April to 32.9°C in mid-August; important nursery for brown and white shrimp. Enteromorpha abundant in fall and winter.

Mud Lake

Empties into Clear Lake; soft mud bottom; shore bordered by marsh grasses; salinity range 8.8 to 20.1 ppt; water temperature range 18.4°C in April to 32.6°C in mid-August; small numbers of shrimp taken in samples.

Taylor Lake

Empties into Clear Lake; fed by Taylor Bayou; soft mud bottom; salinity range 11.5 to 21.3 ppt; water temperature range 18.4°C in April to 32.6°C in mid-August; small numbers of shrimp taken in samples.

Surf Oaks

Marsh area along west shore of Upper Galveston Bay; station in small slough bordered by marsh grass; Enteromorpha sp. present; salinities varied from 12.3 to 24.4 ppt; water temperature range 25.5°C in April to 35.9°C in August; numbers of shrimp caught relatively small.

#### Double Bayou

Empties into Trinity Bay; bottom soft clay with scattered rangia shell; receives runoff from rice fields; salinity range 3.2 to 15.7 ppt; water temperature range 19.7°C in April to 37.1°C in early August; important nursery for brown and white shrimp.

#### Dickinson Bayou

Empties into Dickinson Bay; bottom soft mud and silt; sprouts of Ruppia sp. present; salinities ranged from 9 to 19.7ppt; water temperatures varied 19.0°C in April to 32.5°C in early August; area served as important nursery for brown shrimp in spring.

#### SECONDARY STATIONS:

##### Clear Lake

Empties into Upper Galveston Bay; mud bottom; salinity range 13.5 to 22.1 ppt; water temperatures varied 21.4°C in April to 32.3°C in early October; shrimp enter lake mainly via Mud Lake, Taylor Lake and Clear Creek.

#### PRIMARY STATIONS:

##### Humble Camp

Situated off BacLiff in Upper Galveston Bay; salinity range 14.9 to 29.0 ppt; water temperature range 20.4°C in April to 31.4°C in early September; depth 8 feet; mud bottom.

##### Texas City Dike

Situated in Lower Galveston Bay; depth 9 feet; salinities varied 19.5 to 31.5 ppt; water temperature range 20.9°C in April to 30.7°C in September.

In the Sabine Lake Bay system (Figure 2) the tertiary bays and shoreline areas suited to sampling by bar-seine are somewhat limited. There were two tertiary, one secondary and three primary bay stations. These are described below.

#### TERTIARY STATIONS

##### Old River Cove

Situated in north Sabine Lake; firm mud and scattered shell bottom; water temperature range 20.2°C in October to 33.5°C in July; salinity range 0.6 to 22.0 ppt; numbers of shrimp caught usually small; white shrimp abundant in October.

##### Cameron Causeway

Situated north of Sabine Pass in south Sabine Lake; mud bottom; salinity range 1.8 to 17.4 ppt; water temperature range 25.4°C in May to 34.4°C in September; damage to Pleasure Is. draw bridge prevented continuous sampling at this station.

#### SECONDARY STATION

Situated near Stewts Is. in North Sabine Lake; depth 10 feet; soft mud bottom; salinity range 0.8 to 19.9 ppt; water temperature range 19.7°C in April to 32.9°C in early September.

## PRIMARY STATIONS

Three stations situated in south Sabine Lake; mud bottom; depths varied from 4 to 8 feet; salinities below 2 ppt in early April; salinity range 1.6 to 25.2 ppt; water temperature range 17.4°C in April to 31.5°C in September.

### Brown Shrimp (Galveston Bay)

U. S. Fish and Wildlife Service biologists found postlarval brown shrimp in East Bay and Lower Galveston Bay as early as March 11, 1964, but the peak of immigration was, apparently, reached after mid-March (Commercial Fisheries Review 1964). The small shrimp were not found in tertiary bays (bar-seine stations) until early April (Table 1) when they were less than 30 mm long (Table 2). The absence of juvenile shrimp in the samples from secondary and primary bays indicated that shrimp remained in the back bays throughout most of April. Growth during this period was slow. In late April the modal size of the shrimp was 20-35 mm (Table 2). The slow early spring growth probably resulted from a slow spring warming, since water temperatures at the stations were below those of the previous year. Finally, juvenile brown shrimp were found in Clear Lake (secondary bay) on May 1. In 1963 this species was established in the lake by mid-April (Table 3, Figure 3). As the waters warmed in late April and May the growth rate increased and on June 1 shrimp were entering the Gulf. At emigration the shrimp were about 80 to 90 mm long (Table 4).

The first brown shrimp wave was large. By mid-June a drop in the number of shrimp per sample (Table 1, Figure 3) indicated the majority had left the bay. In August, a second brown shrimp wave was detected (Table 1). The modal length was 10-30 mm (Table 2). Individuals of this second wave were abundant at tertiary bay stations, but not at secondary or primary bay stations (Table 1).

The biological samples of brown shrimp taken in the spring of 1964 were larger than samples collected in the spring of 1963 (Table 1). The increase in the catch per sample was reflected in the June commercial landings, only. After the first shrimp wave left the bay sample catches remained smaller than those collected in 1963 (Table 1).

### White Shrimp (Galveston Bay)

White shrimp were present in the bay system throughout the summer and fall. The first wave appeared in small numbers at tertiary bays in early June (Table 1). At that time a few were taken in the secondary bay sample (Table 1, Figure 4). The size range was 20 to 60 mm (Table 2 and 3). By mid-August (when the commercial bay shrimp season opened) white shrimp in the primary bay had reached legal size (Table 4, Figure 4).

The first wave of white shrimp was followed by two smaller waves (Table 1) that appeared in August and October (modal length 20-30 mm). After August 15, few white shrimp were taken in the samples from the primary bay (Table 1). This made it difficult to follow movements of the later waves. The lack of shrimp in the primary bay samples probably resulted from heavy commercial fishing pressure.

### Brown Shrimp (Sabine Lake)

The samples indicated that one major wave of brown shrimp was present in Sabine Lake in 1964 (Table 5). These small shrimp were taken in samples in early May when most were 30 to 40 mm long (Table 6). Salinities in the lake were low in the spring due to a rise of the Neches River. This may explain the late arrival of brown shrimp. In June, brown shrimp (modal length 50 to 90 mm) were abundant at all trawl stations (Table 7 and 8, Figure 5). After

June there was an abrupt decrease in the number of shrimp per sample (Table 5, Figure 6); thus I assumed that most brown shrimp left the bay before July at a modal length of 80 mm.

Sampling began late in 1963, therefore, data were not available to compare to the 1964 shrimp samples.

#### White Shrimp (Sabine Lake)

There were two waves of white shrimp (Table 5). The first arrived in mid-June at the secondary bay station (Figure 5). The modal length was 40 to 60 mm (Table 7).

The second wave arrived at the tertiary stations in early October (modal length 30 to 40 mm) during the first strong "norther" of the fall (Table 5). The north winds probably flushed the small shrimp from the marshes adjacent to Sabine Lake. Shrimp of this second wave began leaving the lake in November when they were 80 mm long (Table 8, Figure 6). A similar, but much larger wave of white shrimp was observed in the fall of 1963 (Table 5).

#### Commercial Sizes

The twenty-foot trawl shrimp samples taken from August through November were dominated by white shrimp and night catches were small (Table 9). The nighttime samples also showed a closer ratio between brown and white shrimp. The changes in catch composition at night may reflect heavy daytime fishing (all samples were taken in areas being fished commercially) and the nocturnal nature of brown shrimp.

White shrimp length frequency curves, based on measurements from unsorted commercial catches, did not agree with curves drawn from 20-foot trawl data. Some length distributions from both types of samples are shown in Figure 7. The 20-foot trawl caught shrimp of a wider size range (mainly smaller sizes) and the modal length was shorter. Similar results were reported by Moffett (1964). Most shrimp from the commercial catches were 113 to 143 mm long (about 43 to 22 whole shrimp per pound).

#### Total Commercial Landings

A total of 1,660,287 pounds of brown shrimp (heads off) were landed at the major ports in the Galveston Bay and Sabine Lake areas in 1964 (Table 10). This was an 18.5 per cent decline from landings reported in 1963. Brown shrimp landings in June were 14 per cent higher than landings reported in June 1963. After this the 1964 landings declined (Table 11).

White shrimp landings increased 11.5 per cent over 1963. Evidently, the increase was due to the available supply of 1963 year-class shrimp landed during the first six months of 1964 or an increase in fishing intensity. With the recruitment of the 1964 year-class, in August, white shrimp landings remained high. Of 5,747,664 pounds reported, all but 1,444,086 were landed at Galveston Bay ports. The remainder were landed at ports adjacent to Sabine Lake where there was a sharp decrease in production from 1963.

#### Bay Landings

At the time this report was prepared data on shrimp caught inside the bays were complete from January through October. These data and the 1963 bay landings are shown in Table 12. During both years the bulk of the catch came from Upper and Lower Galveston Bays. Trinity Bay contributed little to the brown shrimp catch, but served as an important fishing ground for white shrimp. No brown shrimp production was reported from Sabine Lake in 1964 (where there is no commercial shrimp season in the spring) and white shrimp production was far below the 1963 level. The sudden increase in the white shrimp landings in August represents the start of the bay shrimp season. This increase was most noticeable in Upper and Lower Galveston Bay where catches remained high through October.

Comments:

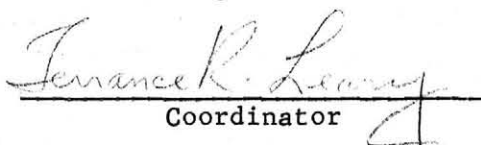
The expansion of the bay shrimp study to include additional tertiary bay and shoreline stations offered a broader picture of the number of small shrimp present and excellent growth measurements of the pre-recruitment waves of both species. Continued sampling at all stations (and weekly sampling in the spring) should supply better data for future shrimp abundance forecasts and to trace growth.

It is evident from 20-foot trawl and commercial catch data that our trawls are not catching the sizes of shrimps available to the commercial fishery. I suggest 20-foot trawl sampling should be de-emphasized and greater concentration placed on sampling directly from the commercial boats.

Prepared by: A. W. Moffett  
Marine Biologist

James R. Stevens  
Supervisor

Approved by:

  
Coordinator

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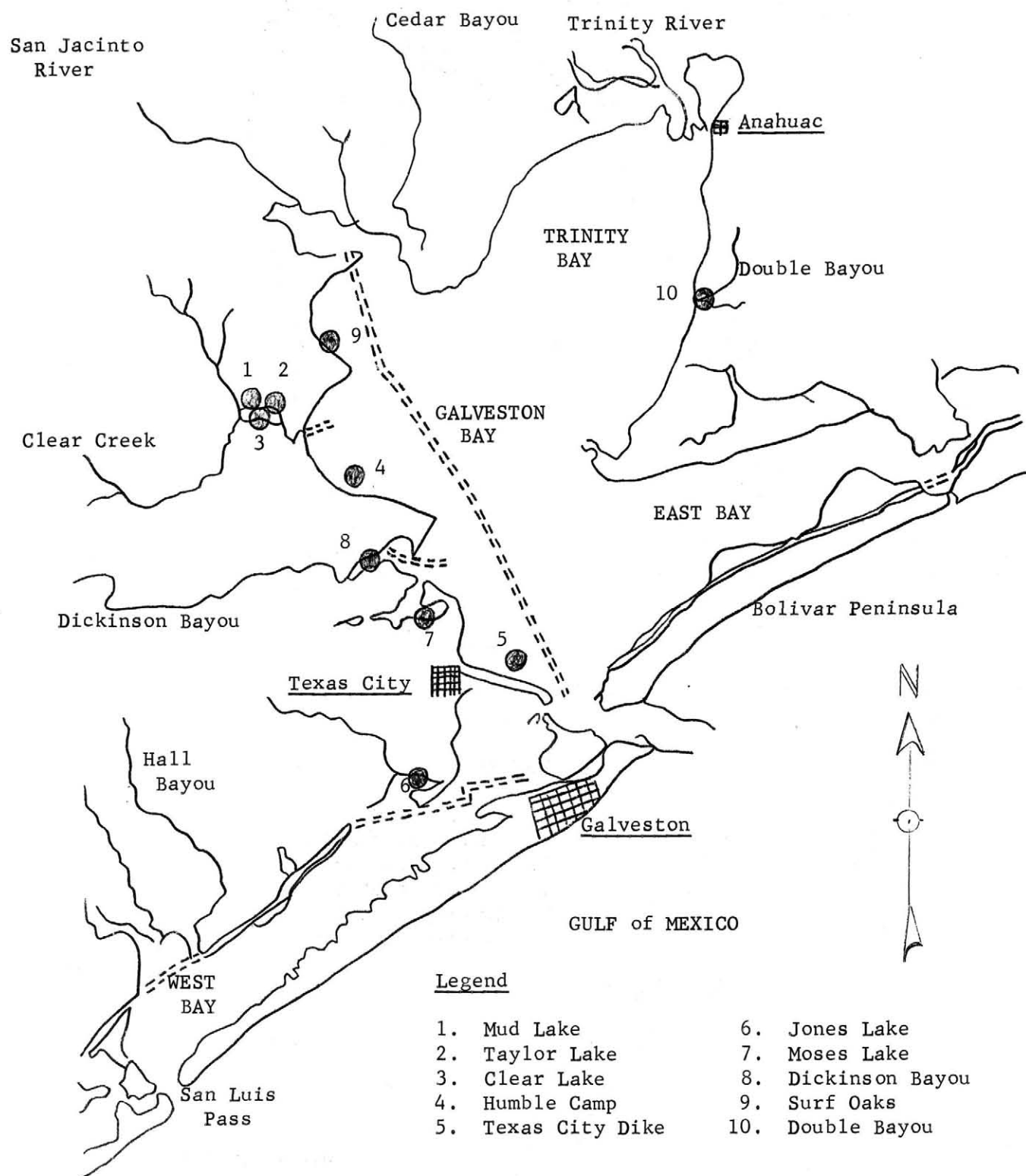


Figure 1. Map of Galveston Bay showing shrimp sampling stations

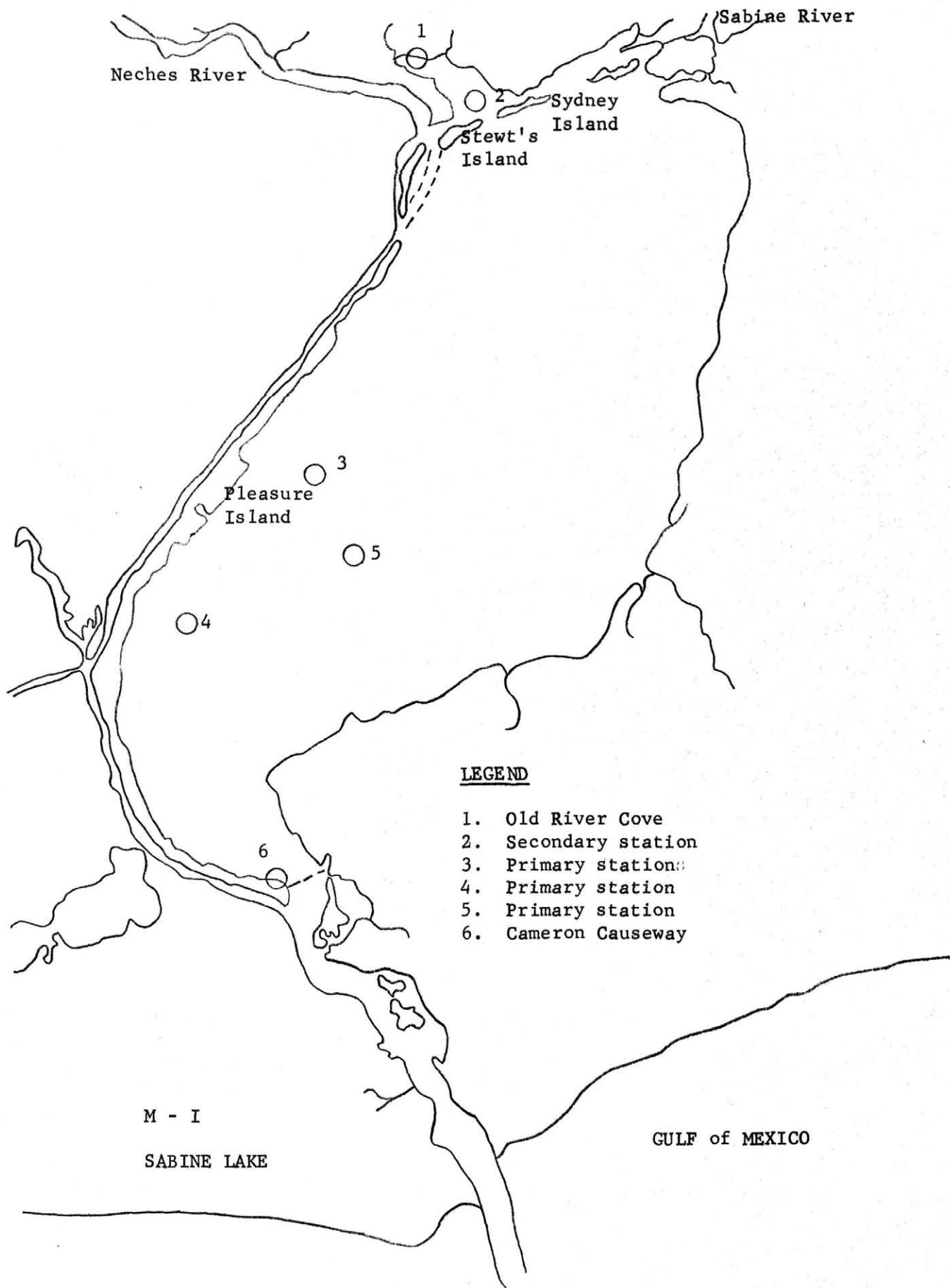


Figure 2. Map of Sabine Lake showing shrimp sampling stations.



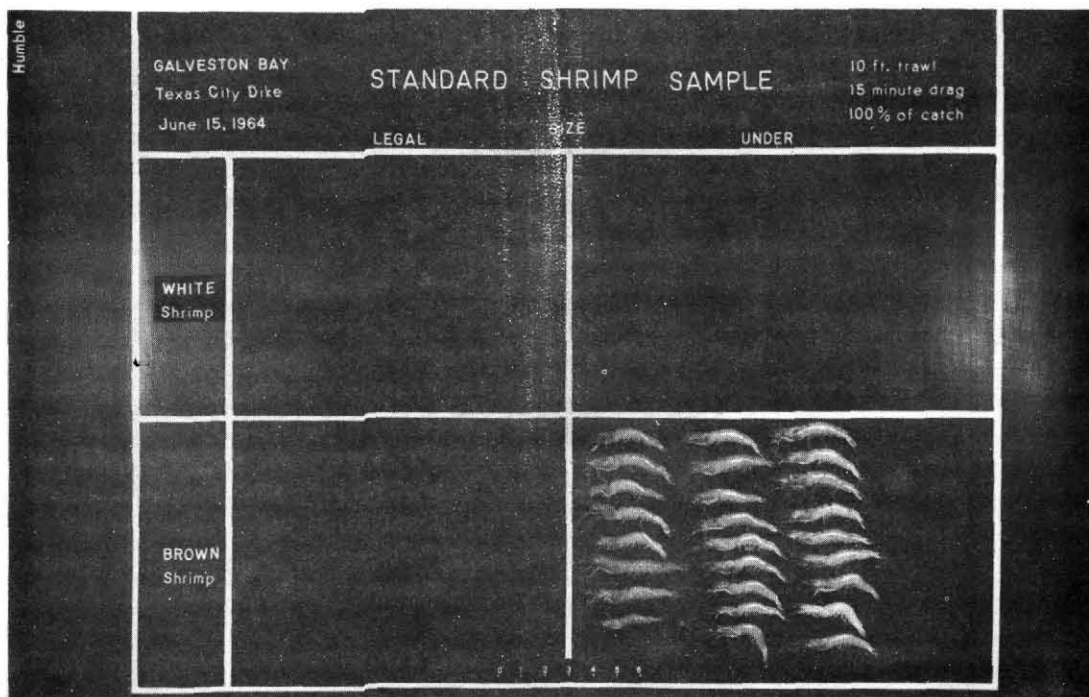
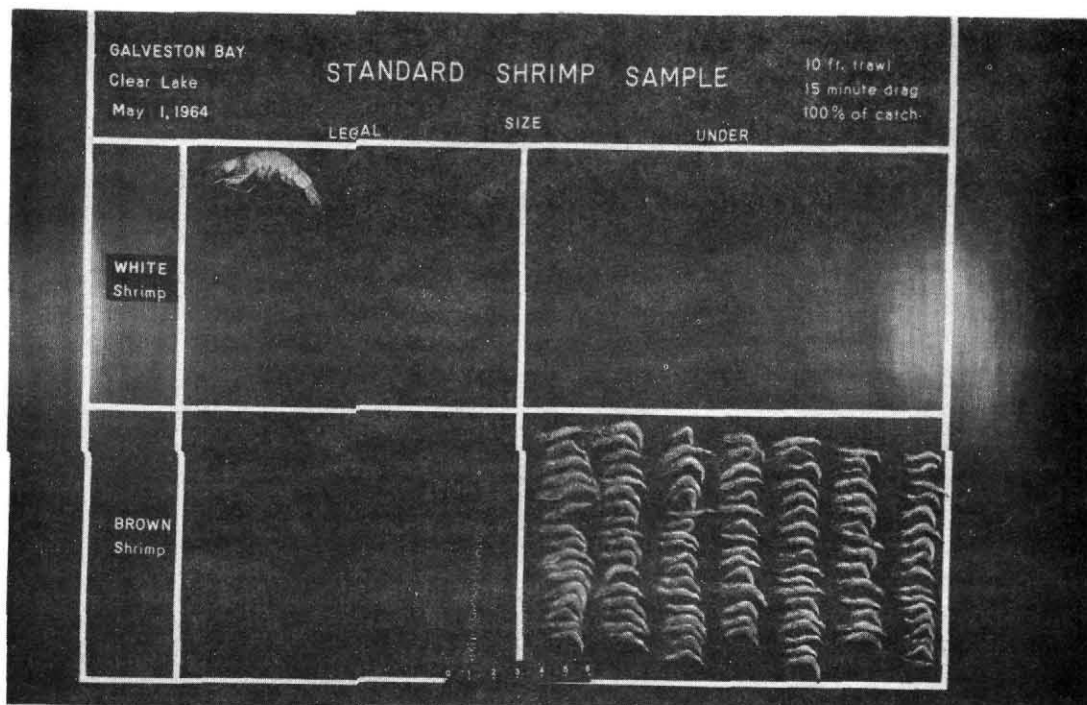


Figure 3. Small brown shrimp appeared at the secondary station in early May (top). Brown shrimp of the spring wave began leaving the bay in June. By mid-June the number per sample had dropped considerably (bottom).

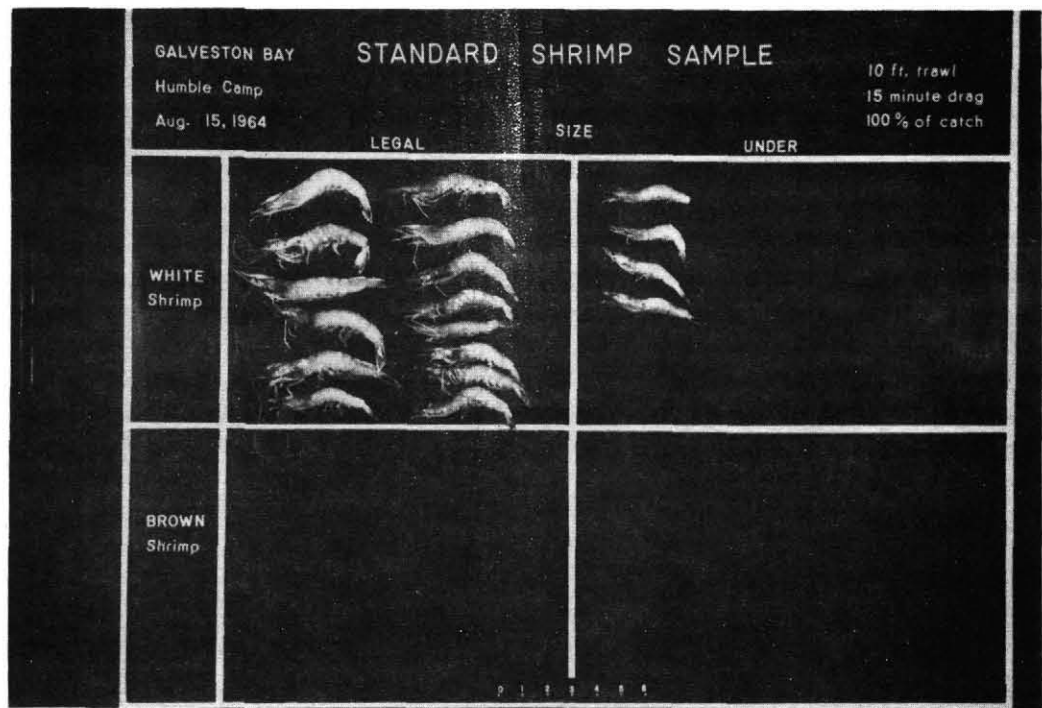
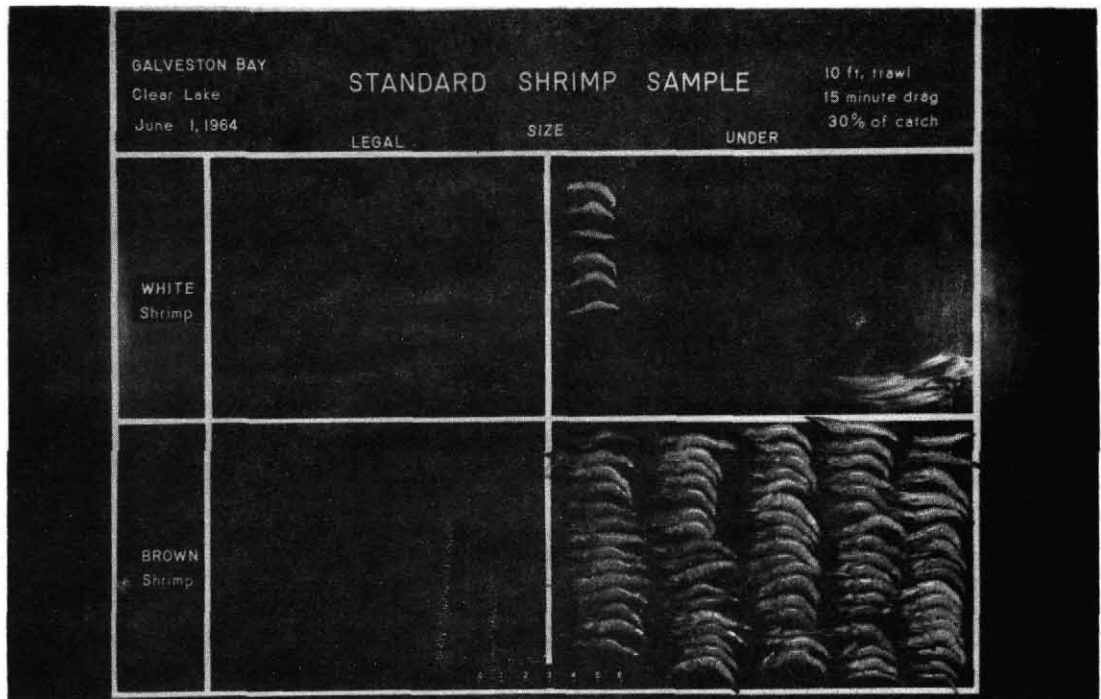


Figure 4. Small white shrimp arrived at the secondary station in early June. At the same time brown shrimp of the first wave were still present (top). In mid-August, when the commercial bay season began white shrimp in Galveston Bay were fishable size (bottom).

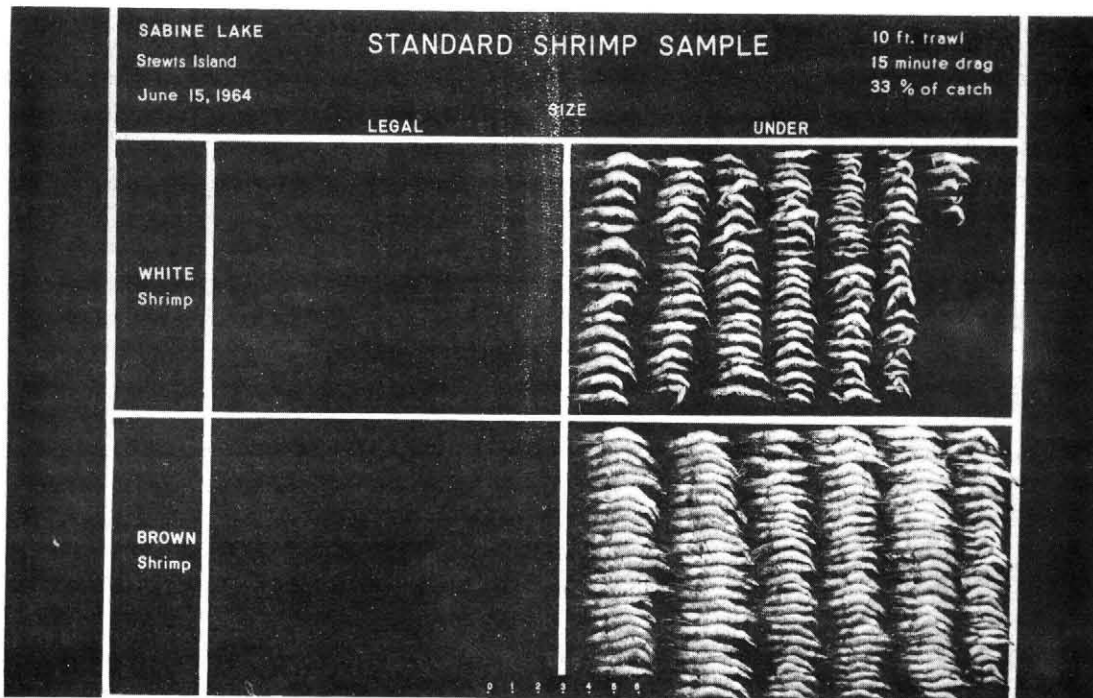
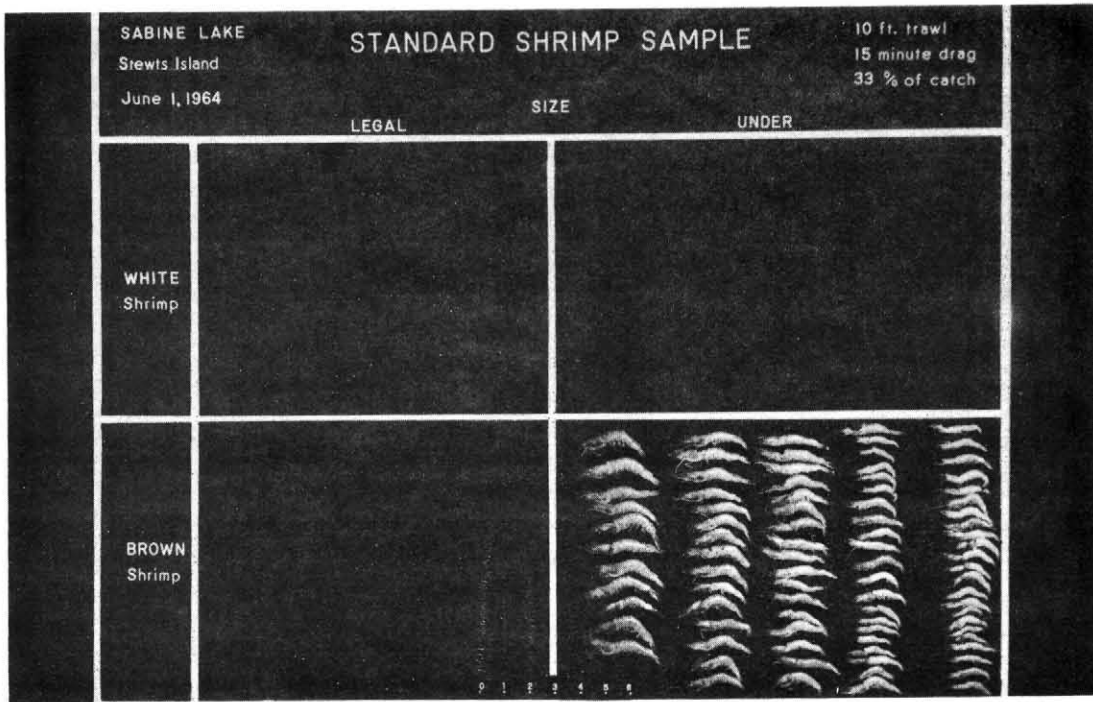


Figure 5. Small brown shrimp were abundant at Sabine Lake trawl stations in June (top). By mid-June small white shrimp had arrived (bottom).

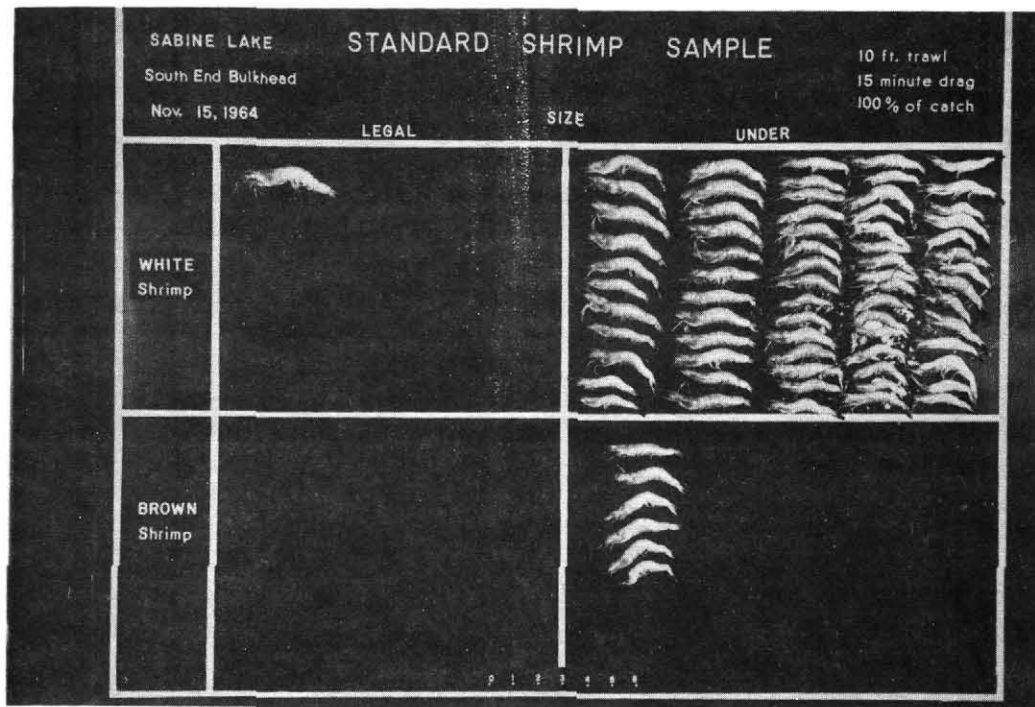
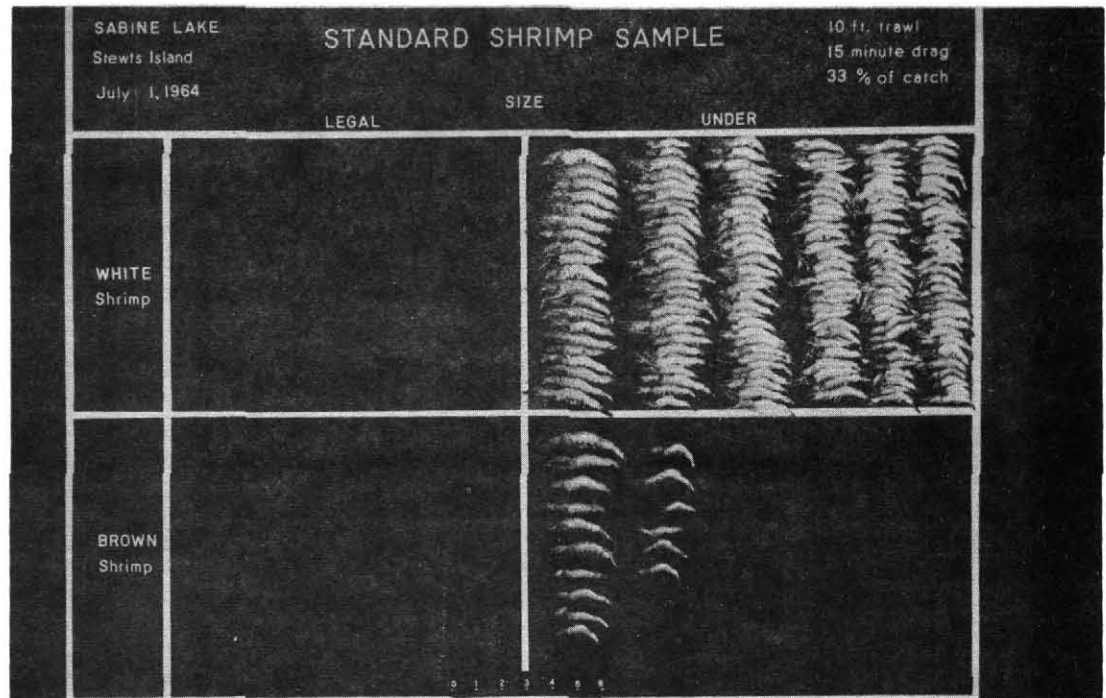


Figure 6. After June there was an abrupt decrease in the number of brown shrimp (top). In the fall a second white shrimp wave was present (bottom).

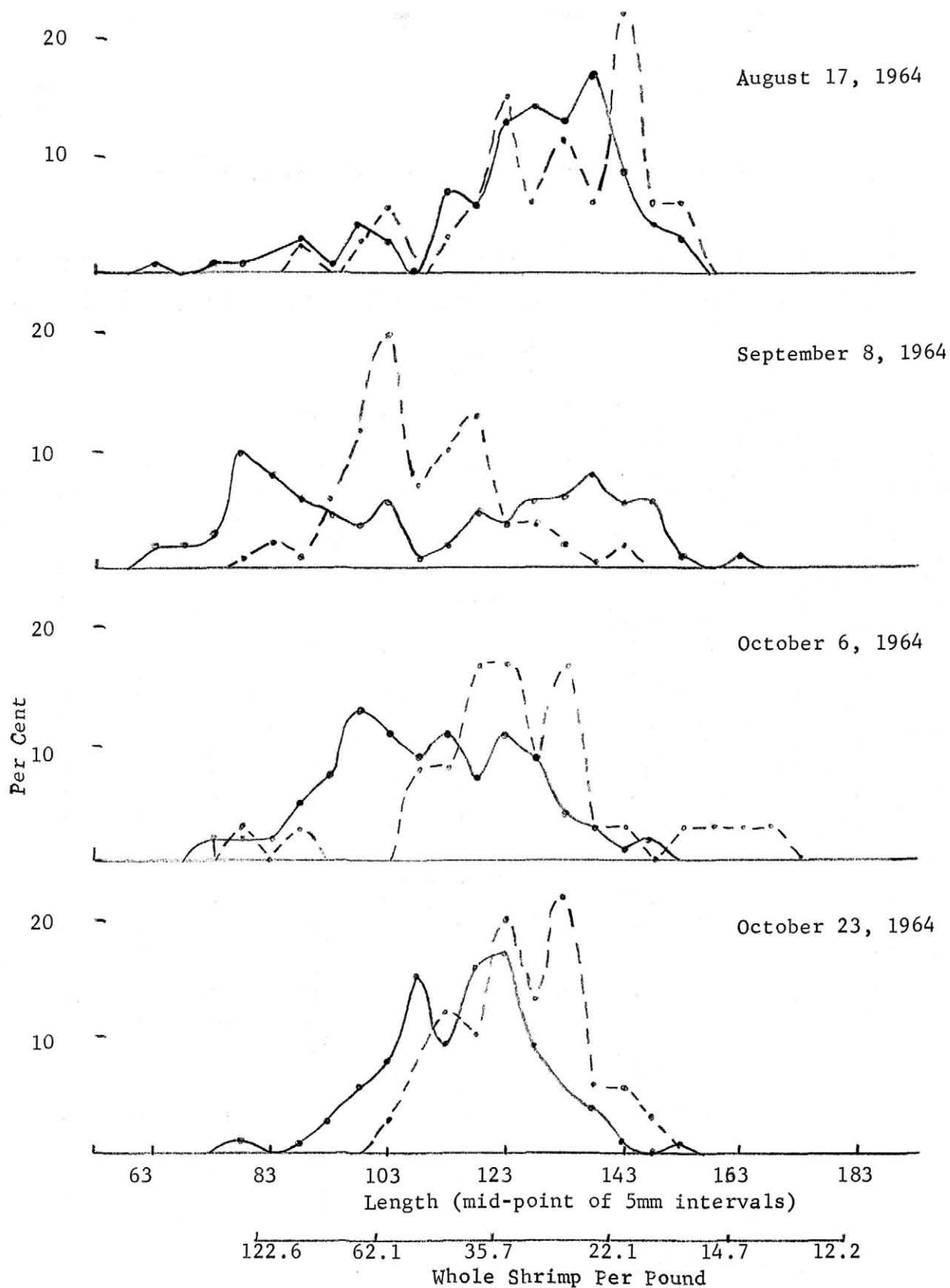


Figure 7. Per cent length-frequency distributions of white shrimp from Galveston Bay based on 20-foot trawl data (solid line) and unsorted commercial catch data (broken line).

Table 1  
Average Number of Shrimp Per Sample (Galveston Bay 1961-64)

Date	Tertiary				Secondary				Primary			
	1961	1962	*1963	*1964	1961	1962	1963	1964	1961	1962	1963	1964
<u>Brown Shrimp</u>												
4-1	16	8	0	0	0	0	0	0	0	0	0	0
4-8	-	-	-	165	-	-	-	0	-	-	-	0
4-15	82	56	75	396	6	0	72	0	0	0	9	0
4-23	-	-	-	402	-	-	-	0	-	-	-	-
5-1	110	128	60	312	87	14	11	139	13	15	6	43
5-15	92	231	15	342	123	105	284	187	72	-	45	12
6-1	82	38	15	66	440	86	275	431	187	-	14	242
6-15	35	51	9	30	540	28	94	107	370	47	15	34
7-1	15	16	0	45	69	133	48	54	10	2	8	24
7-15	0	21	24	54	2	88	11	28	19	2	1	27
8-1	43	24	9	219	30	40	75	5	2	0	8	0
8-15	12	113	57	63	11	23	92	9	4	0	27	0
9-1	17	47	48	126	40	74	47	12	3	2	3	1
9-15	-	15	96	138	-	2	72	13	-	2	4	2
10-1	7	3	66	72	4	19	36	27	0	10	1	2
10-15	15	10	3	9	3	18	30	15	1	2	2	1
11-1	-	15	3	27	4	15	12	11	2	0	2	0
11-15	2	4	3	24	1	8	53	3	4	0	4	0
12-1	0	14	9	3	0	1	10	2	0	1	0	0
<u>White Shrimp</u>												
6-1	0	0	0	15	0	0	0	12	0	-	0	1
6-15	2	0	16	36	10	0	2	38	0	1	0	1
7-1	2	4	0	261	3	61	56	88	7	0	1	12
7-15	0	21	6	255	2	64	19	120	14	3	1	28
8-1	32	15	29	192	234	17	312	63	9	2	12	19
8-15	28	27	9	168	42	12	151	54	36	1	29	9
9-1	16	137	0	96	680	22	42	33	26	2	2	4
9-15	-	11	3	222	-	92	71	34	-	8	2	3
10-1	131	57	48	108	221	198	78	27	1	8	1	2
10-15	496	78	57	16	102	59	64	6	16	0	2	1
11-1	-	103	24	51	325	53	270	22	3	1	5	1
11-15	11	30	21	78	0	5	263	71	76	3	55	1
12-1	2	17	33	12	41	248	104	76	0	7	4	6

\*Data converted from 500 ft. tow to 15 min. tow.

Table 2  
 Length Frequency Distribution of Shrimp Caught at Bar-Seine Stations  
 (Galveston Bay 1964)

Date	Length (cm)											Total Caught	
	1	2	3	4	5	6	7	8	9	10	11		
<u>Brown Shrimp</u>													
4-8	314	14										328	330
4-15	418	489										907	927
4-23	122	323	116	3								564	934
5-1	23	107	196	157	81	2						566	727
5-15		68	190	201	176	64	13	1				713	796
6-1	1	12	26	30	27	20	11	1				128	132
6-15		10	6	15	12	14	13	2				72	72
7-1	12	37	19	3	3	3	9	6				92	104
7-15	4	65	19	14	3	3	5	5				118	126
8-1	215	206	55	8	3	1	5	5				498	514
8-15	18	44	57	8	4	1	1					133	151
9-1	79	103	43	14	5	5	4	4				257	293
9-15	20	139	76	58	11	5	4					313	319
10-1	10	43	34	12	12	1	1					113	167
10-15	1	2	3	5	2	7						20	20
11-1	4	8	16	17	9	4	3					61	64
11-15	2	9	11	8	7	6	5					48	53
12-1		3	1	1								5	7
<u>White Shrimp</u>													
6-1		12	18	1								31	31
6-15		19	31	28	7	1						86	86
7-1	52	130	223	99	17	5	3					529	608
7-15	8	128	134	25	11	3	1					310	599
8-1	37	207	98	23	9	5	3	1	1	9	2	395	449
8-15	56	155	42	23	15	5	0	1	0	2		299	395
9-1	8	69	64	37	11	4	0	1				194	226
9-15	0	27	121	147	109	53	12	2				471	517
10-1	16	102	23	16	40	35	13	3	5			253	255
10-15			10	13	3							26	26
11-1		6	19	55	25	4	2	0	5			116	124
11-15		34	61	20	28	11	3	1	2	2		162	181
12-1			1	6	3	2	3	0	1			16	28

Table 3  
Length Frequency Distribution of Shrimp Caught in Clear Lake By 10-foot Trawl  
(Galveston Bay 1964)

Date	Length (cm)														Total Caught	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
<u>Brown Shrimp</u>																
5-1	1	0	5	26	61	36	5	1							135	139
5-15		2	4	13	56	62	32	13	4						186	187
6-1			1	10	29	86	95	132	74	4					431	431
6-15				1	6	4	10	40	36	9	1				107	107
7-1						1	3	15	20	14	1				54	54
7-15			1	0	0	0	2	6	13	5	1				28	28
8-1							1	1	0	2	1				5	5
8-15				1	4	1	1	0	1	1					9	9
9-1				1	0	0	8	3							12	12
9-15			3	1	0	0	4	4	1						13	13
10-1			3	8	6	2	2	4							25	27
10-15				1	3	6	2	1	2						15	15
11-1					1	2	3	3	2						11	11
11-15							2	0	1						3	3
12-1							2								2	2
<u>White Shrimp</u>																
6-1		2	4	6											12	12
6-15			1	1	8	15	8	5							38	38
7-1				2	22	13	23	18	9	1					88	88
7-15			1	4	14	20	13	24	20	6	0	1			103	120
8-1			1	3	6	6	8	8	8	13	7	1			61	63
8-15			3	11	12	1	0	3	8	4	2	6	4		54	54
9-1				1	1	1	5	3	0	5	5	5	2	4	32	33
9-15				6	8	11	3	3	1	1	1				34	34
10-1		2	1	2	4	5	3	3	4	1	2				27	27
10-15						1	1	0	3	1					6	6
11-1				2	5	9	1	2	3	5	5				32	32
11-15			1	3	11	25	19	6	2	4					71	71
12-1				6	7	9	10	37	6						75	76



Table 4  
Length Frequency Distribution of Shrimp Caught at Primary Bay Station by 10-foot Trawl  
(Galveston Bay 1964)

Date	Length (cm)														Total Caught	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
<u>Brown Shrimp</u>																
5-1	3	20	17	2	1										43	43
5-15	2	2	6	9	1	1	1								22	24
6-1		3	1	39	57	57	167	98	39	7	1				469	485
6-15			1	0	4	4	11	25	22	6	1				74	76
7-1						2	7	13	22	2	1				47	47
7-15						1	1	13	26	9	3	1			54	54
8-1															0	0
8-15															0	0
9-1	1					1				1					3	3
9-15						1	3								4	4
10-1							2	2	1						5	5
10-15							3								3	3
11-1															0	0
11-15															0	0
12-1								1							1	1
<u>White Shrimp</u>																
6-15						1									1	1
7-1		1	0	2	4	3	2	7	5						24	24
7-15					2	11	19	14	4	3	1	1			55	57
8-1				1	4	2	3	6	11	5	3	1	2		38	38
8-15								1	3	4	3	3	4		18	18
9-1				2	1	2	0	1	0	1					7	8
9-15					1	1	0	0	1	0	0	2			5	6
10-1				1	1	0	1	1	1						5	5
10-15											1				1	1
11-1											1				1	1
11-15					1	0	1	0	1						3	3
12-1						3	1	5	2	2					13	13

Table 5  
Average Number of Shrimp Per Sample  
(Sabine Lake 1963-64)

Date	Tertiary		Secondary		Primary	
	1963	1964	*1963	*1964	1963	1964
<u>Brown Shrimp</u>						
5-1	-	2	-	0	-	4
5-15	-	4	-	0	-	15
6-1	-	6	-	303	3	133
6-15	-	40	-	519	36	59
7-1	-	6	63	60	1	51
7-15	-	7	39	21	26	12
8-1	-	20	47	-	10	4
8-15	-	1	303	21	12	3
9-1	-	2	93	9	8	1
9-15	-	1	-	3	-	2
10-1	-	16	39	-	4	25
10-15	-	0	6	0	0	0
11-1	-	0	18	0	0	0
11-15	-	2	3	0	6	6
12-1	-	0	3	3	0	0
<u>White Shrimp</u>						
6-15	-	18	-	480	0	0
7-1	-	10	15	609	0	2
7-15	-	3	1	12	3	1
8-1	-	12	14	-	1	3
8-15	-	0	135	33	48	1
9-1	-	0	16	18	9	0
9-15	-	2	-	3	-	50
10-1	-	283	493	-	113	52
10-15	-	7	248	105	373	2
11-1	-	24	244	30	79	87
11-15	-	29	691	33	259	72
12-1	-	0	546	96	53	1

\*Represents 5 minute tows converted to 15 minutes

NOTE: - Represents no data

Table 6  
Length Frequency Distribution of Shrimp Caught At Bar-Seine Stations  
(Sabine Lake 1964)

Date	Length (cm)								Total Caught	
	1	2	3	4	5	6	7	8		
<u>Brown Shrimp</u>										
5-1		2	5						7	7
5-15		3	1	2	3				9	9
6-1	1	0	5	0	2	5	5		18	18
6-15	3	8	13	21	17	8	3		73	80
7-1		4	3	1	0	2	1		11	11
7-15		1	5						6	7
8-1		10	5	3	5	6	3	4	36	41
8-15					1				1	1
9-1		1	0	1					2	2
9-15					1				1	1
10-1			3	2	1				6	6
10-15									0	0
11-1									0	0
11-15				2					2	2
12-1									0	0
<u>White Shrimp</u>										
6-15		8	13	7	2				30	37
7-1	1	10	2	3	4				20	20
7-15				1	2				3	3
8-1		9	11	1	1				22	25
8-15									0	0
9-1									0	0
9-15					2				2	2
10-1		21	42	19	18	14	5		119	283
10-15		5	1	1					7	7
11-1		2	9	7	6				24	24
11-15				2	13	14			29	29
12-1									0	0

NOTE: Dates on the first and fifteenth of each month are used in the Sabine Lake shrimp length-frequency tables, however, on several occasions samples were collected late.

Table 7  
Length Frequency Distribution of Shrimp Caught at a Secondary Station by 10-foot trawl (Sabine Lake 1964)

Date	Length (cm)											Total Caught	
	1	2	3	4	5	6	7	8	9	10	11		
Brown Shrimp													
6-1			1	13	31	18	18	10	1			92	101
6-15			1	20	27	39	39	26	11	1		164	173
7-1					5	8	2	3	2			20	20
7-15			1		2	1	1	2				7	7
8-1	No Data												
8-15			1	3		1	1	1				7	7
9-1					1	2						3	3
9-15				1								1	1
10-1	No Data												
10-15												0	0
11-1												0	0
11-15												0	0
12-1				1								1	1
White Shrimp													
6-15			18	45	37	28	8	5				141	160
7-1			3	15	35	52	46	28	6			185	203
7-15								2			2	4	4
8-1	No Data												
8-15					2				3	3	3	11	11
9-1						2	1				3	6	6
9-15								1				1	1
10-1	No Data												
10-15				3	8	11	3	3	3	4		35	35
11-1						1	5	3	1			10	10
11-15							4	2	5			11	11
12-1				4	8	12	5	3				32	32

NOTE: Trawling time at this station was 5 minutes due to nature of bay bottom.

Table 8  
Length Frequency Distribution of Shrimp Caught at Primary Stations By 10-foot Trawl  
(Sabine Lake 1964)

Date	Length (cm)														Total Caught	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
<u>Brown Shrimp</u>																
5-1															0	0
5-15	10	15	8	15	10	7									65	65
6-1		10	64	76	81	51	56	13	9						360	400
6-15		2	8	25	40	35	37	16	1	1	1				166	178
7-1			1	9	29	44	49	9	2	1					144	154
7-15		4	5	10	8	3	2								32	38
8-1			1	0	0	1	1								3	4
8-15				3	2	0	0	4	1						10	10
9-1				3											3	3
9-15				3											3	6
10-1	3	4	11	40	15	3	7								83	70
10-15															0	0
11-1							1								1	1
11-15			2				8	3							13	13
12-1															0	0
<u>White Shrimp</u>																
7-1	3	0	0	3	4	0	0	0	0	2					13	12
7-15		1	2	0	1										4	4
8-1						1	1	1							3	3
8-15							1	3							4	4
9-1															0	0
9-15		2	0	3	7	29	43	35	11	7	5	6	1		149	149
10-1	1	1	9	17	10	19	17	13	9	1	3	0	3		103	104
10-15					1	1									2	2
11-1			3	8	14	93	99	43	3						263	263
11-15			2	7	23	39	28	31	9	3	2				144	144
12-1						2									2	2

Table 9  
Summary of the Number of Shrimp Caught in Day and Nighttime 20-foot Trawl Samples  
(Galveston Bay 1964)

Species	August		September		October 7		October 23		November
	Day	Night	Day	Night	Day	Night	Day	Night	Day
White Shrimp	71	19	96	11	151	27	116	61	36
Brown Shrimp	5	10	11	5	54	16	4	6	3
TOTAL	76	29	107	16	205	43	120	67	39

Table 10  
Total Shrimp Landings at Major Ports in The Galveston Bay and Sabine Lake Areas  
(1963-1964)\*

Port	Brown Shrimp		White Shrimp	
	1963	1964	1963	1964
Galveston & Kemah	1,284,074	1,152,392	1,952,797	2,670,752
Port Arthur & Sabine	392,753	199,561	2,133,672	1,444,086
Seabrook	359,897	308,325	1,068,834	1,632,826
TOTAL	2,036,374	1,660,278	5,155,303	5,747,664

\*Source: Orman Farley, Branch of Statistics, Bureau of Comm. Fish., Biological Laboratory, Galveston, Texas.

NOTE: Data subject to revision

Table 10  
Pounds of Shrimp Landed (1,000 lb.) in the Galveston Bay and Sabine Lake Areas  
(1963-1964)\*

Month	Brown Shrimp (Lbs. heads-off)		White Shrimp (Lbs. heads-off)	
	1963	1964	1963	1964
January	9	3	46	107
February	8	6	6	19
March	10	11	76	98
April	9	12	39	196
May	141	46	97	326
June	314	358	124	244
July	698	505	60	151
August	587	380	1,016	1,127
September	179	292	1,147	1,279
October	56	31	1,586	1,233
November	22	16	744	801
December	<u>1</u>	<u>1</u>	<u>213</u>	<u>164</u>
Total	2,037	1,661	5,154	5,745

\*Includes landings at Seabrook, Kemah, Galveston, Port Arthur, and Sabine Pass.

Source: Orman H. Farley, Branch of Statistics, Bureau of Commercial Fisheries, Biological Laboratory, Galveston, Texas.

Note: Data subject to revision.

Table 11  
Pounds of Shrimp (heads off) Caught by Bay Area (1963-64)\*

Month	Sabine Lake		Trinity Bay		Upper Galveston		Lower Galveston	
	1963	1964	1963	1964	1963	1964	1963	1964
April	-	-	-	-	-	-	-	-
May	7,100	-	-	-	12,572	17,628	41,899	939
June	2,237	-	13,372	2,711	149,748	157,903	62,667	120,164
Brown Shrimp July	86,691	-	-	-	57,952	85,733	29,154	57,433
August	9,575	-	1,604	-	2,697	-	103	2,854
September	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-
Total	105,603	-	14,976	-	222,969	-	133,823	-
April	129	-	-	-	430	1,666	-	175
May	21,010	-	-	-	262	3,317	4,929	85
June	9,733	-	19	-	925	208	221	398
White Shrimp July	987	-	-	339	463	30,049	14,752	35,925
August	85,631	38,509	143,143	103,421	388,168	425,965	231,173	431,716
September	194,958	31,284	163,626	123,685	191,731	463,671	186,074	305,540
October	231,343	34,713	143,425	57,087	207,603	348,109	217,640	272,243
November	150,924	-	863	-	19,056	-	40,099	-
December	53,088	-	-	-	-	-	-	-
Total	747,803	-	451,076	-	808,638	-	694,888	-

\*Source: Orman H. Farley, Branch of Statistics, Bureau Comm. Fisheries, Biological Laboratory, Galveston, Texas

Note: Data subject to revision