

## Job Report

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Project Name: A Study of the Texas Shrimp Populations

Period Covered: January 1, 1962, through December 31, 1962 Job No. 1

A Study of the Bay and Gulf Populations of Shrimp:  
Penaeus aztecus, Penaeus setiferus, and Penaeus duorarum

Abstract: During the 1962 study 894 shrimp samples were collected on the Texas Coast from Galveston to the Lower Laguna Madre. These samples produced 42,745 brown shrimp and 18,072 white shrimp.

Postlarval samples, collected with a plankton net, a pull seine, and a beam trawl at Aransas Pass, indicated two major groups of small shrimp entered Aransas and Corpus Christi Bays. The first wave entered the bays in February and March, and the second wave entered in October and November.

Bay samples, collected with the standard trawls and seines, indicated at least three major waves each of brown and white entered most bays this year. Brown shrimp were found to grow at the rate of 0.8 millimeters per day leaving the bays at 80 millimeters mean size. White shrimp grew 1.1 millimeters per day moving Gulfward at 110 millimeters. Brown and white shrimp left the lower Laguna Madre at a smaller size than in other bays. Pink shrimp were stragglers in the more southerly bays, San Antonio Bay to the Lower Laguna Madre. They grew at the rate of 0.7 millimeters per day in the Lower Laguna moving Gulfward at 50 millimeters mean size.

Gulf samples collected in the Port Aransas Area at depths of 15 fathoms showed the brown shrimp to be present from March to November but were more abundant from July to September. The majority of the brown shrimp caught in the inshore Gulf were under legal count size about 118 mm. White shrimp were found year round in the collections but were more abundant during the winter and spring. White shrimp taken in the collections were legal count size all year except in February.

Salinities were higher this year than in 1961. Temperatures followed the normal seasonal trend except for the freeze in January and a slight temperature drop in March.

Commercial shrimp landings shows the total shrimp production increased one per cent from 1961 and decreased 28 per cent from the 1960 commercial production.

Data collected this year further substantiates the need for closing certain shallow nursery areas to shrimping. There also appears to be a need for additional regulations of the inshore Gulf to protect the transit, undercount brown shrimp during the summer and fall.

Objective: To compare coastal shrimp data collected in 1962 with that accumulated in 1960 and 1961 and make predictions on abundance of the important commercial species. This data will also be utilized in determining sound conservation practices for future regulation of this valuable fishery.

Procedure: The 1962 shrimp study is a continuation of the 1960 and 1961 coastal studies. For the most part sampling and reporting procedures remained identical with the original study plan established in 1960. A postlarval shrimp sampling program was inaugurated in 1962 to check the entry of young shrimp into Aransas and Corpus Christi Bays. The Gulf segment of this job is a continuation of Compton's 1960 and 1961 studies.

Postlarval sampling was done with a one millimeter square mesh plankton net with a 46-inch mouth opening, a 6-foot pull seine of one millimeter square mesh with a plankton bag in the cod end, and a beam trawl with an opening of 1 foot by 3 feet and a 6-foot bag of one millimeter square mesh. The seine was pulled once a week in a measured arch of 471 feet (to get a quantitative sample) on the sand flats east of the Lydia Ann Ship Channel. The beam trawl was pulled once a week for a duration of 6 minutes on the bottom of the Aransas Ship Channel. The plankton net, with a flow meter attached to it, was occasionally pulled for 2 minutes on the bottom and mid-water of the Aransas Channel. Sample stations are shown in Figure 1.

Bay trawl and seine samples were collected semi-monthly, within 3 days of the first and 3 days of the fifteenth of each month, in all the bays from Galveston to the Lower Laguna Madre. All sampling was secured December 15, 1962, for the duration of the unproductive winter months. Figures 2 through 8 show the locations of the various stations in each bay. Stations were chosen according to depth, as in previous 1960 and 1961 studies. Tertiary stations ranged from 1 to 3 feet, secondary stations ranged from 4 to 5 feet, and primary stations were 6 feet or over. Sampling procedures were standardized for all bay collections. Tertiary bay stations were sampled with a 6-foot pull seine of 1/4-inch square mesh. Secondary and primary stations were sampled with a 10-foot shrimp trawl of 1 1/4 inch stretch mesh and a liner of 1/4 inch square mesh in the cod end. A 20-foot trawl of 1 1/2 stretch mesh was occasionally used in the areas worked by the commercial shrimp fleet. These 20-foot trawl samples were generally made in pairs i.e., one day trawl was made followed by a night trawl 6 hours later. All trawls and seines were 15 minutes in duration so that a unit of effort measurement could be made. In cases where it was impossible to pull the trawls and seines 15 minutes, the data was adjusted to correct for time.

Gulf shrimp stations were sampled once a week, as regularly as weather permitted, in the Port Aransas Area. See Figure 9. Samples were collected in the Gulf out to depths of 15 fathoms with a flat 42-foot otter trawl of 2 inch stretch mesh. The trawl was pulled for a duration of 30 minutes in order that a unit of effort measurement could be determined.

A standard station sheet was kept for each bay, Gulf, and postlarval shrimp station. This sheet was a record of the type gear employed in the sampling, the hydrographic and climatic conditions at the time of sampling, the total weight of each species of shrimp caught, and the abundance of each species. All the shrimp in each sample or a representative aliquot were measured in millimeters from the tip of the rostrum to the tip of the telson, and the measurements were recorded in 5 millimeter groups on the length-frequency sheets that were kept for each species of shrimp caught at each station. In cases where data were comparable in a bay system, they were grouped according to tertiary, secondary, or primary stations for processing.

For each bay system and the Gulf a semi-monthly average yield for each type station was determined by the following method. The total number of each species of shrimp that were caught in similar type stations was divided by the number of collections that had been made at those stations. These averages were plotted on abundance graphs. Figures 10 through 25.

Length frequency graphs or histograms were also made semi-monthly on each type area in each bay and the Gulf. This was done by determining the average number of each size group of shrimp caught at each type station for each species. From these histograms modes were plotted. Figures 10 through 25. Modes were selected by the same method used by Compton and Leary (1960) and Compton (1961).

The 1960 coastal shrimp data referred to in this report includes only eight months, May through December.

### Findings:

#### Postlarval Shrimp Study

This phase of the Coastal program got off to a slow start. Due to personnel changes and other unforeseen difficulties, only 25 samples were collected this year furnishing insufficient data to support any conclusions in a comparison with the bay and Gulf data. The smallest postlarval shrimp were identified only as Penaeids. Data for the postlarval sampling are compiled in Table 1.

Numerous postlarval Penaeid shrimp appeared in the collections in February and March. An average of one hundred and six were caught per collection with the beam trawl and 83 per collection with the sand flat sampler. These young shrimp probably corresponded with the spring group of juvenile brown shrimp in Aransas and Corpus Christi Bays. This first group of young shrimp ranged from 10 to 15 millimeters in size.

The late fall, October and November, group of Penaeids was the second largest group found this year. At that time the beam trawl produced an average of 21 per collection, the plankton net produced 41 per collection, and the sand flat sampler produced 6 per collection. Some of these shrimp were identified as pink shrimp and the remainder identified only as Penaeid shrimp. They ranged from 9 to 26 millimeters in size.

#### Bay Juvenile Shrimp Study

##### Penaeus aztecus

Galveston Bay: The 1962 shrimp samples indicated three major waves, or groups, of small shrimp coming into Galveston Bay. The first group, which entered the bay in early April, was the largest.

Wave	Period of Time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	April - June	20 mm	95 mm	0.9 mm/day
2	July - September	38 mm	85 mm	0.8 mm/day
3	August	30 mm	-	-

The average size of the brown shrimp caught at the tertiary stations was 37 millimeters, at the secondary station it was 72 millimeters, and at the primary station it was 74 millimeters. Samples indicated the catch per unit of effort decreased 71 per cent from 1961 and 84 per cent from 1960.

Matagorda Bay: Samples indicated four waves of juvenile shrimp in the bay this year.

Wave	Period of Time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	April - June	25 mm	85 mm	1.3 mm/day
2	June - September	35 mm	78 mm	0.7 mm/day
3	August - October	33 mm	85 mm	0.8 mm/day
4	October	38 mm	-	0.9 mm/day

The average size of shrimp at the tertiary stations was 40 millimeters, at the secondary stations it was 50 millimeters, and at the primary stations it was 72 millimeters. There was a 43 per cent decrease in the catch per unit of effort from 1961 and a 54 per cent decrease from 1960.

San Antonio Bay: There were three groups of young brown shrimp in the bay this year. The first and largest group appeared in early April.

Wave	Period of Time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	April - June	23 mm	88 mm	1.1 mm/day
2	September - November	50 mm	80 mm	0.5 mm/day
3	December	25 mm	-	-

The average size of the shrimp at the tertiary station was 64 millimeters, at the secondary stations it was 71 millimeters, and at the primary stations it was 78 millimeters. The catch per unit of effort was 30 per cent below the 1961 catch and 27 per cent below the 1960 catch.

Aransas Bay: Four waves of juvenile shrimp were found in the bay this year. The first and largest wave appeared in early April.

Wave	Period of Time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	April - June	25 mm	83 mm	1.0 mm/day
2	June - August	30 mm	78 mm	0.8 mm/day
3	August - October	35 mm	80 mm	0.7 mm/day
4	September	35 mm	-	0.7 mm/day

The average size shrimp caught at the tertiary stations was 34 millimeters, at the secondary stations it was 71 millimeters, and at the primary stations it was 73 millimeters. The catch per unit of effort was 71 per cent below the 1961 catch and 83 per cent below the 1960 catch.

Corpus Christi Bay: Samples showed a small winter and spring population of straggler shrimp in the bay followed by five waves of juvenile brown shrimp. The largest wave of small shrimp entered the bay in June.

Wave	Period of Time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	April - May	48 mm	83 mm	0.7 mm/day
2	May - July	50 mm	83 mm	0.7 mm/day
3	June - August	55 mm	83 mm	0.6 mm/day
4	August - November	40 mm	75 mm	0.6 mm/day
5	November	48 mm	-	1.1 mm/day

The average size of shrimp at the tertiary stations was 61 millimeters, at the secondary stations it was 64 millimeters and at the primary stations it was 75 millimeters. There was a 13.7 per cent decrease in the catch per unit of effort as compared to 1961. Not enough samples were collected in 1960 to give comparative figures.

Upper Laguna Madre: The bay stations were not divided into tertiary, secondary, and primary areas as in other bays, but the data were handled according to the type sampling gear used. The data were graphed as either seine<sup>1</sup> or trawl stations.

Samples indicated three groups of juvenile shrimp entered the bay this year. The June group was the largest.

Wave	Period of Time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	April - June	50 mm	85 mm	0.8 mm/day
2	June - July	60 mm	93 mm	1.1 mm/day
3	October	58 mm	-	-

The average size of the shrimp caught in the seine was 85 millimeters and in the trawl it was 71 millimeters. The catch per unit effort was 74 per cent above the 1961 catch and 89 per cent above the 1960 catch.

Lower Laguna Madre: Like the Upper Laguna, the bay was not divided into tertiary, secondary or primary areas. Samples were plotted according to the type sampling gear used.

Five groups of juvenile shrimp appeared in the Lower Laguna in 1962. The May and June groups were the largest.

Wave	Period of Time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	April - June	43 mm	63 mm	0.3 mm/day
2	May - July	43 mm	65 mm	0.5 mm/day
3	June - August	38 mm	68 mm	0.9 mm/day
4	September - December	28 mm	68 mm	0.5 mm/day
5	December	28 mm	-	-

The average size of the shrimp caught in the seine was 52 millimeters and in the trawl it was 46 millimeters. This year's samples showed a 53 per cent increase in the catch per unit of effort over 1961 and a 68 per cent decrease from the 1960 catch.

#### Penaeus setiferus

Galveston Bay: Three waves of juvenile white shrimp were indicated by the collections. The third wave produced the most shrimp.

<sup>1</sup>The 60-foot bay seine was occasionally used in the Upper Laguna Madre.

Wave	Period of time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	June - August	33 mm	133 mm	1.6 mm/day
2	August - November	30 mm	118 mm	0.9 mm/day
3	September	28 mm	-	0.6 mm/day

Average size of the shrimp caught at tertiary stations was 35 millimeters, at the secondary stations it was 59 millimeters, and at the primary stations it was 90 millimeters. Samples indicated a 68 per cent decline in the catch per unit of effort as compared to the 1961 catch and 88 per cent decline as compared to 1960.

Matagorda Bay: Straggler shrimp were found in the bay during the winter and spring, but the first of four waves of juvenile shrimp did not enter until June.

Wave	Period of time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	June - August	13 mm	75 mm	0.8 mm/day
2	August - October	35 mm	78 mm	0.7 mm/day
3	September - December	33 mm	110 mm	1.0 mm/day
4	December	45 mm	-	-

The average size of the shrimp caught at the tertiary stations was 41 millimeters, at the secondary stations it was 69 millimeters, and at the primary stations it was 84 millimeters. Samples indicated a 34 per cent decrease in the catch per unit of effort from 1961 and a 66 per cent decrease from the 1960 catch.

San Antonio Bay: Straggler shrimp were found in the bay during the winter and spring. Two waves of juveniles appeared in the summer and fall.

Wave	Period of time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	July - August	25 mm	115 mm	1.3 mm/day
2	September	60 mm	-	0.3 mm/day

Note: These growth rate figures were determined from small samples and may be in error.

The average size of the shrimp caught at the tertiary stations was 76 millimeters, at the secondary stations it was 81 millimeters, and at the primary stations it was 96 millimeters. There was a 91 per cent decrease in the catch per unit of effort from 1961 and 97 per cent decrease from 1960.

Aransas Bay: Three groups of juvenile shrimp were in the bay this year, as indicated by the samples.

Wave	Period of time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	July - September	53 mm	123 mm	1.1 mm/day
2	September - October	73 mm	100 mm	-
3	November	70 mm	-	0.4 mm/day

The average size of the shrimp caught at the tertiary stations was 73 millimeters, at the secondary stations it was 76 millimeters, and at the primary stations it was 88 millimeters. The catch per unit of effort decreased 59 per cent from 1961 and 98 per cent from 1960.

Corpus Christi Bay: Straggler shrimp were found in the bay during the winter and spring months growing at the rate of approximately 0.9 millimeters per day. These shrimp left the bay in May at 153 millimeters. In July the first of three groups of juvenile shrimp appeared in the bay.

Wave	Period of time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	July - September	35 mm	80 mm	0.9 mm/day
2	August - October	28 mm	90 mm	1.0 mm/day
3	October	60 mm	-	0.9 mm/day

The average size of the shrimp caught at the tertiary stations was 72 millimeters, at the secondary stations it was 72 millimeters, and at the primary stations it was 81 millimeters. There was a 52 per cent decrease in the catch per unit of effort from 1961 and 79 per cent decrease from 1960.

Upper Laguna Madre: A few white shrimp were caught in July, November, and December in salinities above 40 parts per thousand. These shrimp were probably stragglers from the Corpus Christi Bay populations.

Lower Laguna Madre: Samples indicated three waves of juvenile shrimp in the Lower Laguna.

Wave	Period of time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	July - August	35 mm	68 mm	0.7 mm/day
2	September - November	20 mm	83 mm	0.9 mm/day
3	December	33 mm	-	-

The average size of shrimp caught with the seine was 66 millimeters, and with the trawl it was 35 millimeters. Samples this year indicated an 85 per cent increase in the catch per unit of effort from 1961 and a 22 per cent increase from 1960.

#### Penaeus duorarum

San Antonio Bay: A few shrimp, 78 millimeters average size, were caught in salinities above 20 parts per thousand in April.

Aransas Bay: Pink shrimp, average size 68 millimeters, were caught in March, May, June, and October in salinities above 19 parts per thousand.

Corpus Christi Bay: A few pink shrimp were caught in April, May, August, and December in salinities above 20 parts per thousand. The average size of these shrimp was 83 millimeters.

Upper Laguna Madre: Pink shrimp were common during the spring, late fall and early winter in salinities above 29 parts per thousand. Their average size during the spring was 108 millimeters, and during the fall it was 88 millimeters.

Lower Laguna Madre: Pink shrimp were common in the samples during the spring, becoming very abundant in late April and early May. There appeared to be two groups of young shrimp in the bay. They were caught in salinities above 34 parts per thousand.

Wave	Period of time in Bay	Appeared at mm mean size	Departed at mm mean size	Growth rate
1	March - April	35 mm	55 mm	0.6 mm/day
2	April - May	23 mm	45 mm	0.7 mm/day

#### Summary

Penaeus aztecus were found year round in the more southerly Texas Bays. This was thought to be because of the higher salinities and water temperatures in those bays. Juvenile shrimp entered all bays in groups, or waves, in April and continued to appear through December. The number of waves to enter the bays ranged from three to five. In Galveston, San Antonio, and Upper Laguna Madre there were three distinct groups of juveniles. Matagorda and Aransas Bays had four groups, while Corpus Christi Bay and the Lower Laguna Madre had five waves.

The young shrimp grew at an average rate of 0.8 millimeters per day and left the bays when they were about 80 millimeters in size. However, they began to leave the Lower Laguna at a smaller size, 65 millimeters.

As expected, the brown shrimp catch per unit of effort increased from Galveston to the Lower Laguna Madre. May through July were the months of greatest abundance of these shrimp in all bays. Brown shrimp appeared to be most abundant in the Upper and Lower Laguna Madre.

Penaeus setiferus also had winter populations in some of the bays. Waves or groups of juveniles entered the bays during the summer and fall. Galveston, Aransas, Corpus Christi, and the Lower Laguna had three distinct groups of shrimp. San Antonio had two groups, and Matagorda had four. The Upper Laguna had no distinct groups but seemed to have stragglers from the Corpus Christi shrimp populations. Incidentally, juvenile white shrimp first entered Galveston and Matagorda Bay in June, a month earlier than the other bays.

These shrimp grew an average of 1.1 millimeters per day and left the bays for the Gulf by the time they were about 110 millimeters. Shrimp in the Lower Laguna left that bay at a smaller size than those in other bays, 75 millimeters.

September through November were the months of greatest abundance of white shrimp in all bays. The Lower Laguna Madre, Galveston Bay, and Matagorda Bay, respectively, produced the largest catches of white shrimp. Shrimp caught in the Lower Laguna were taken near the Arroyo Colorado in salinities of 30 to 85 parts per thousand.

Penaeus duorarum were found only in the more southerly bays, San Antonio Bay to the Lower Laguna Madre. These shrimp, caught in salinities above 20 parts per thousand, appeared to be stragglers in most bays. The Lower Laguna Madre was the only bay in which samples indicated distinct waves of pinks entering the bay. These shrimp were more common during the spring.

Mode and abundance graphs for the pink shrimp will not be included in this report due to lack of available space. This data may be found on file at the Seabrook Laboratory.

#### Twenty-Foot Trawl Samples

Due to the few samples collected in most areas, it was impossible to draw many valid conclusions from the data; however, there were several trends noticed that merit mentioning.

Twenty-foot trawls were supposed to furnish some information on the commercial shrimp fleet landings. These samples indicated the commercial fleet harvested at least two major groups of brown shrimp in most bays, one during the summer and the second during the fall. The first group, found from May through August, was generally the largest. These shrimp averaged 85 millimeters in size. The second, smaller group was harvested in October and November. Their average size was 80 mm. Night samples usually produced more shrimp than the day samples.

The commercial fleet also harvested two major groups of white shrimp in most bays. These groups were found in late summer and late fall. Samples indicated that the majority of these harvested shrimp were 100 millimeters in size. Night samples, as expected, yielded fewer shrimp than the day samples.

Pink shrimp were of minor value to the bait shrimpers in the southerly bays. They were generally caught during the spring, late fall and winter. These shrimp averaged 86 millimeters in size.

Mode and abundance graphs for the twenty-foot trawls will also be excluded from this report because of available space. These graphs will be on file at the Seabrook Laboratory.

#### Gulf Study

##### Penaeus aztecus

Brown shrimp were common in the inshore Gulf waters, 1 to 15 fathoms, from March to November but were more abundant from the middle of July to the the middle of September. Months of peak abundance corresponded with the movement of juvenile shrimp out of Aransas and Corpus Christi Bays. The average size of the brown shrimp caught in the inshore Gulf was 105 millimeters, 15 millimeters below the legal commercial count size. Samples indicated that the majority of the shrimp moved offshore, beyond 15 fathoms, by the time they reached 130 millimeters in size. Samples this year showed a 67 per cent decrease in the catch per unit of effort from 1961 and a 58 per cent decrease from 1960.

##### Penaeus setiferus

White shrimp were collected in the inshore Gulf waters all year but were more abundant in the samples during the winter and spring. The spring group of shrimp, probably spawners that overwintered from last year's crop of shrimp, averaged 130 millimeters in size. The smaller summer and fall groups of shrimp were probably a mixture of spawning shrimp and shrimp migration from the bays to the Gulf. These shrimp averaged 165 millimeters in size.

The majority of the white shrimp left the inshore waters by the time they reached 170 millimeters in size. Samples yielded legal count shrimp all year, except in February. At that time the shrimp averaged 108 millimeters in size. These shrimp were no doubt a fall or early winter crop that left the bays due to the drop in water temperatures. Samples this year showed a 90 per cent decrease in the catch per unit of effort from 1961 and a 83 per cent decrease from 1960.

#### Penaeus duorarum

Pink shrimp were caught only one time during this study, in April. At that time the shrimp averaged 140 millimeters in size.

#### Gulf Area 20 Compared to Aransas and Corpus Christi Bays

Straggler Penaeus aztecus were found in the inshore Gulf waters during the spring and in the bays during the winter and spring. Juvenile shrimp first appeared in the bays in early April and continued to recruit the population through the summer and fall. These shrimp remained in the bays growing at the rate of 0.8 millimeters per day until they reached a mean size of 80 millimeters before moving Gulfward. They appeared in the Gulf samples at an average size of 100 millimeters. The bay populations continued to recruit the Gulf populations through the fall and early winter. Brown shrimp remained in the shallow inshore Gulf waters until they reached a mean size of 130 millimeters at which time they moved off shore.

The decrease in abundance of juvenile brown shrimp in the bay samples in 1962 was further reflected in the decrease in shrimp in the catches in the inshore Gulf.

Penaeus setiferus remained in the inshore Gulf waters and Corpus Christi Bay all year. They were found to be most abundant in the Gulf samples during the winter and spring following fall migration from the bays. Juvenile whites entered the bays in July reaching their peak of abundance in October and November. These shrimp moved Gulfward at about 110 millimeters in size. They appeared to remain in the inshore Gulf waters until they reached a mean size of 170 millimeters before they moved offshore.

Shrimp samples from the bays indicated a smaller population of white shrimp than in 1960 or 1961, which was further reflected in the reduced numbers of whites found in the inshore Gulf in 1962.

Penaeus duorarum appeared to be stragglers in both the inshore Gulf and the bays during the spring. Their average size was 70 millimeters in the bays and 140 millimeters in the Gulf.

#### Comparison of 1960-61-62

Shrimp data collected over the past three years indicated definite seasonal trends. Straggler brown shrimp usually wintered over in the more southerly bays moving to the Gulf in the spring. At least three major waves of juvenile shrimp entered most bays during the spring and summer. The first and largest wave was generally in April and May. Brown shrimp grew at an average rate of 1.0 millimeters per day in 1960, 0.9 millimeters per day in 1961, and 0.8 millimeters per day in 1962. They left the bays at a mean size of 100 millimeters in 1960, 105 millimeters in 1961, and 80 millimeters in 1962. The bay samples collected from April through November, during months of greatest abundance of the brown shrimp, indicated the population was 68 per cent below the 1960 population and 7.5 per cent above 1961.

White shrimp also wintered over in some of the bays moving Gulfward in the spring. Juvenile white shrimp entered most bays in three waves during the summer and fall. The first and normally the largest wave appeared in the bays in June except in 1962 when they entered the southerly bays in July. These

shrimp grew at an average rate of 0.9 millimeters per day in 1960, 1.0 millimeters per day in 1961, and 1.1 millimeters per day in 1962. They left the bays in 1960 at a mean size of 120 millimeters, in 1961 at a mean size of 120 millimeters, and in 1962 at a mean size of 110 millimeters. White shrimp data collected during peak months of abundance, June through November, indicated an 85 per cent decline in the population from 1960 and a 24 per cent decline from 1961.

Pink shrimp data were not included in the 1960 or 1961 reports; therefore no comparison could be made.

The postlarval and Gulf segment of the coastal report was added this year resulting in no data for comparison.

Figures 26 through 29 shows the bay and Gulf abundance graphs for 1960 through 1962. They were plotted, as in previous studies, by the following method. The first of the month average samples for all bays were totaled and divided by the number of samples; the fifteenth of the month data were handled in the same manner. The first and the fifteenth figures were totaled but not divided and graphed. The Gulf catch was divided by the number of samples collected and the resulting figures plotted as monthly abundance.

#### Hydrographic Data (Figures 30-36)

Salinities were higher this year than in comparable months in 1961. From March to June, during months of greatest abundance of juvenile brown shrimp, salinities in the nursery areas ranged from 2 to 12 parts per thousand higher than in 1961. When young whites entered the bays, the salinities were from 5 to 18 parts per thousand higher than in 1961. These higher salinities were no doubt more favorable to the young brown shrimp.

Temperatures followed the normal seasonal trend this year except during the freeze in January and a slight temperature decline in March. There were no reports of the freeze hurting the shrimp populations.

Postlarval shrimp appeared in the Aransas Pass samples in February at a water temperature of 15.8°C. The first juvenile brown shrimp did not appear in the bays until April at which time the water temperatures averaged 20°C. When the young whites entered the bays in June and July the water temperatures averaged 29°C. Both species began their fall movement Gulfward when the water temperature declined below 19°C.

#### Commercial Landings

Figures 37 and 38 are graphs of the pounds of brown and white shrimp landed by the commercial fleet per day fishing effort on the Texas Coast in 1962 as compared to 1960 and 1961. This data, five months behind due to processing, was taken from the U. S. Fish and Wildlife Service Report on Gulf Coast Shrimp Catch by Area and Depth, Catch by Variety for the Texas Coast. Catches for statistical Areas 18 (Galveston), 19 (Matagorda and San Antonio), 20 (Aransas and Corpus Christi) and 21 (Laguna Madre) were totaled according to species. The totals were divided by the number of fishing days per month and the weights graphed as pounds per day fishing effort. Tables 2 and 3 compare the average number of pounds of brown and white shrimp landed per day for the four statistical areas for 1960, 1961, and 1962. Gunter (1960) pointed out that most of the white shrimp on the Texas Coast came from areas 18 and 19 and most of the brown shrimp came from areas 19 and 20. He also mentioned the possibility of a southward drift of the shrimp during the fall. This idea is further confirmed in the above tables by the rapid decline in the catches during the fall along the upper coast with a subsequent increase in the catches southward.

The Texas Gulf production graphs, figures 39 and 40, were plotted from the U. S. Market News Report published by the U. S. Bureau of Commercial Fisheries.

Monthly brown and white shrimp landings for nine Texas ports were added together and plotted as monthly totals.<sup>2</sup> These figures were compared to 1960 and 1961 data. Brown shrimp production was 30 per cent below the 1960 production and 8 per cent above the 1961 production. White shrimp production in 1962 was down 18 per cent from 1960 production and down 4 per cent from 1961. The Texas Preliminary Shrimp Landings published by the U. S. Fish and Wildlife Service shows the total shrimp landing increased 1 per cent from 1961 and was 28 per cent below the 1960 commercial production.

### Conclusion

Biological samples and Gulf Commercial catches indicated the total shrimp population was at about the same level as in 1961 but was below the 1960 level.

Data collected by the Game and Fish Commission marine biologists indicated a need for the closure of certain shallow nursery areas to shrimping. These areas are important for sustaining the shrimp populations and should be protected in order that the young shrimp may reach optimum size of harvesting.

Gulf samples indicated that many brown shrimp in the inshore Gulf, 1 to 15 fathoms, were under legal count size during the summer and fall. There appears to be a need for additional regulation of the inshore Gulf to protect these shrimp.

### Recommendations for 1963 Sampling

1. Sampling of the present shrimp stations should be continued in order to determine the movement and relative abundance of the shrimp populations.
2. New stations should be sampled in each bay to determine if the old stations are representative of the bay system.
3. A 20-foot trawl should be pulled a minimum of 15 minutes semi-monthly in areas of the bay that the commercial fleet are working.
4. Night samples should also be collected with the 20-foot trawl during months of greatest abundance of white and brown shrimp.
5. Spot checks should be made of the commercial shrimpers catch to correlate with the biological samples collected in the bays.
6. The present postlarval sampling in the Aransas channel should be continued and records kept on current, salinity, and temperature.

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<sup>2</sup>Port Arthur and Sabine Pass Area, Texas Shrimp Landings included with Galveston, Texas since July 1962.

## Bibliography

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Figure 1  
Postlarval Shrimp Stations

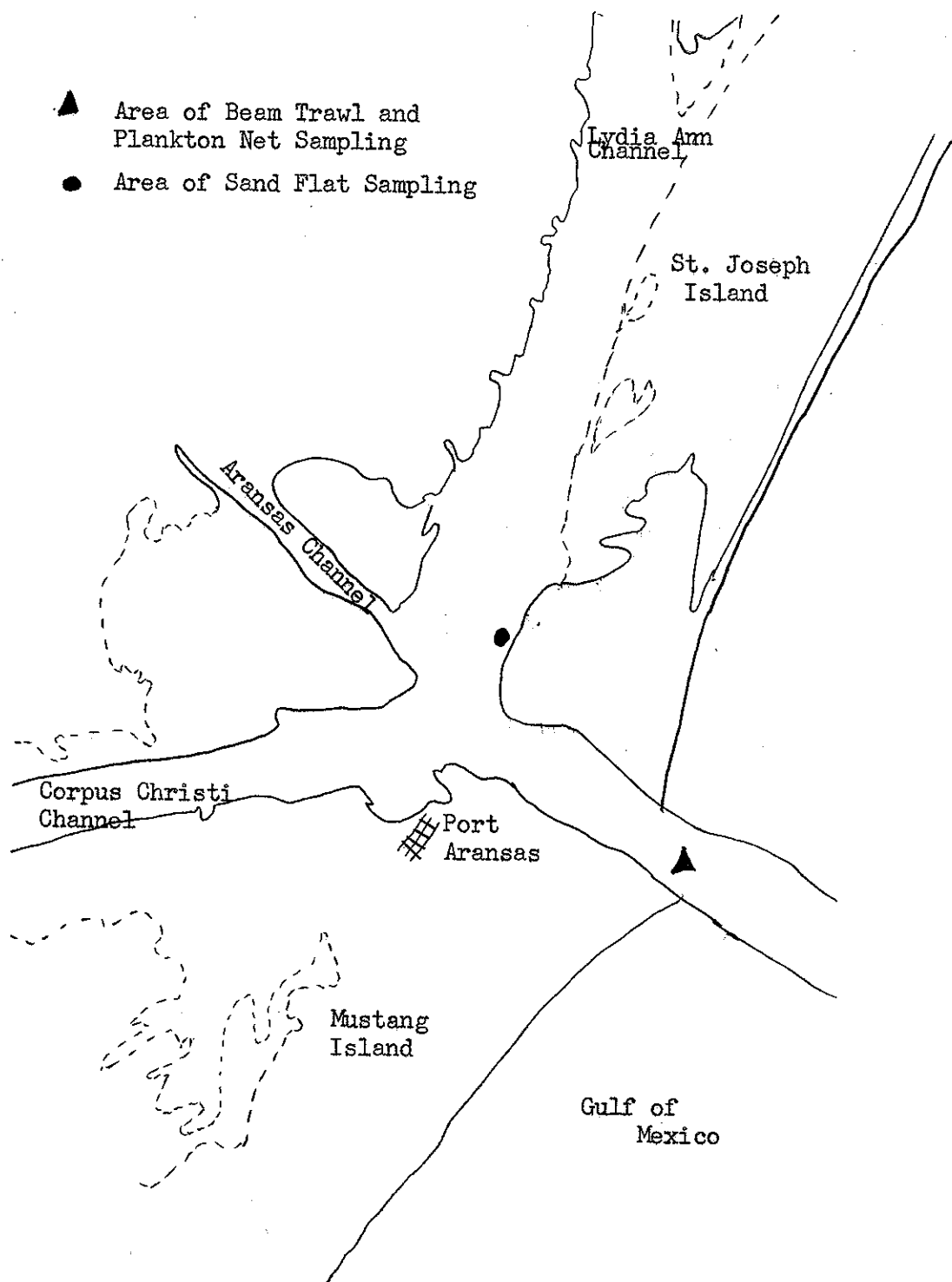


Figure 2

Galveston Bay Station Locations

- 1 Primary Stations
- 2 Secondary Stations
- 3 Tertiary Stations

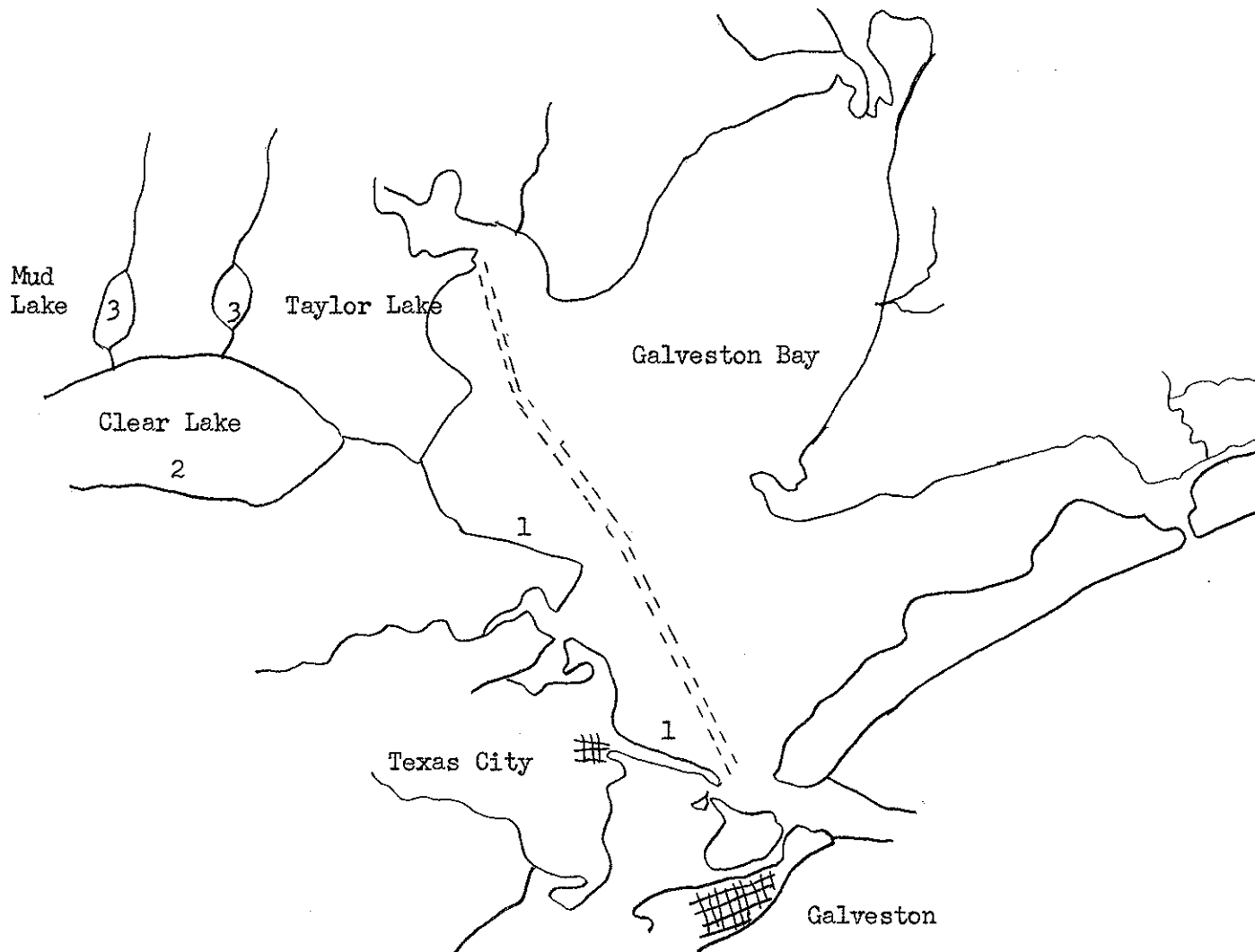


Figure 3

Matagorda Bay Station Locations

- 1 Primary Bay Stations
- 2 Secondary Bay Stations
- 3 Tertiary Bay Stations

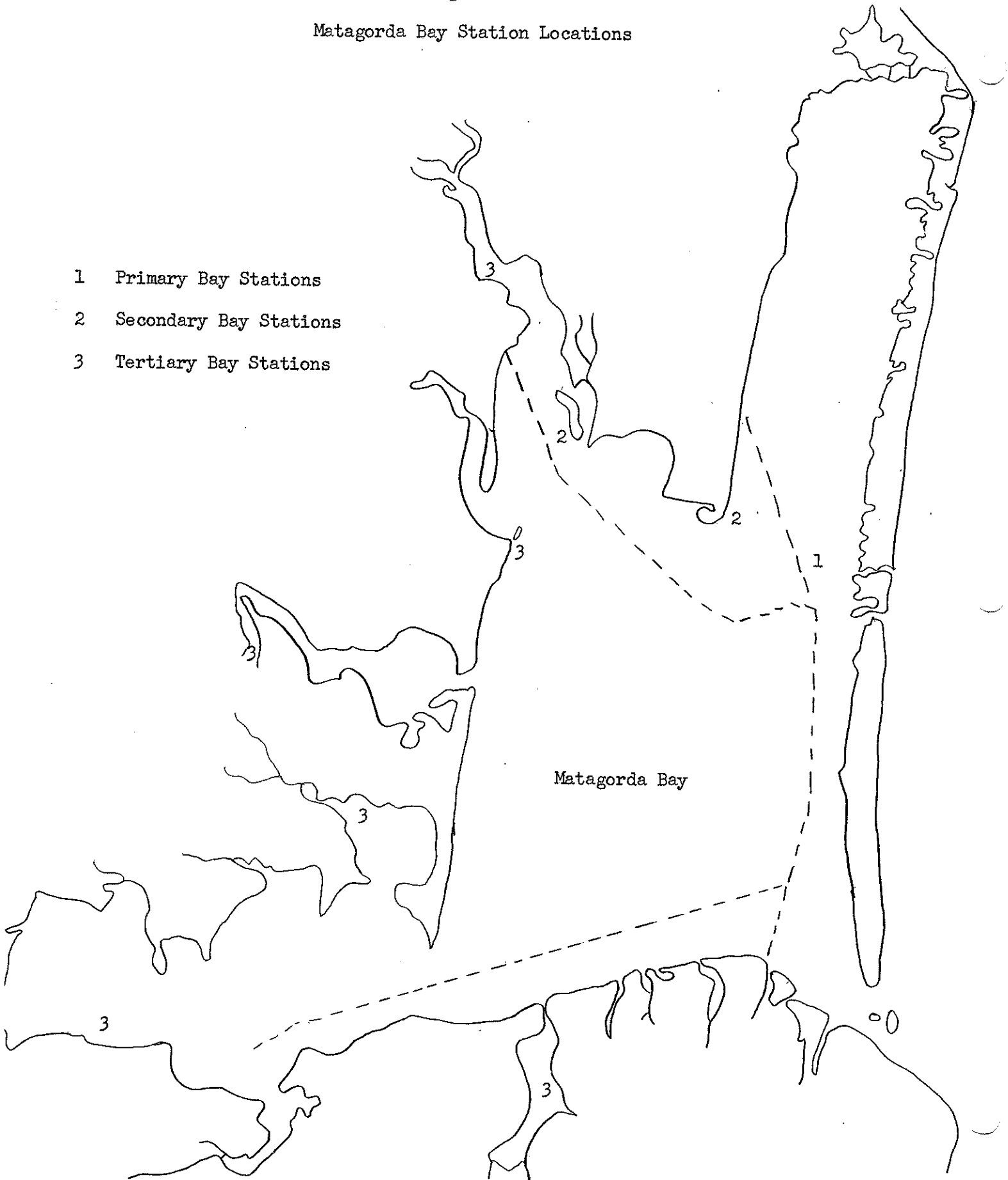


Figure 4

San Antonio Bay Station Locations

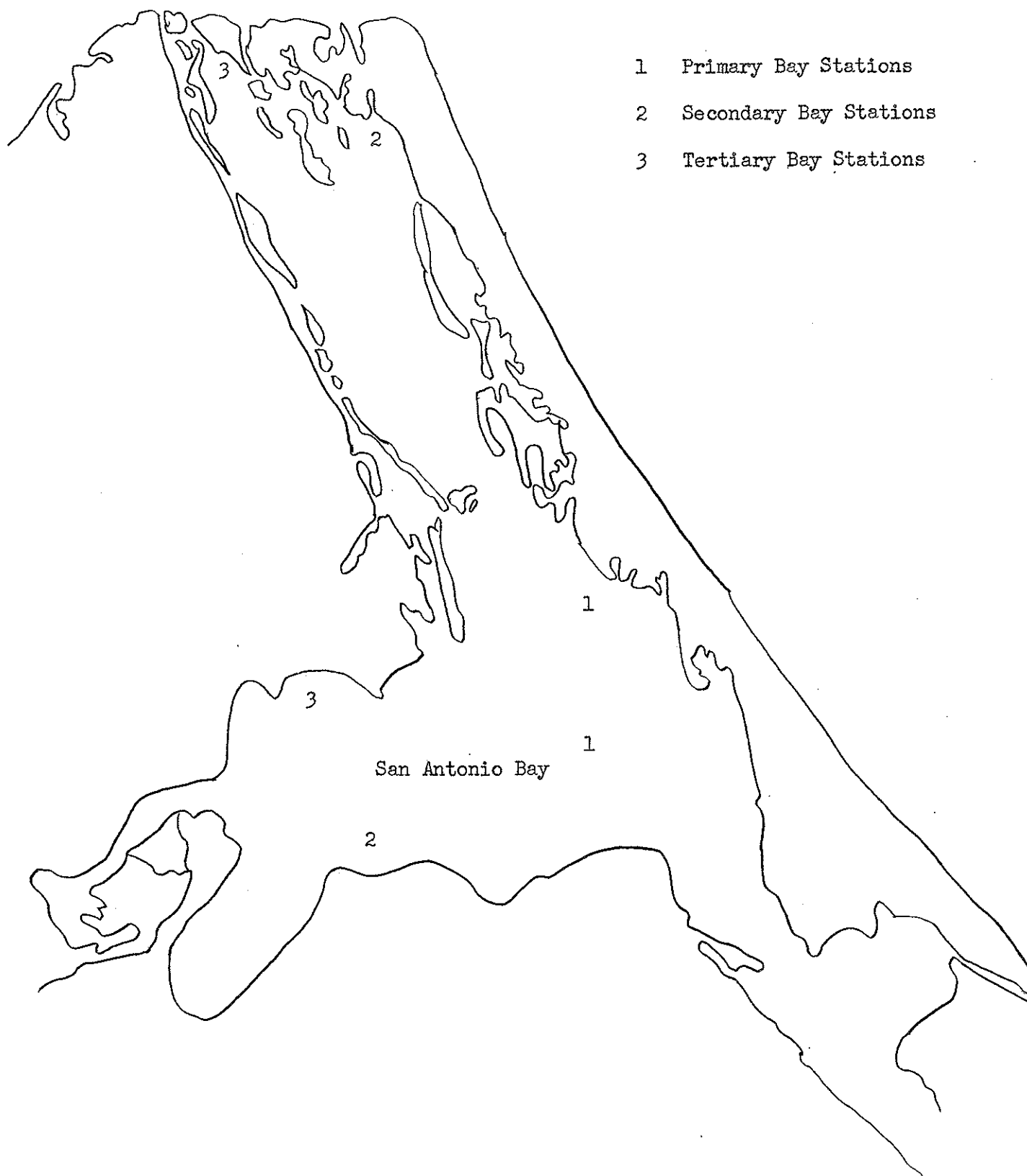


Figure 5

Aransas Bay Station Locations

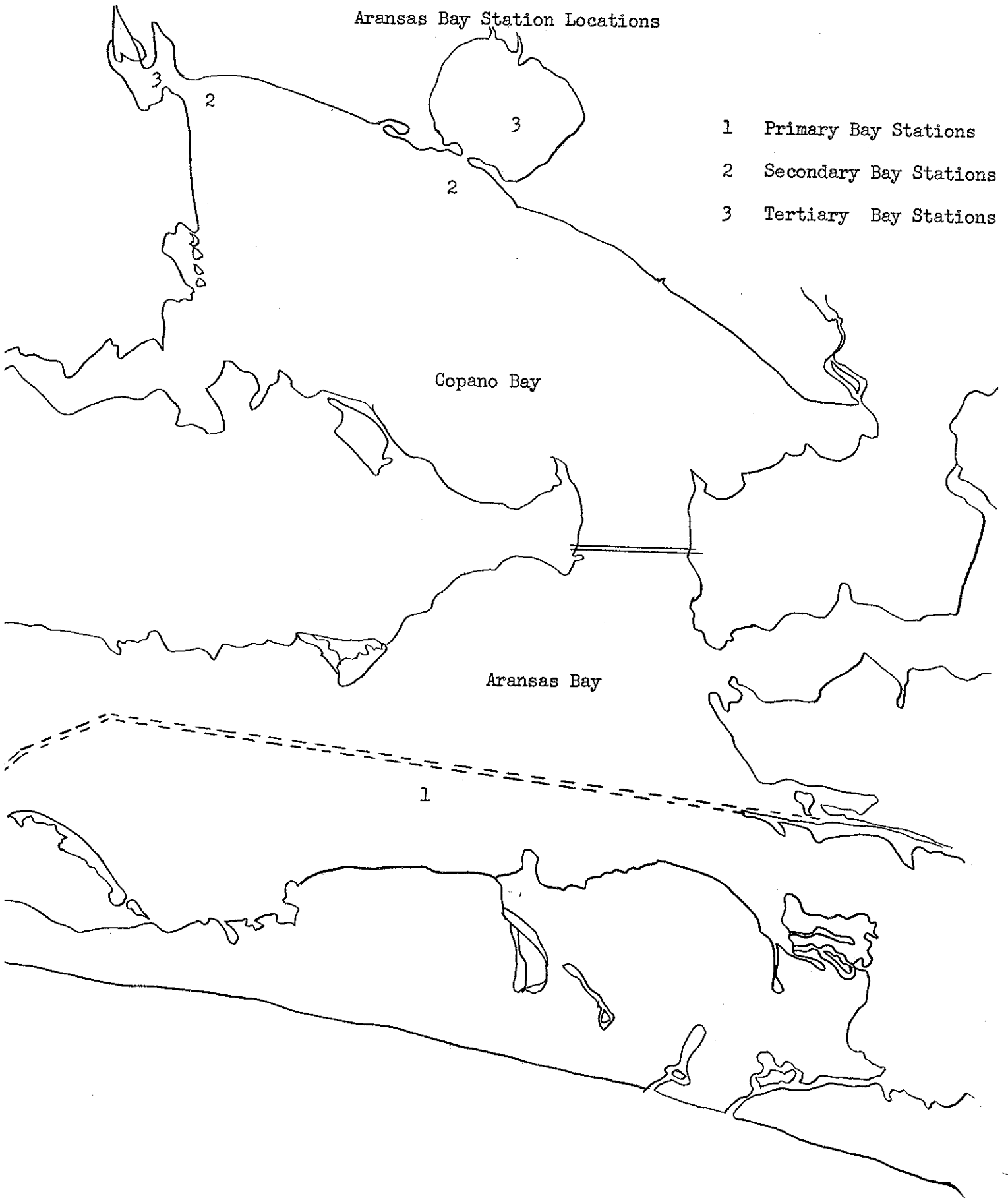
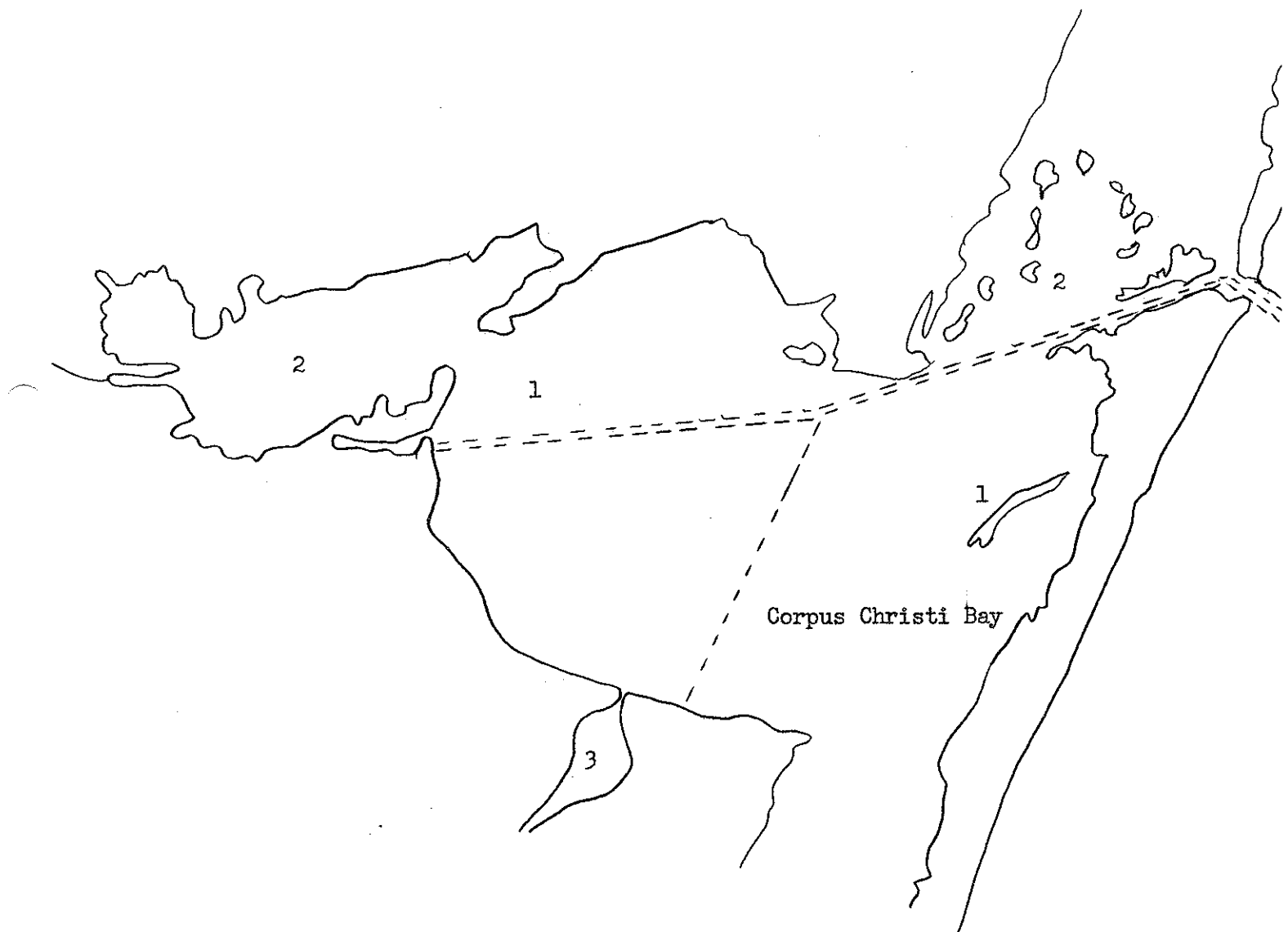


Figure 6

Corpus Christi Bay Station Locations

- 1 Primary Bay Stations
- 2 Secondary Bay Stations
- 3 Tertiary Bay Stations



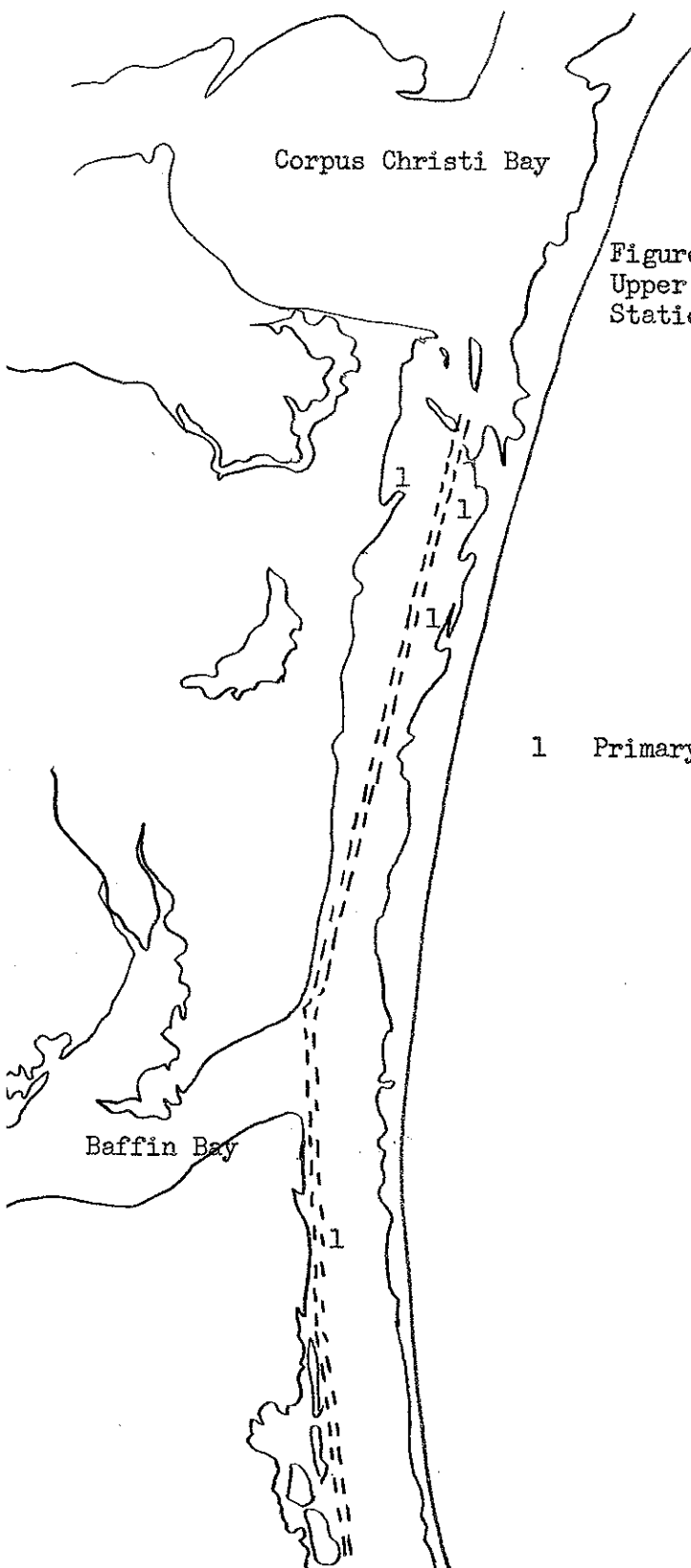


Figure 7  
Upper Laguna Madre  
Stations

1 Primary Bay Stations

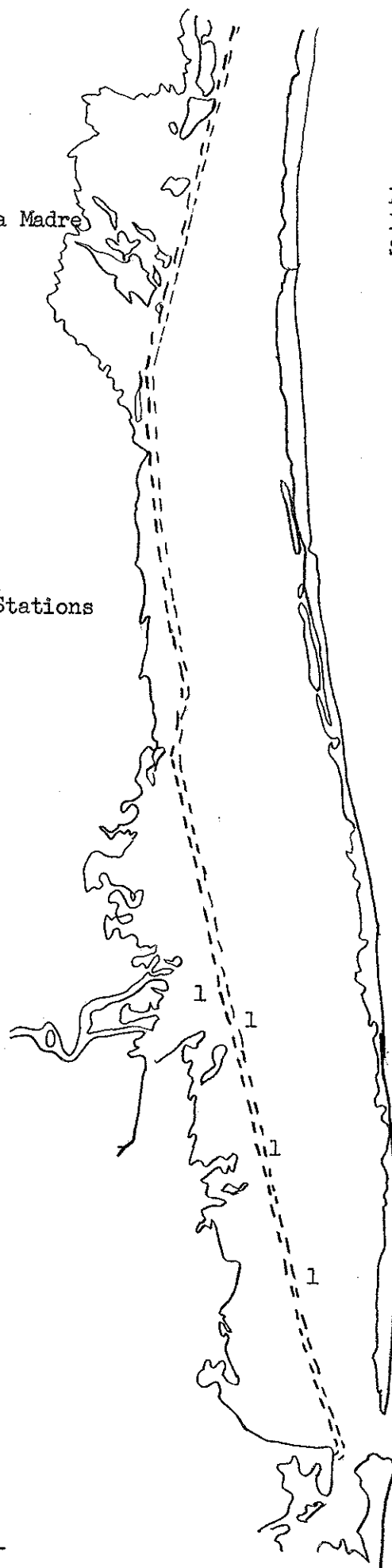


Figure 8  
Lower Laguna Madre  
Stations

Figure 9

Gulf Sampling Area 20

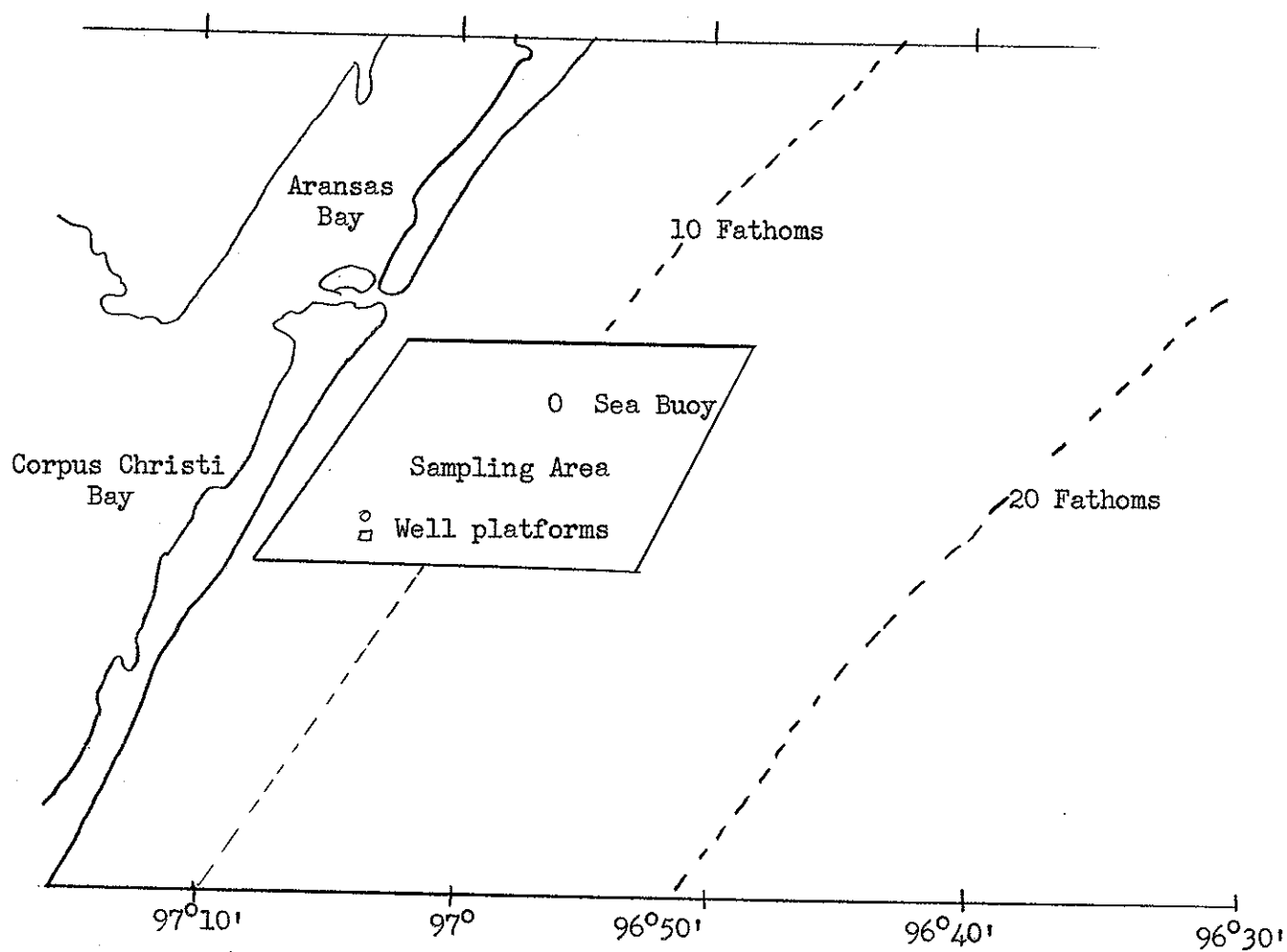
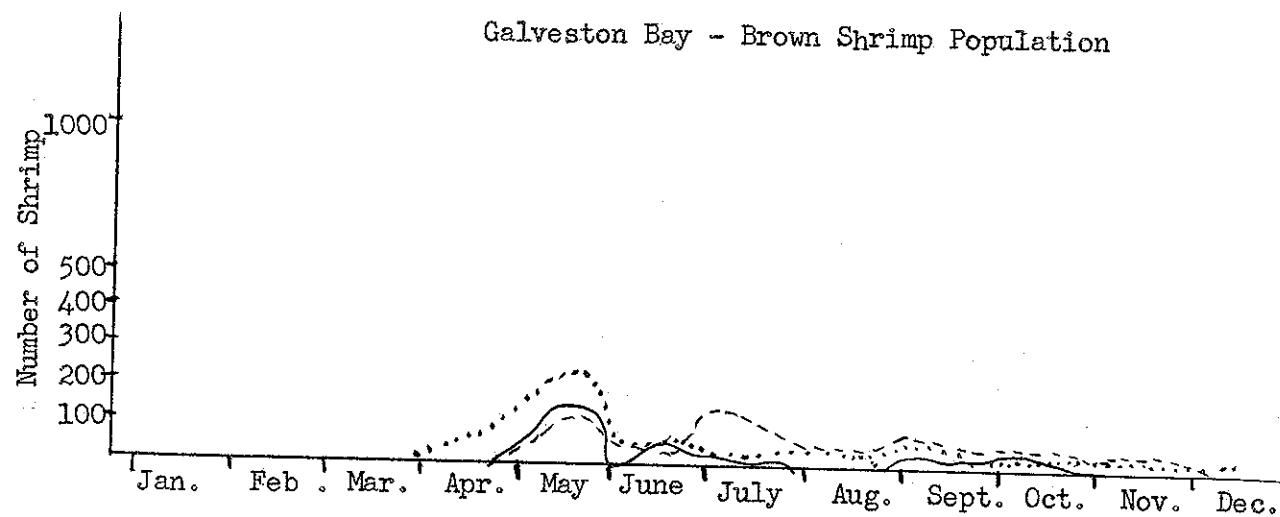


Figure 10

— Primary Station  
 - - - Secondary Station  
 ..... Tertiary Station

Galveston Bay - Brown Shrimp Population



Average Number Per Sample by Month

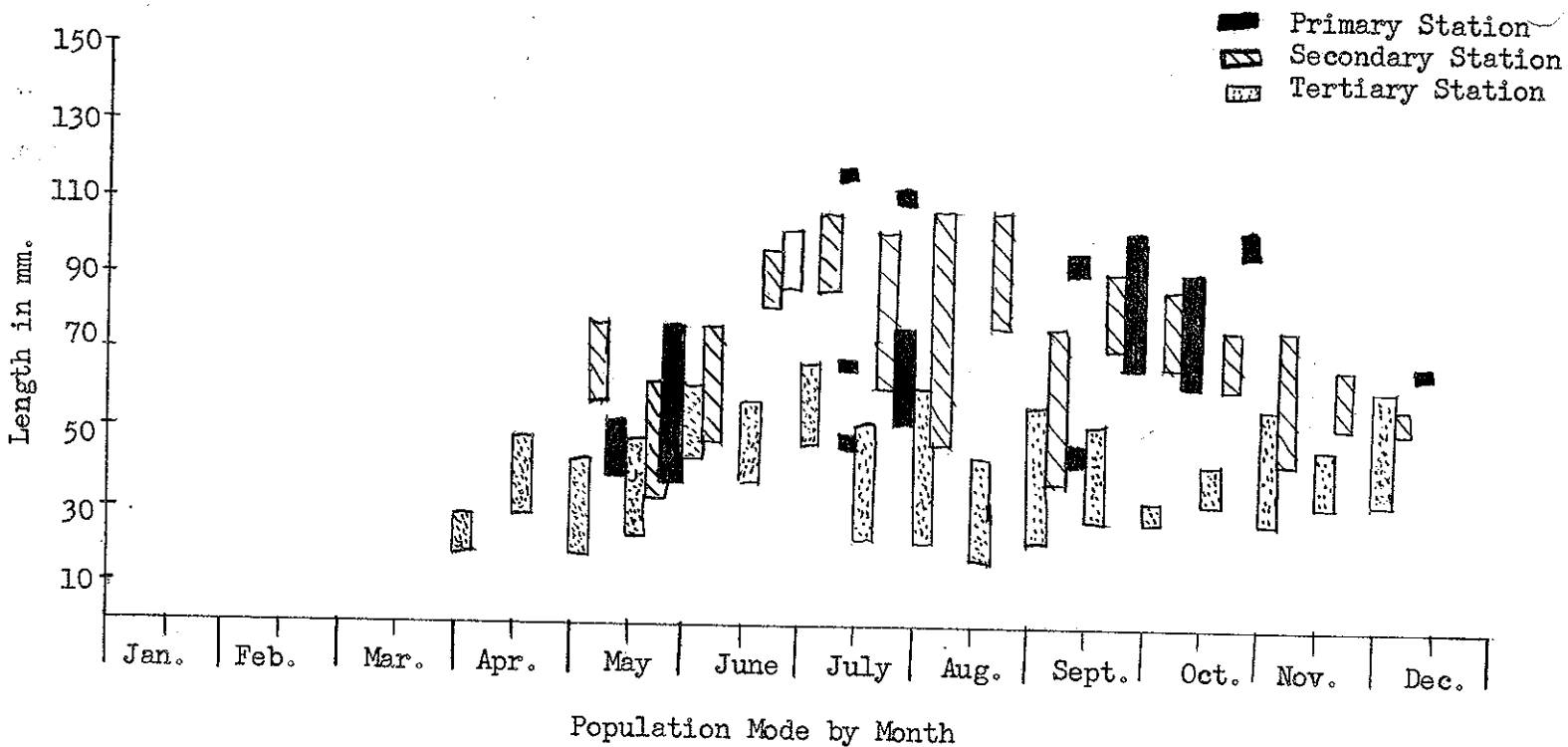
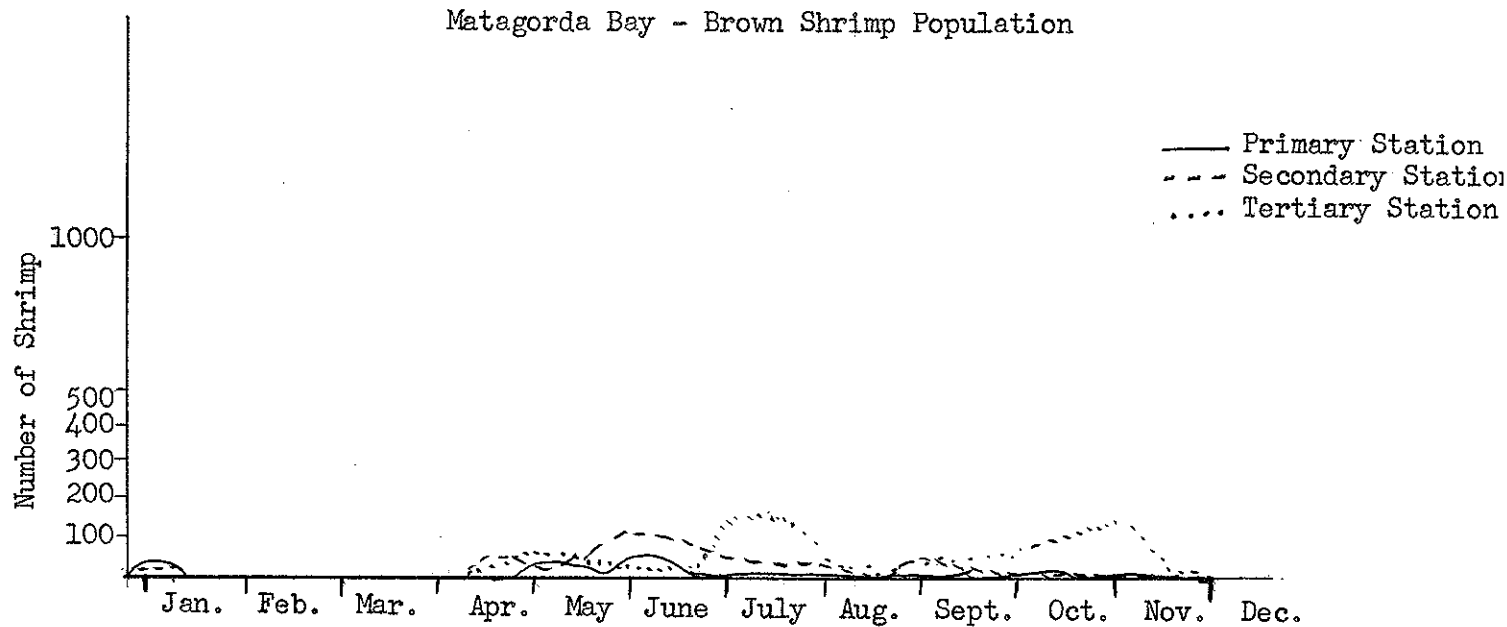
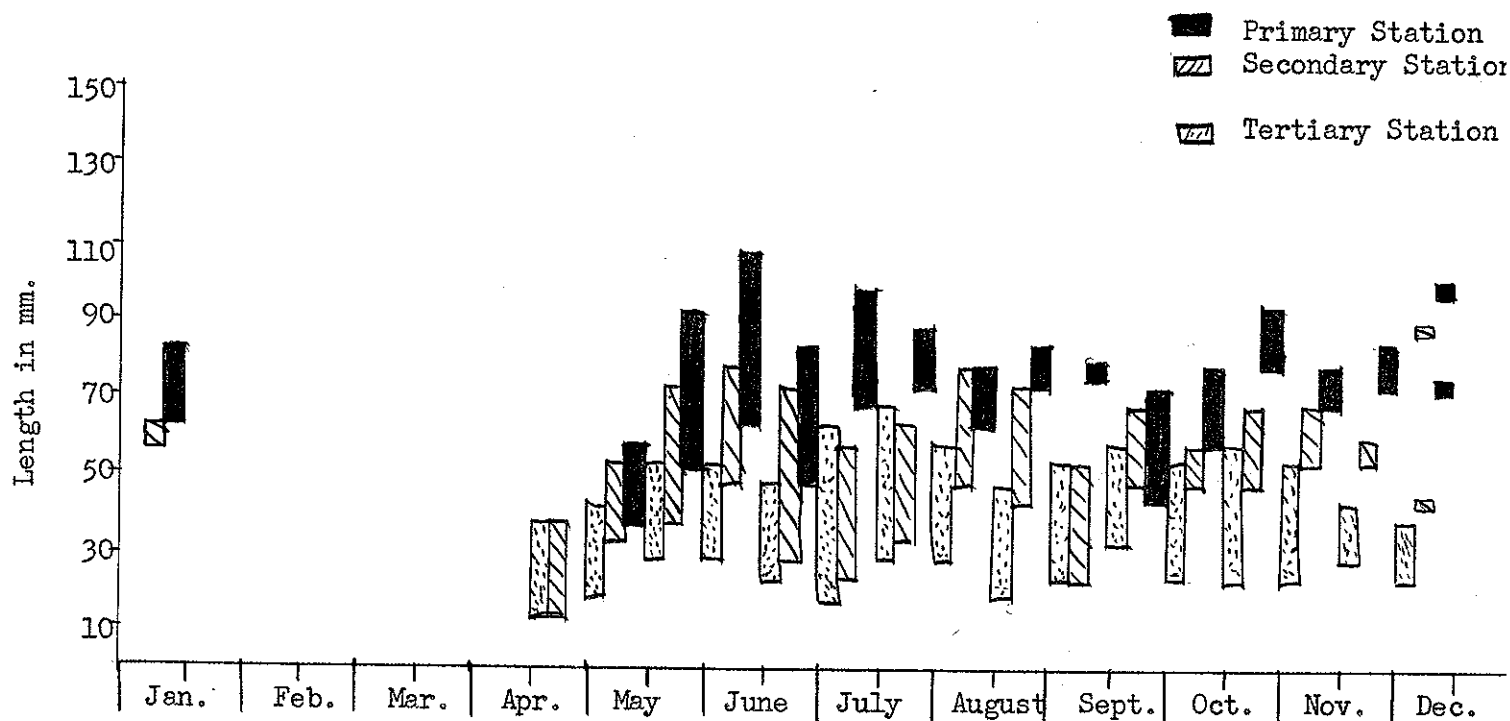


Figure 11

Matagorda Bay - Brown Shrimp Population



Average Number Per Sample by Month



Population Mode by Month

Figure 12

San Antonio Bay - Brown Shrimp Population

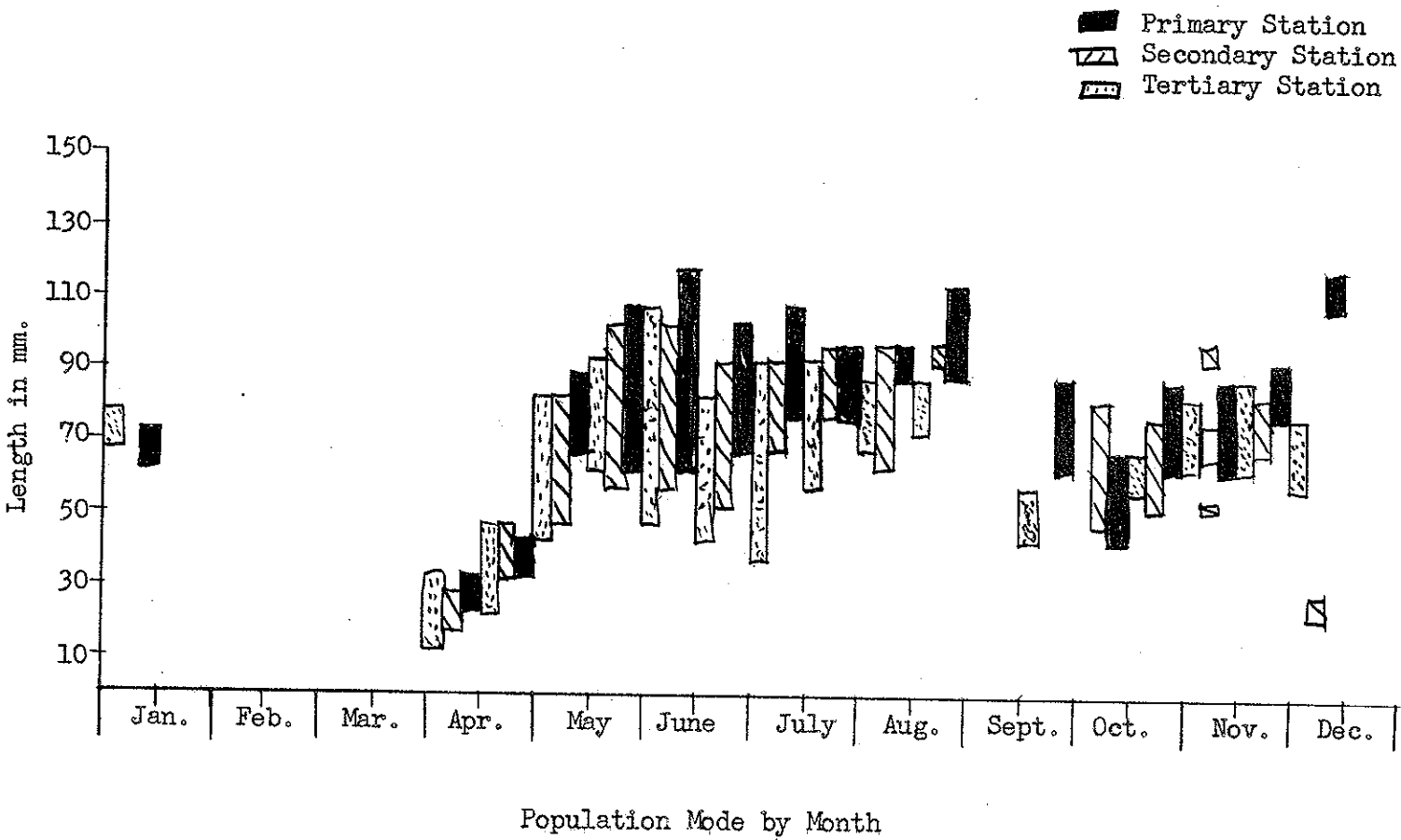
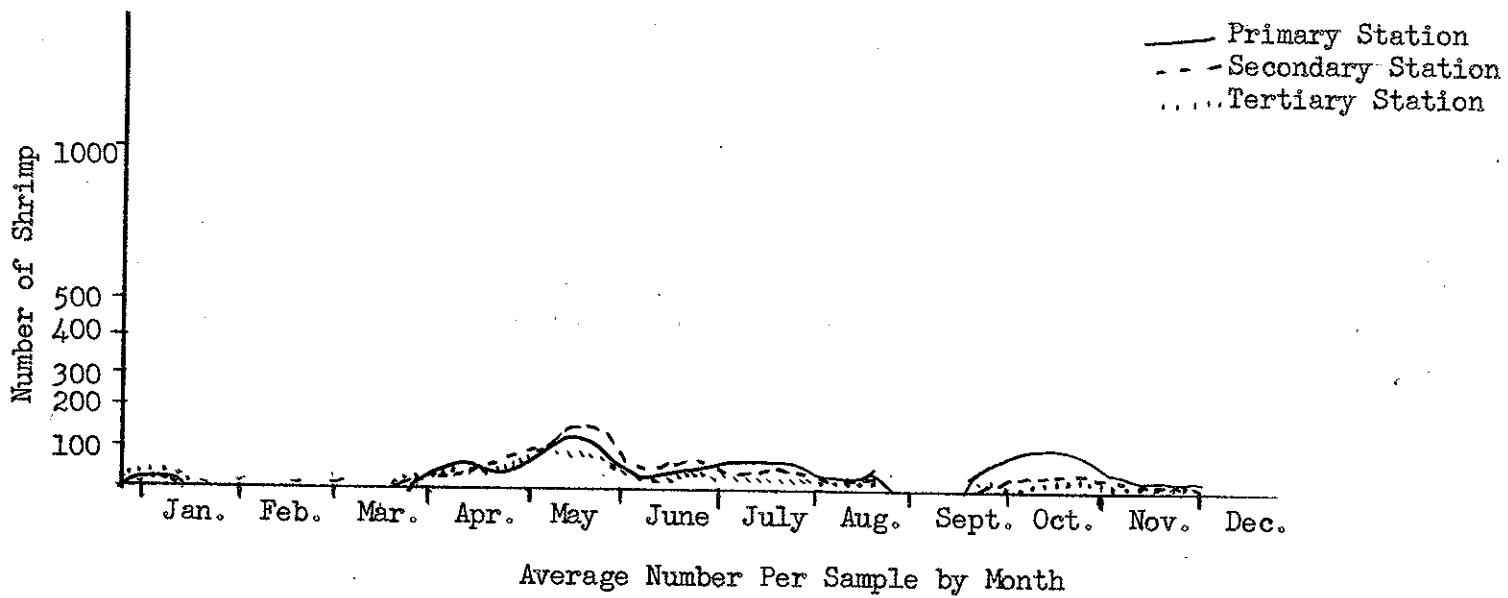


Figure 13

Aransas Bay - Brown Shrimp Population

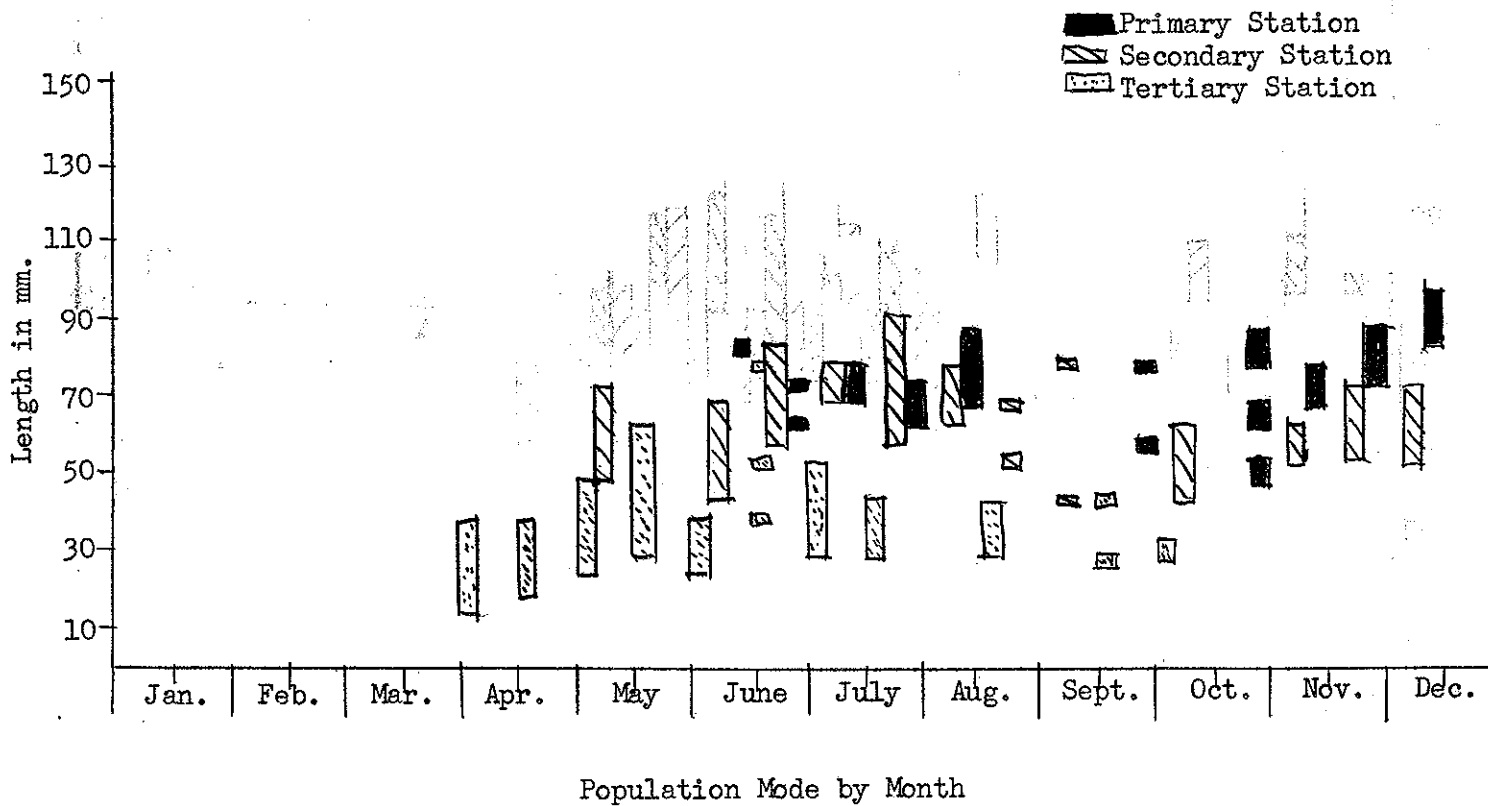
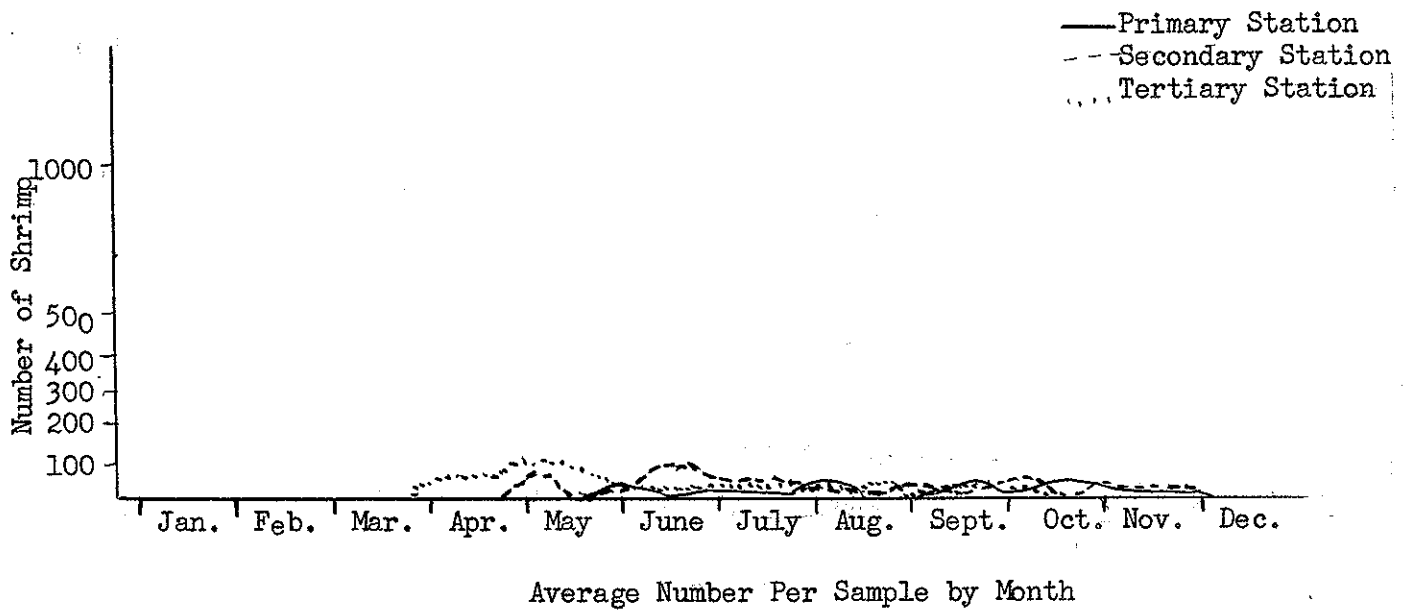
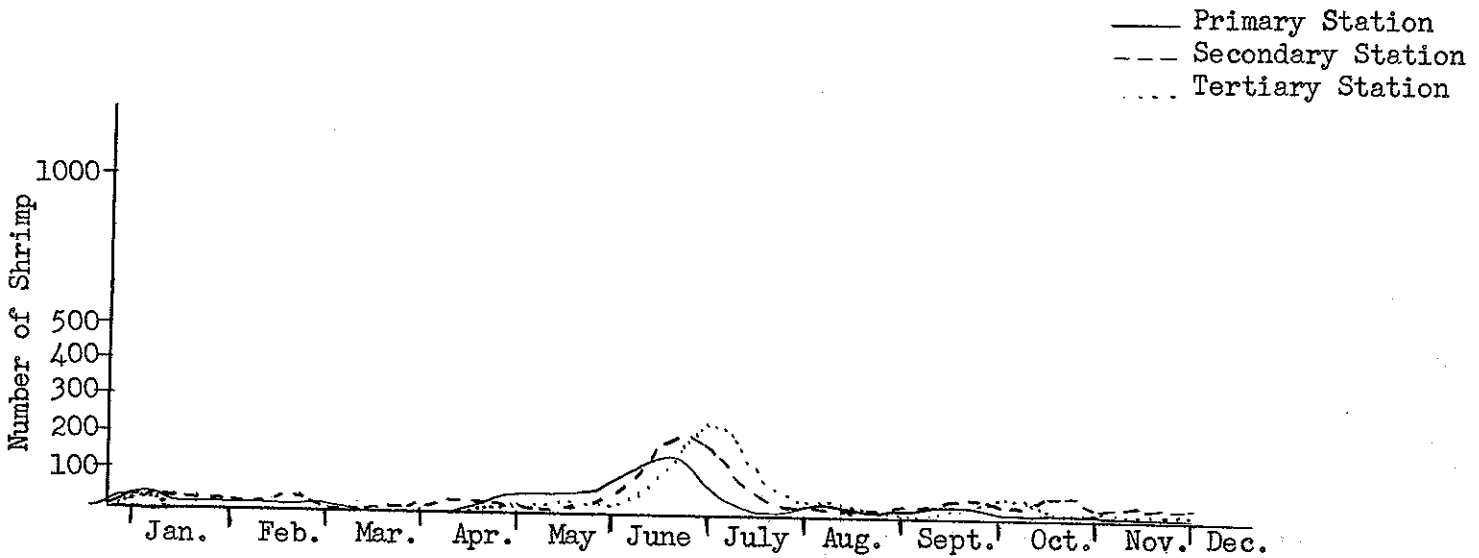
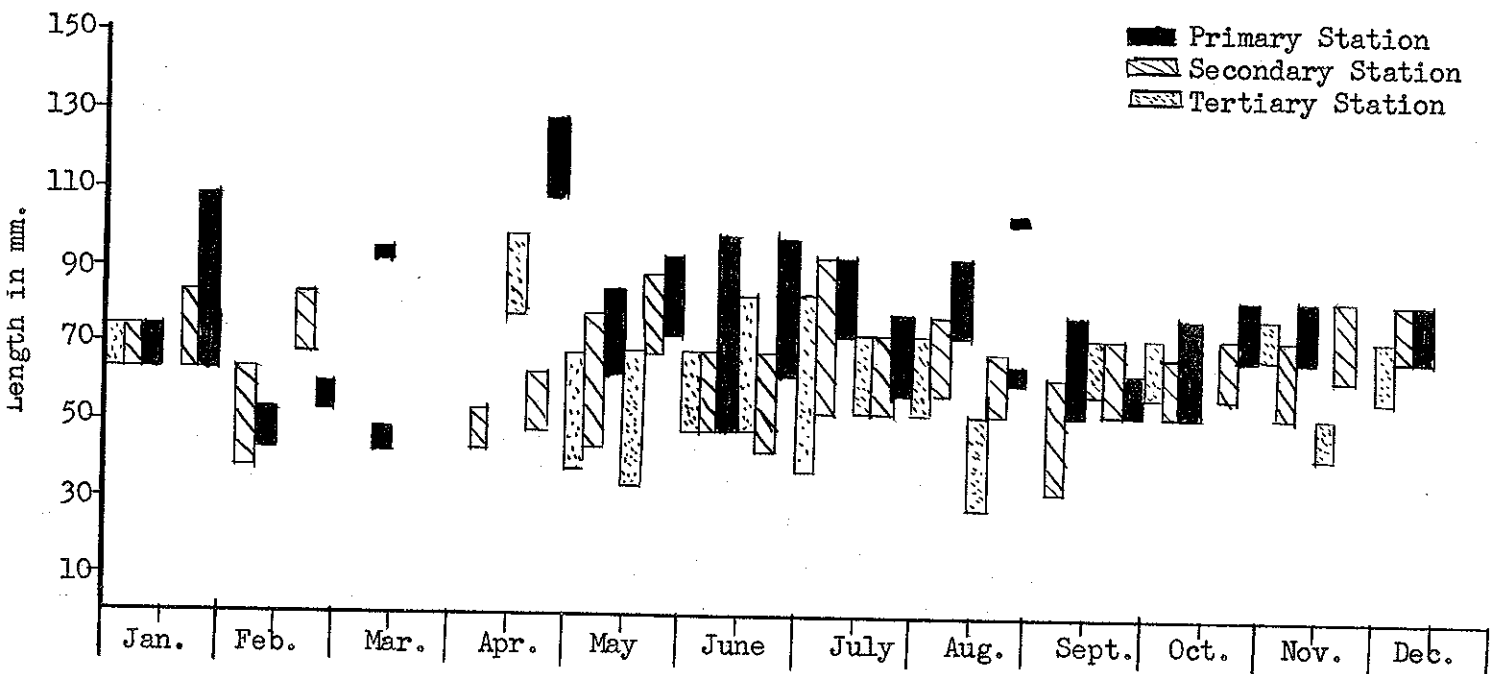


Figure 14

Corpus Christi - Brown Shrimp Population



Average Number Per Sample by Month



Population Mode by Month

Figure 15

Upper Laguna Madre - Brown Shrimp Population

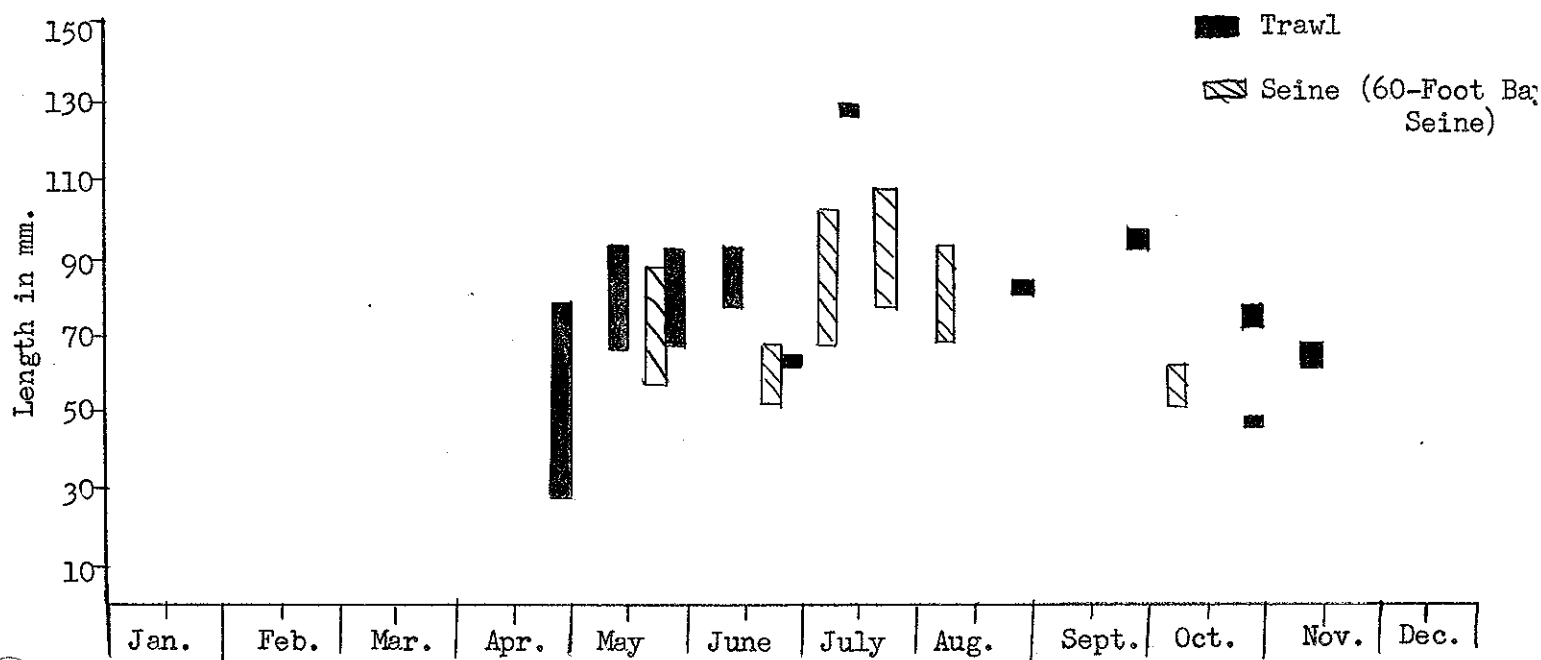
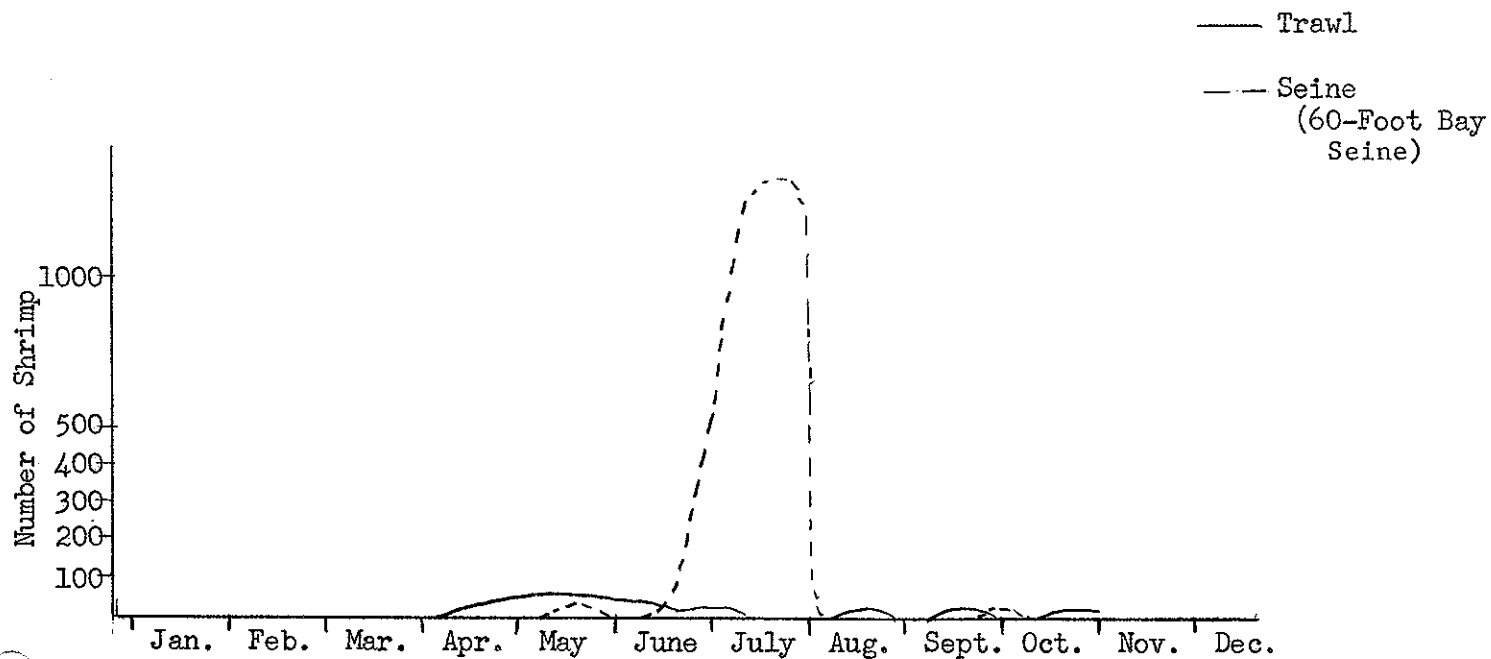


Figure 16  
Lower Laguna Madre - Brown Shrimp Population

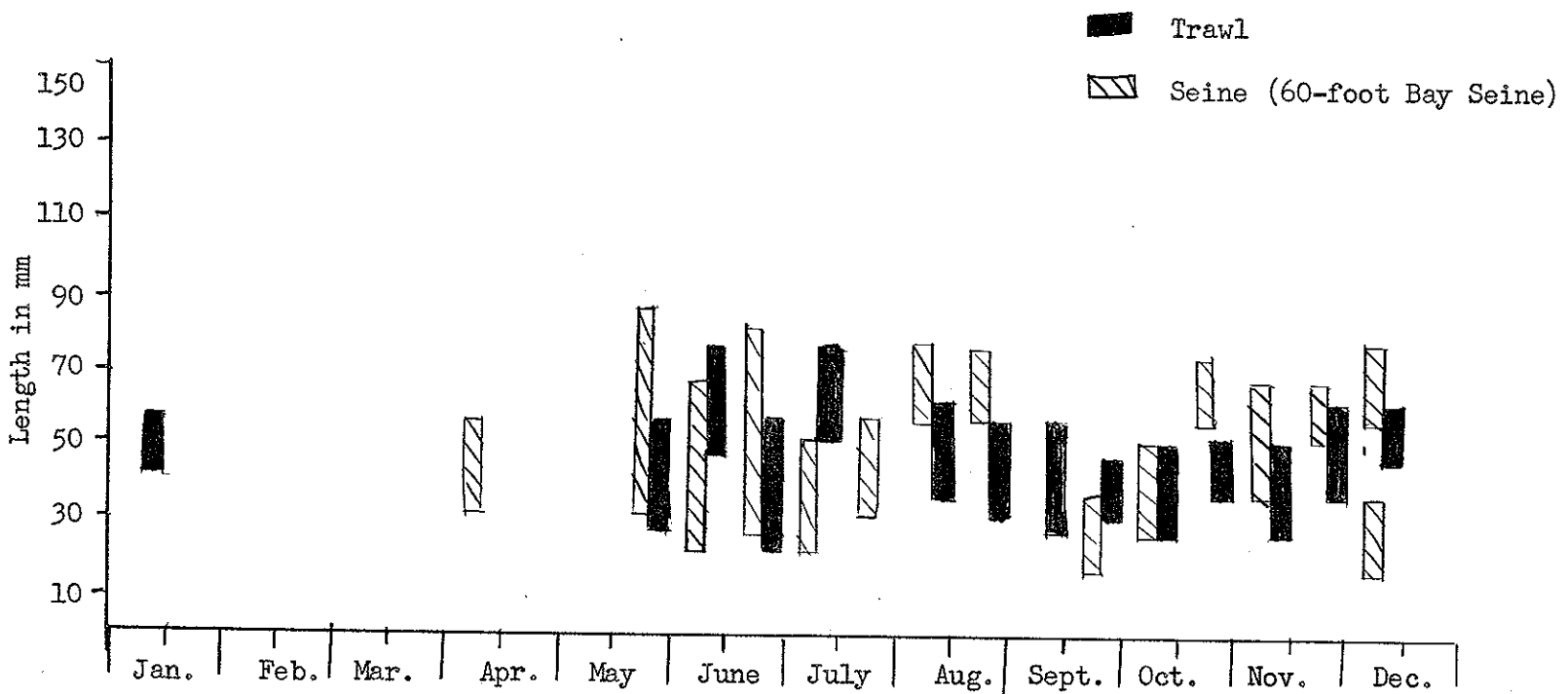
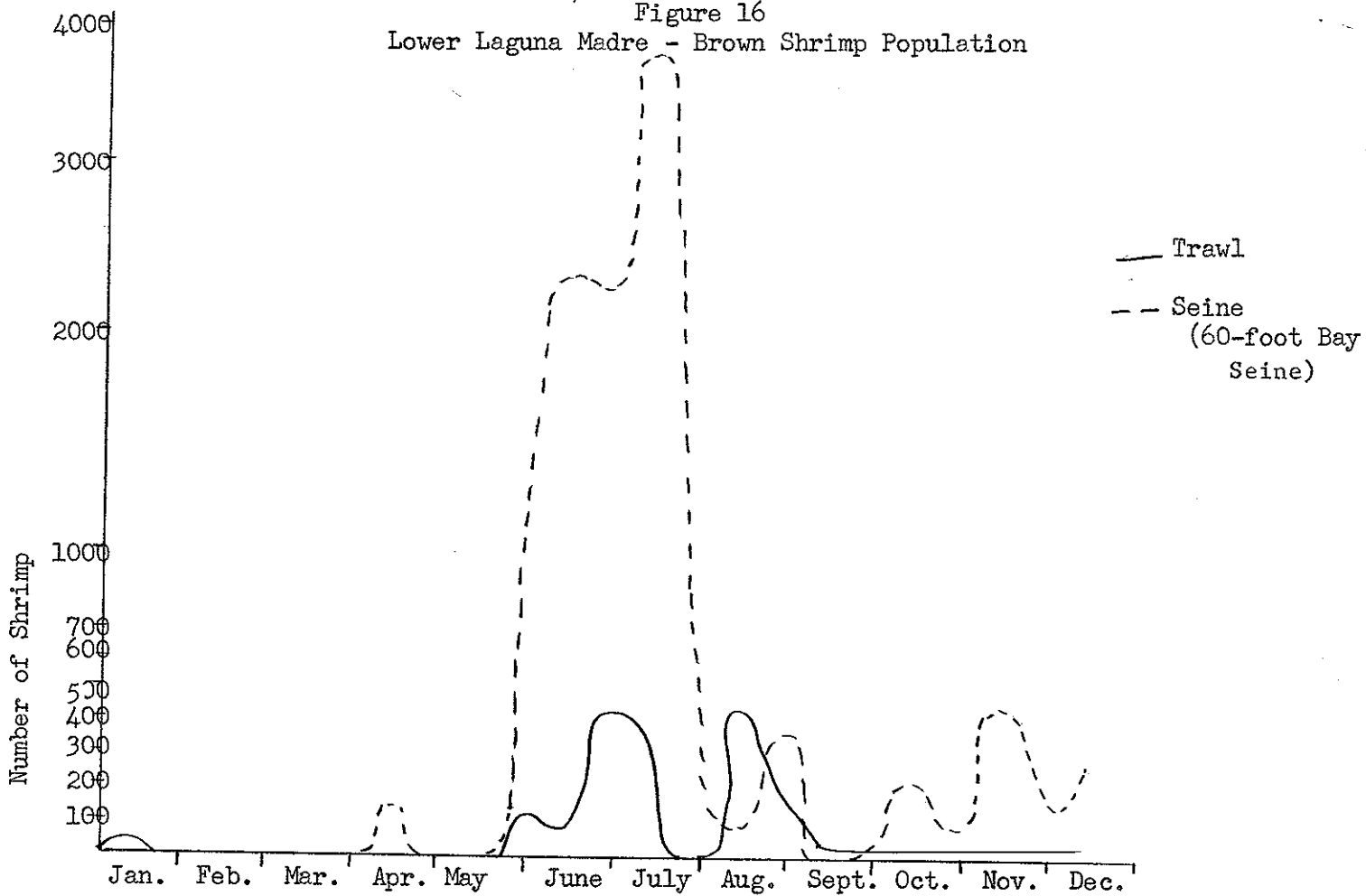
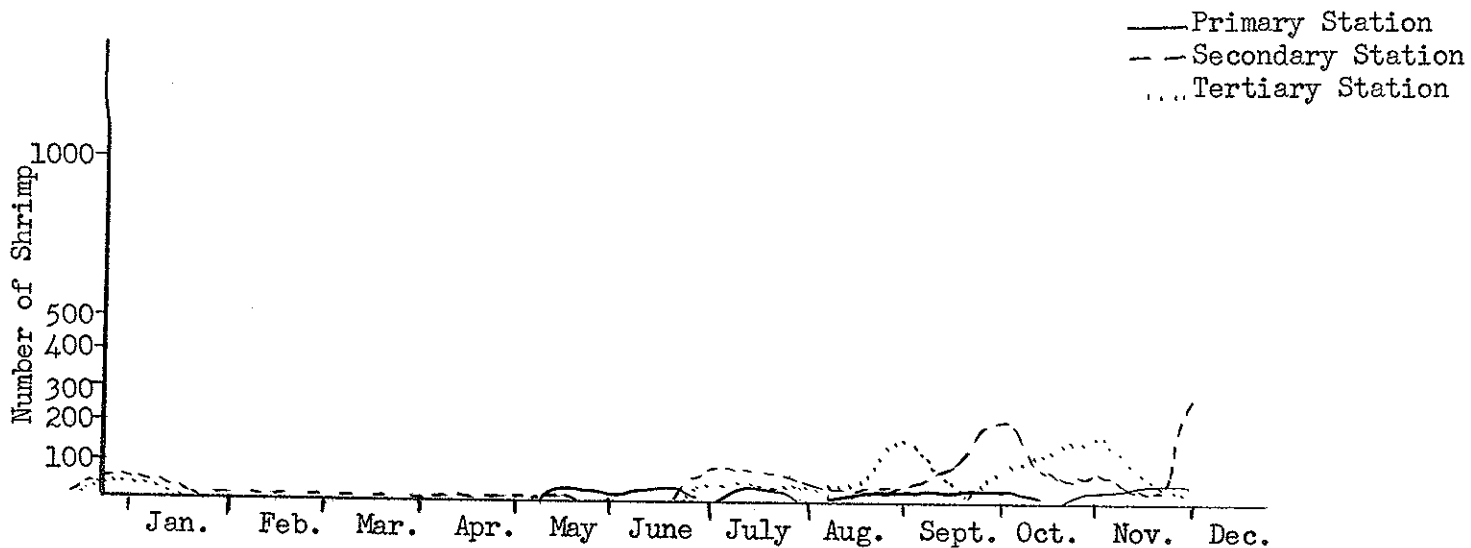
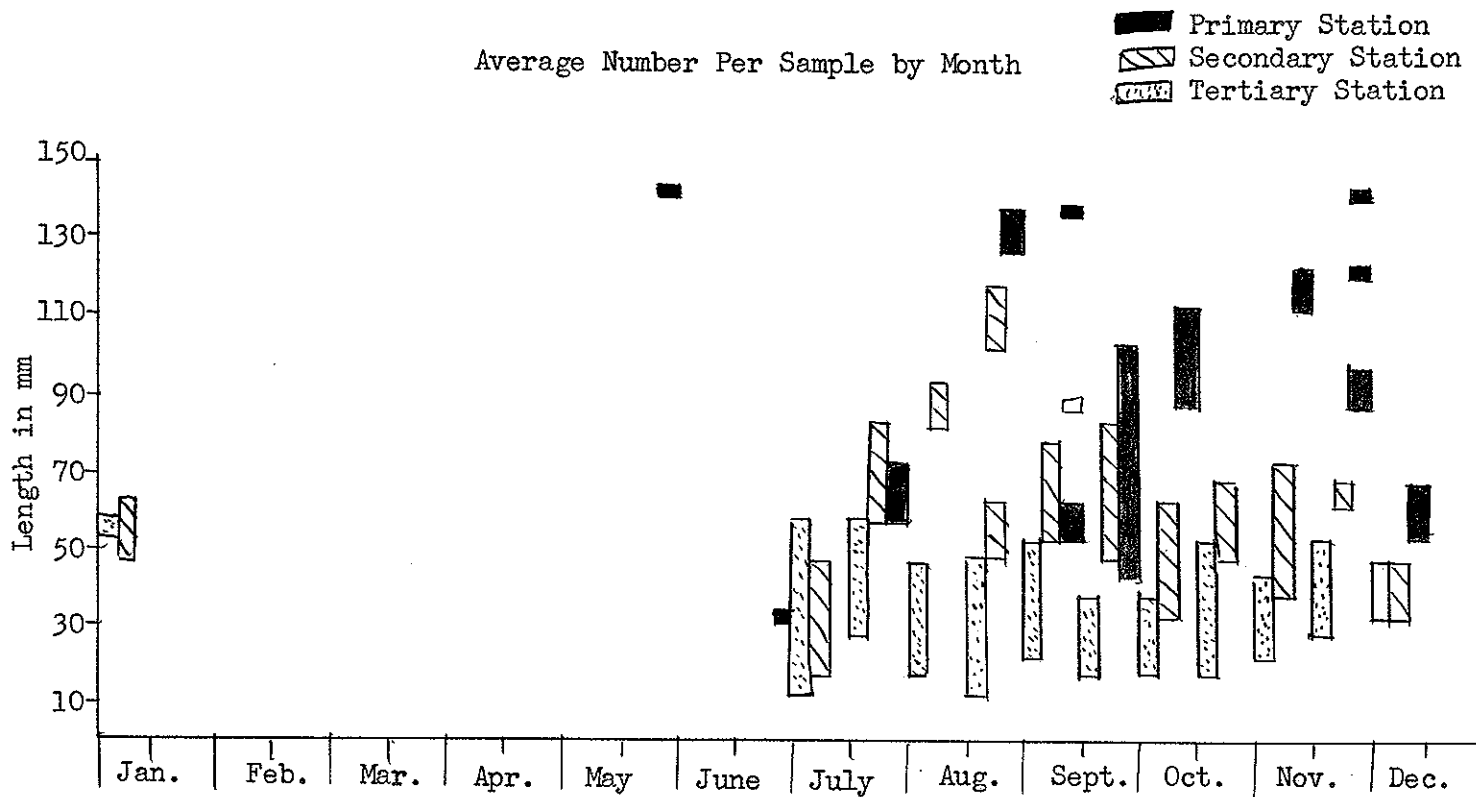


Figure 17

Galveston Bay - White Shrimp Population



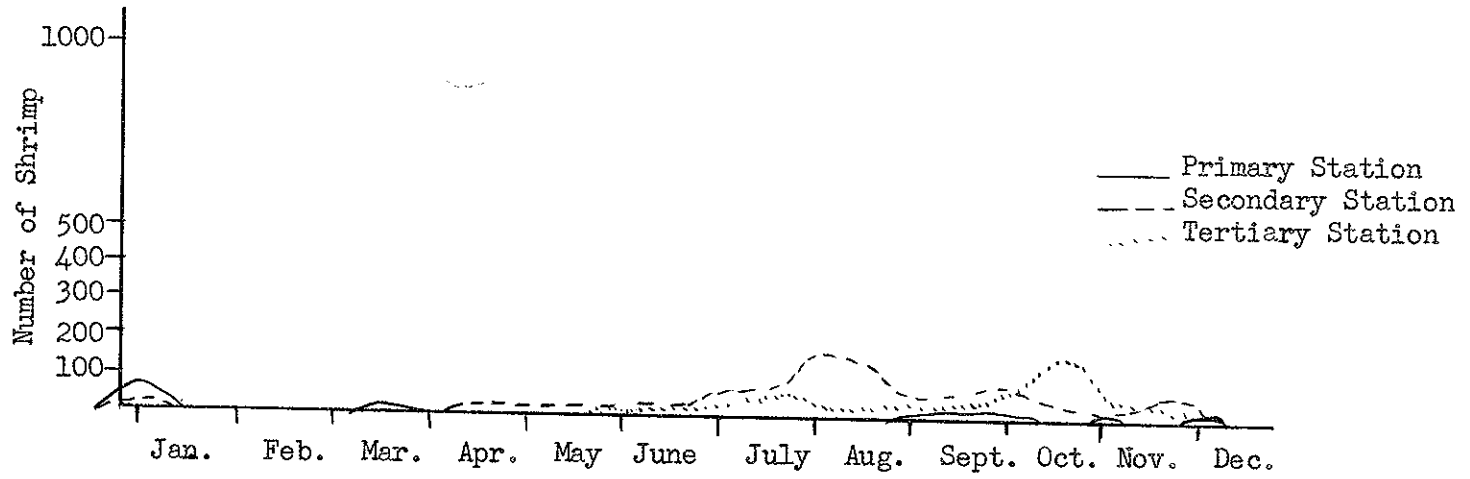
Average Number Per Sample by Month



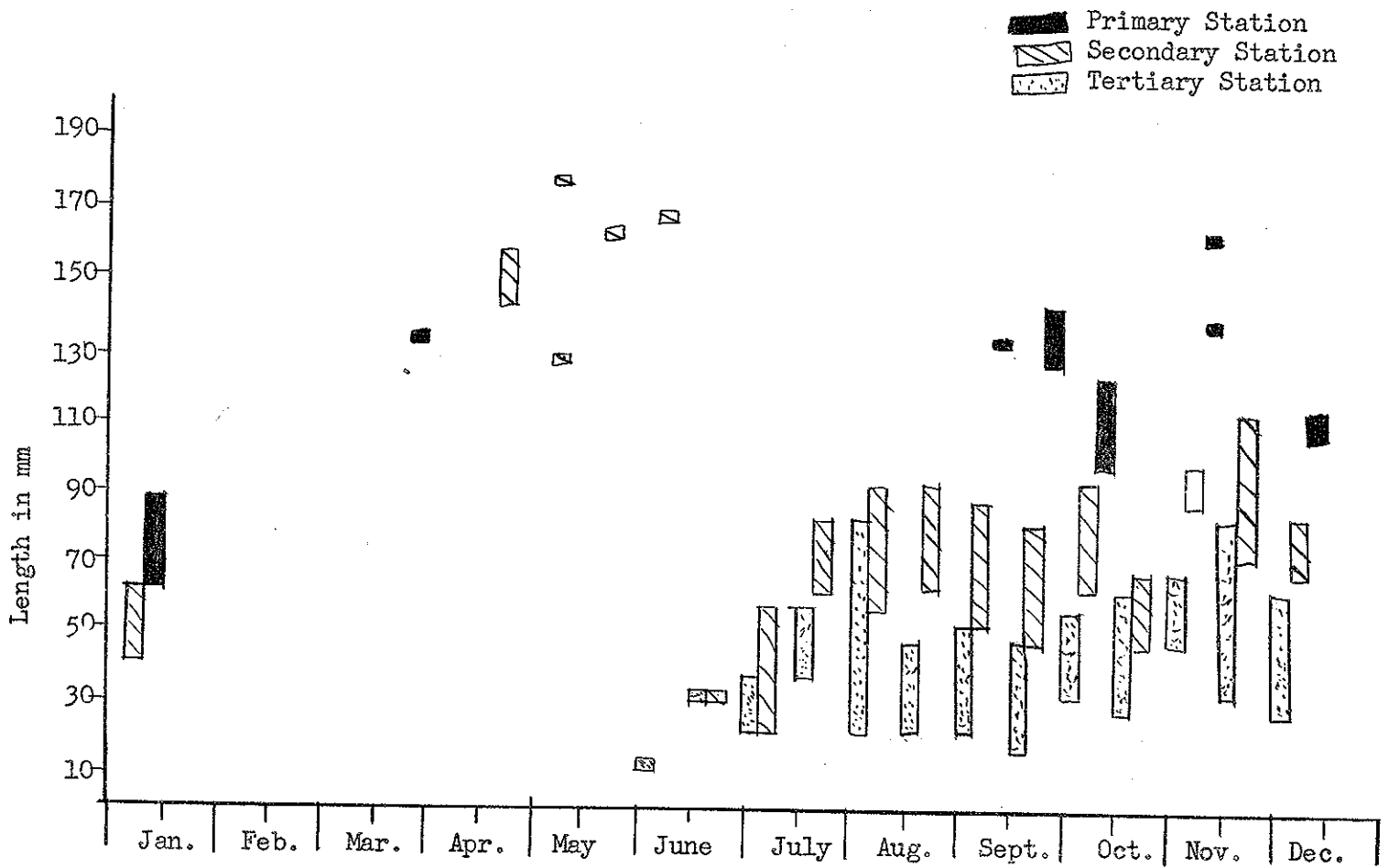
Population Mode by Month

Figure 18

Matagorda Bay - White Shrimp Population



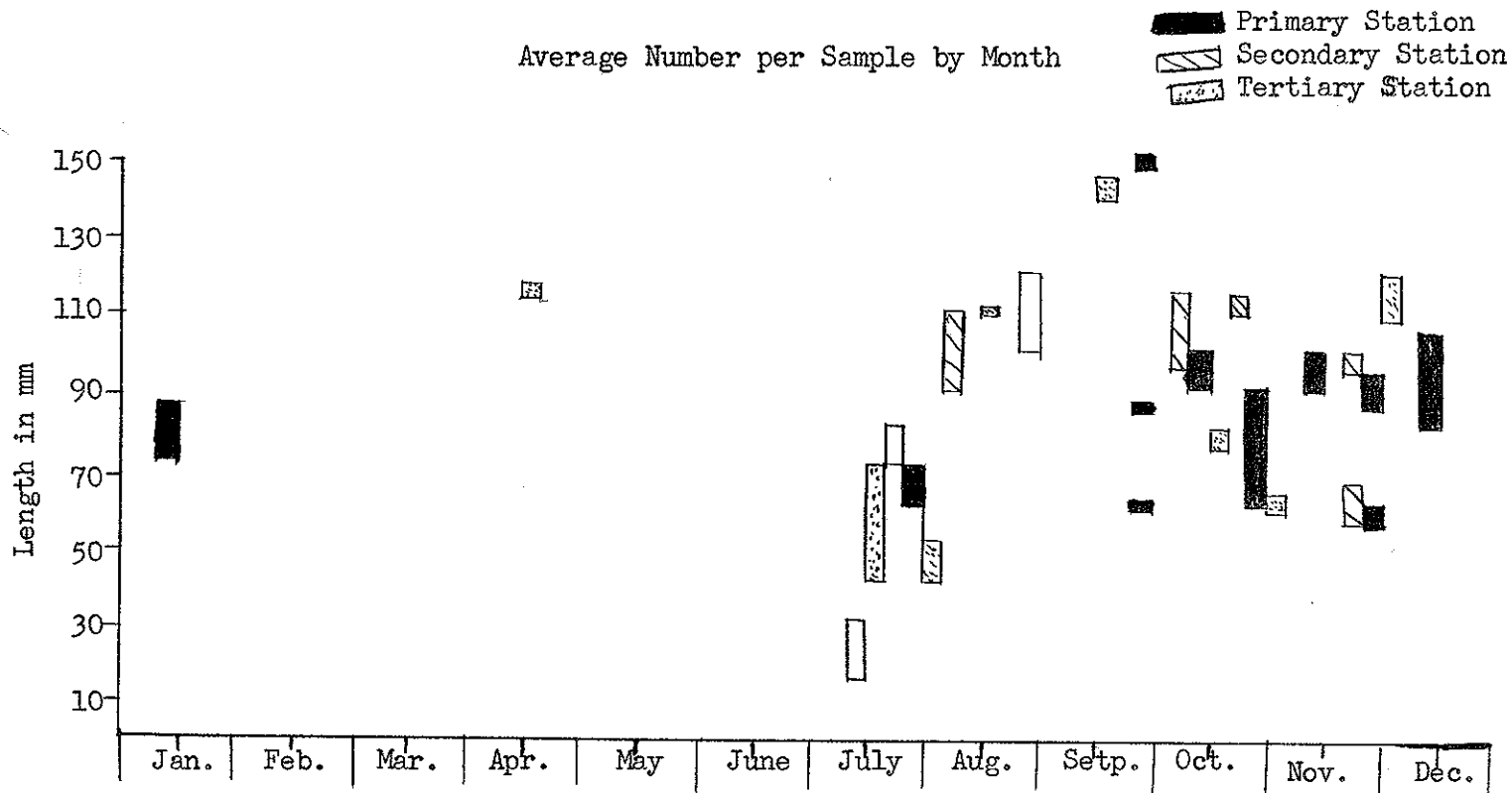
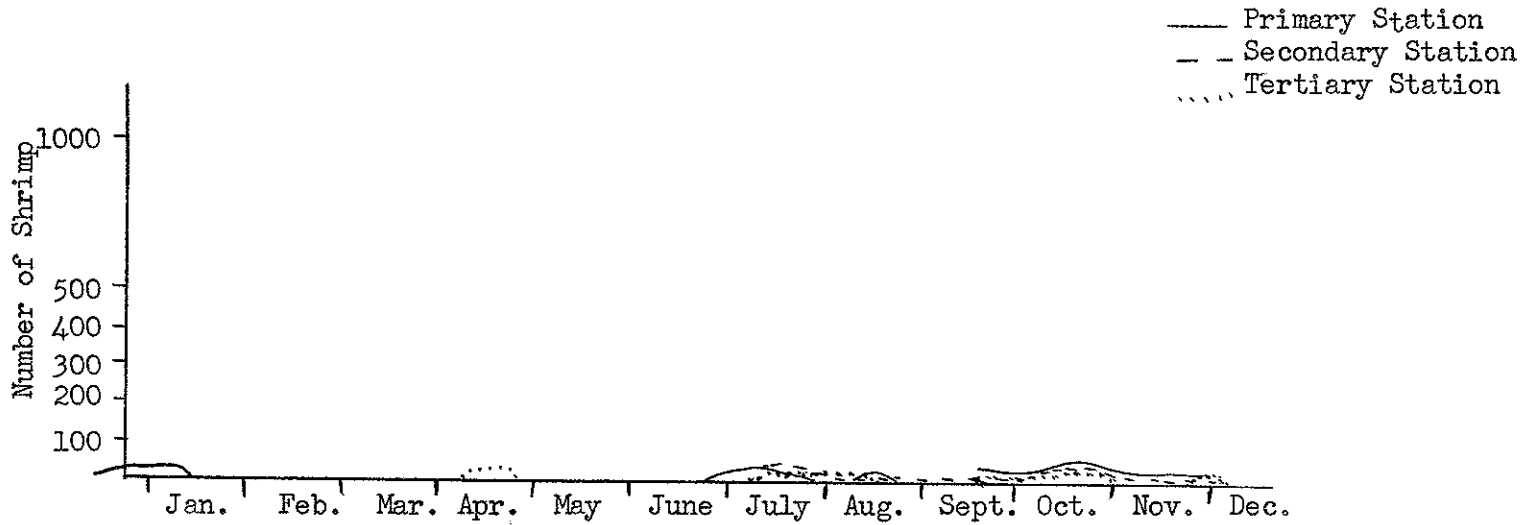
Average Number Per Sample by Month



Population Mode by Month

Figure 19

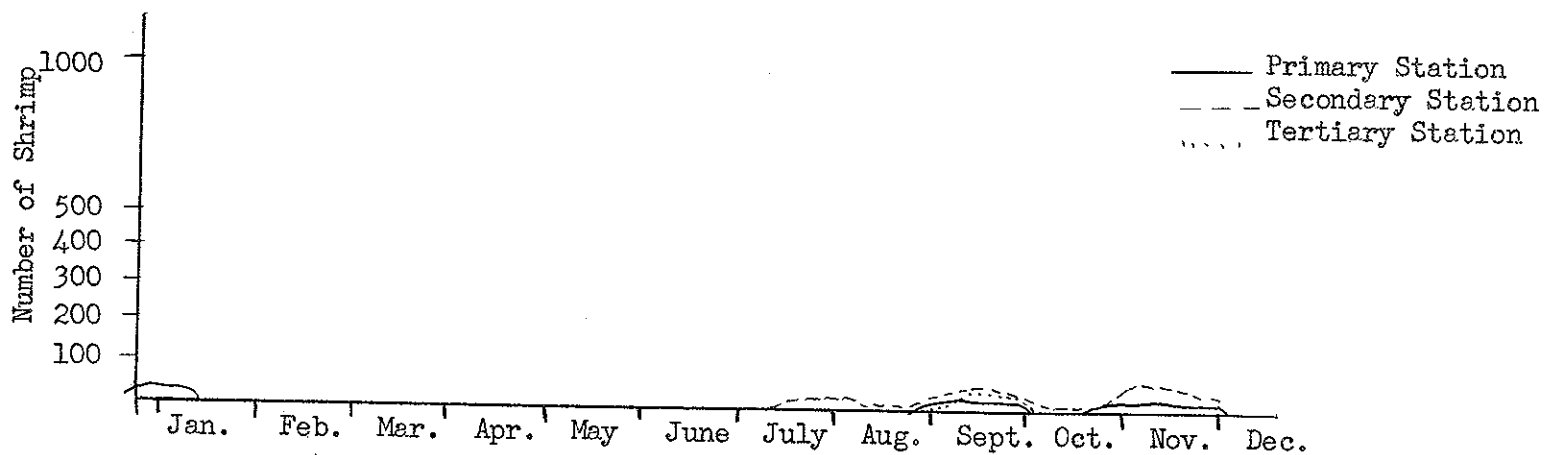
San Antonio Bay - White Shrimp Population



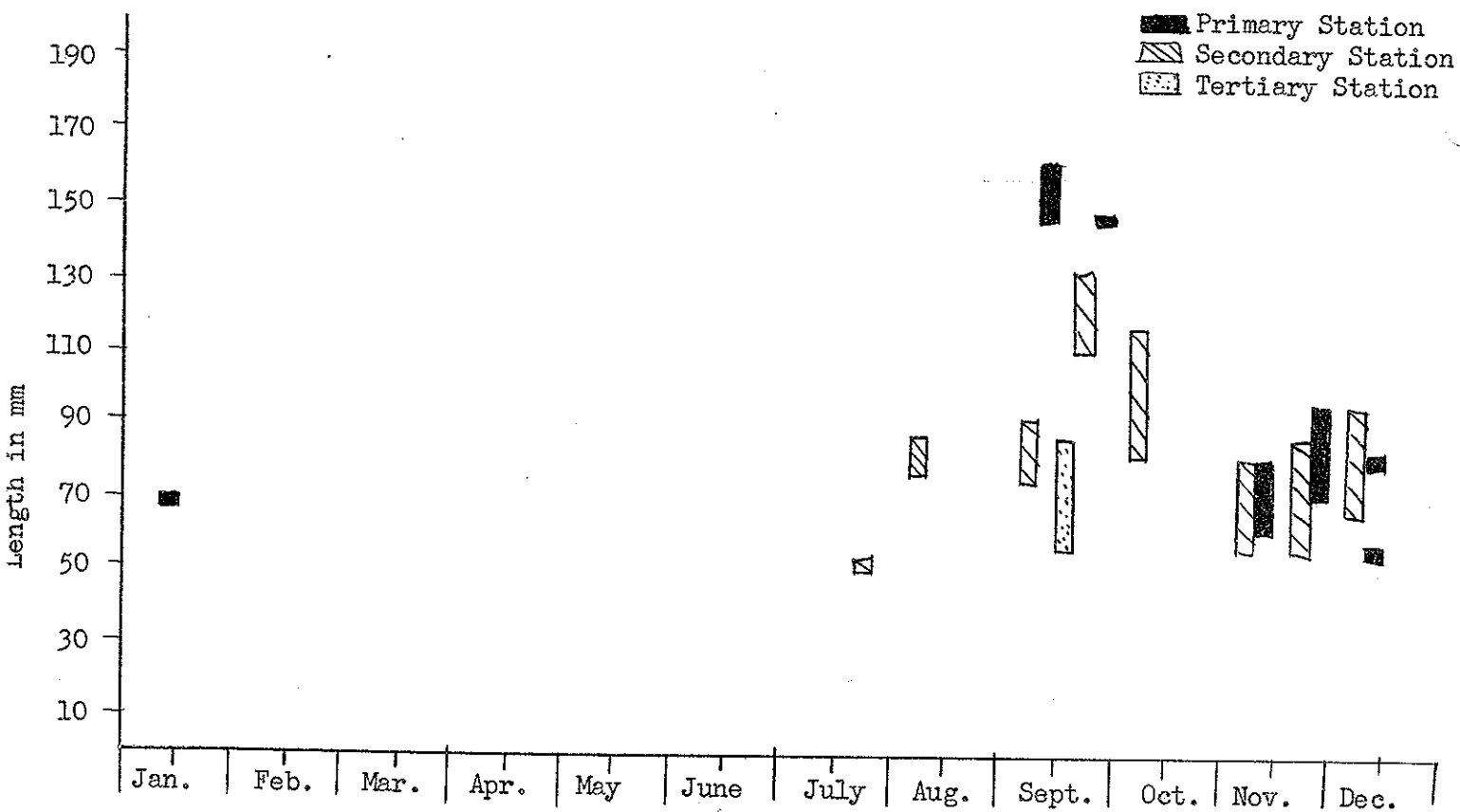
Population Mode by Month

Figure 20

Aransas Bay - White Shrimp Population



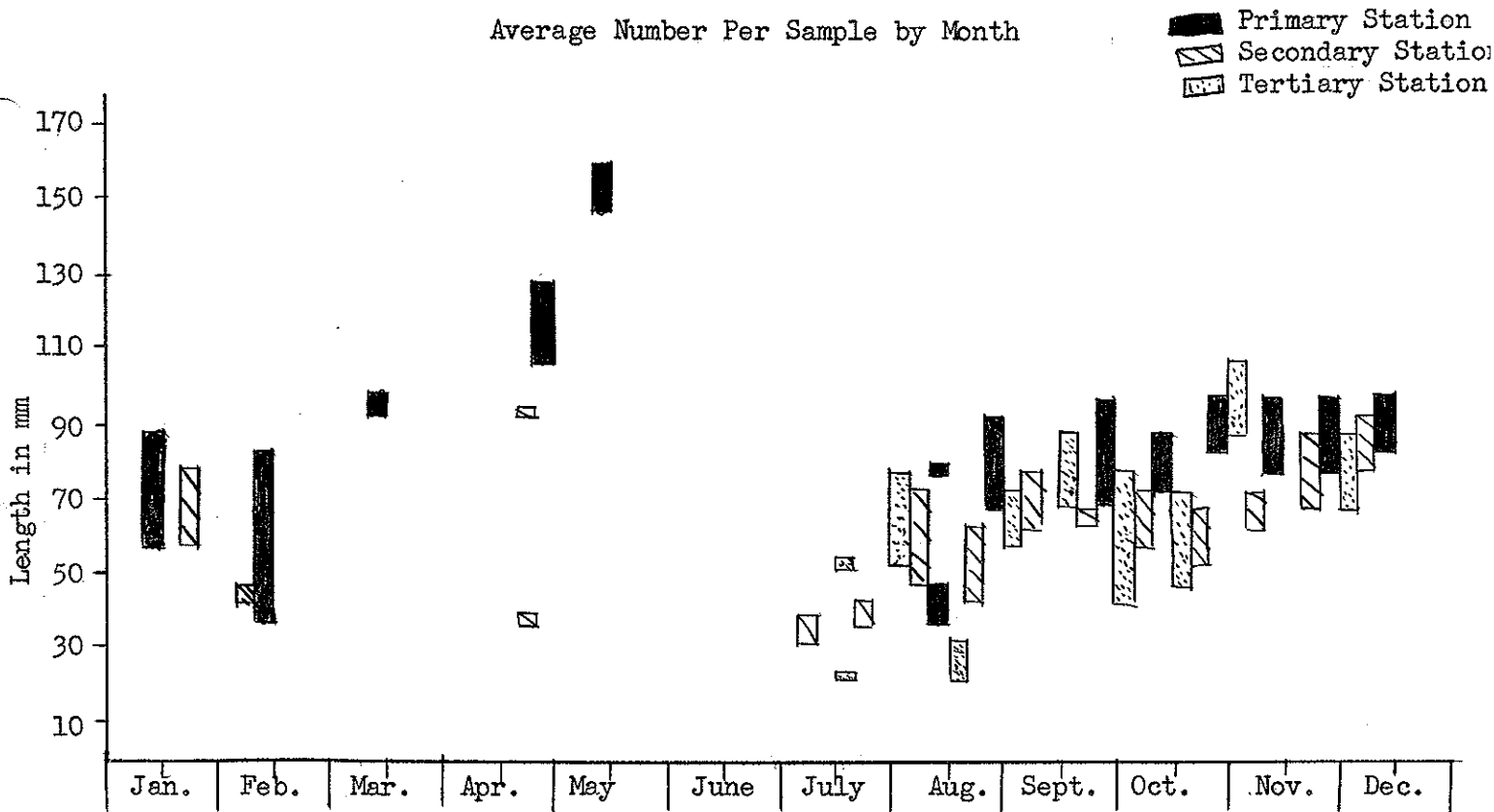
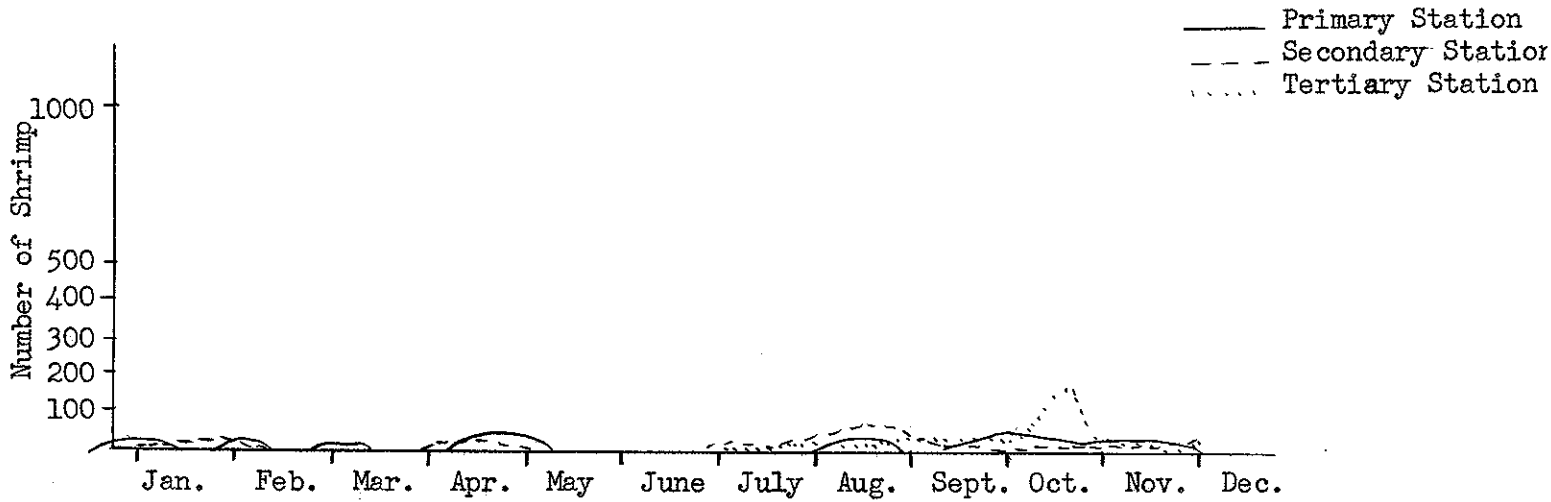
Average Number Per Sample by Month



Population Mode by Month

Figure 21

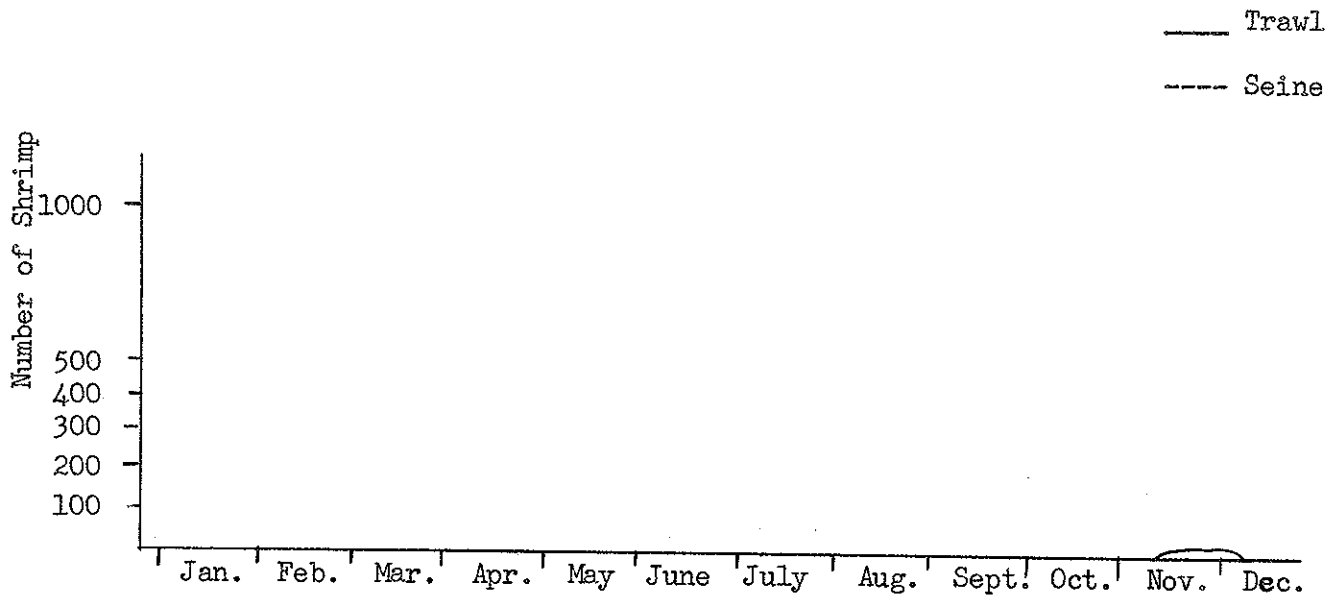
Corpus Christi Bay - White Shrimp Population



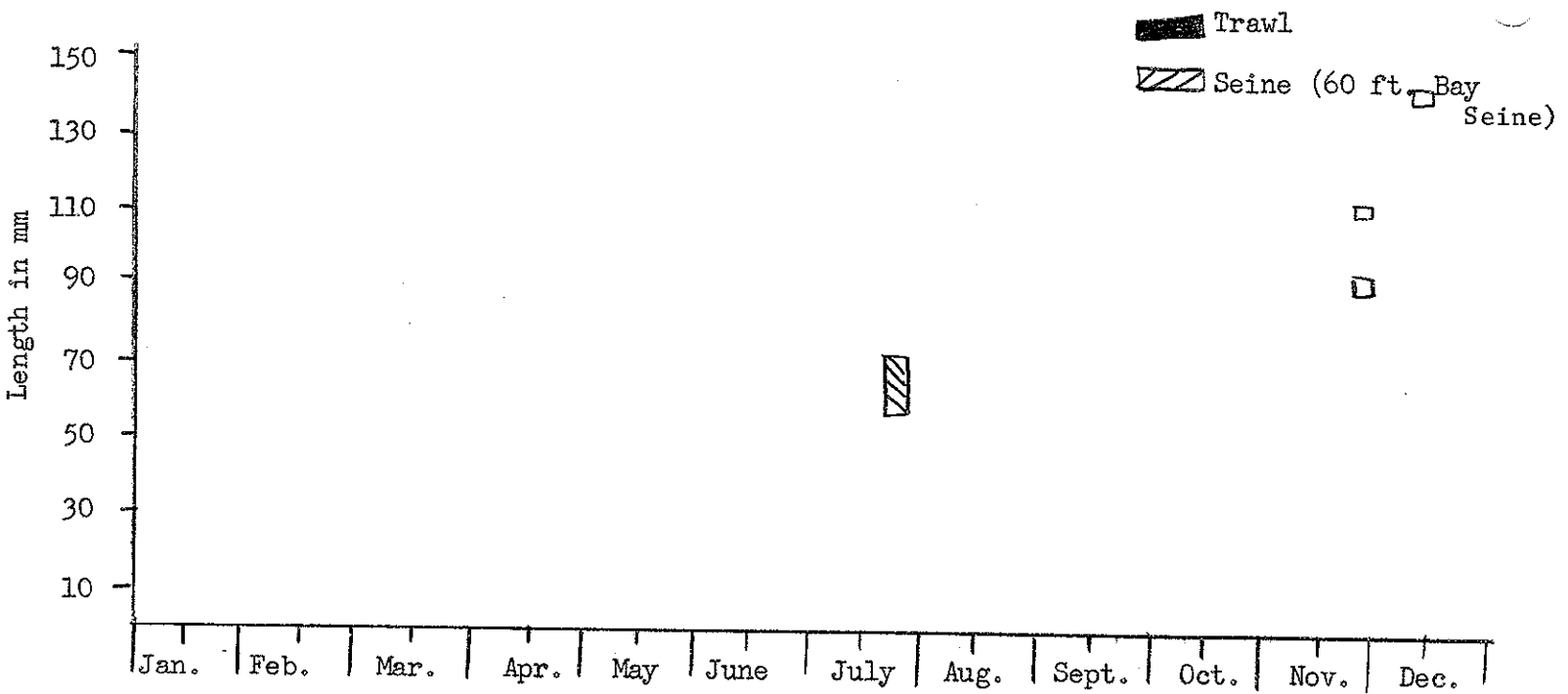
Population Mode by Month

Figure 22

Upper Laguna Madre - White Shrimp Population



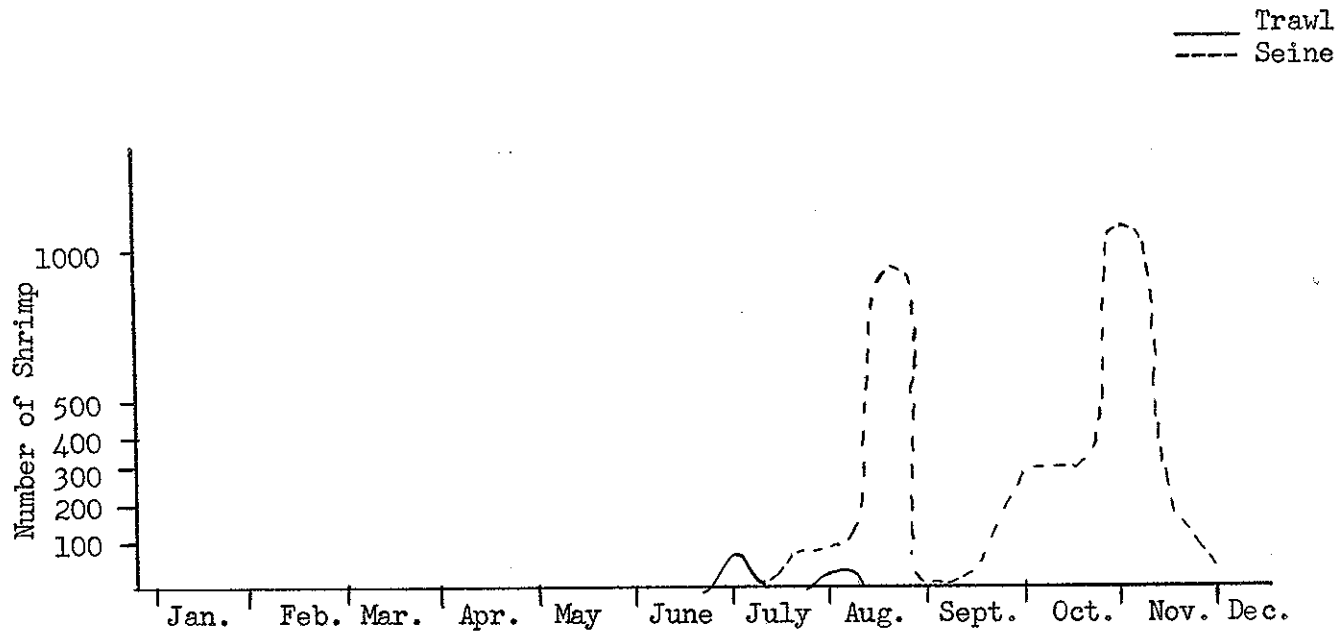
Average Number Per Sample by Month



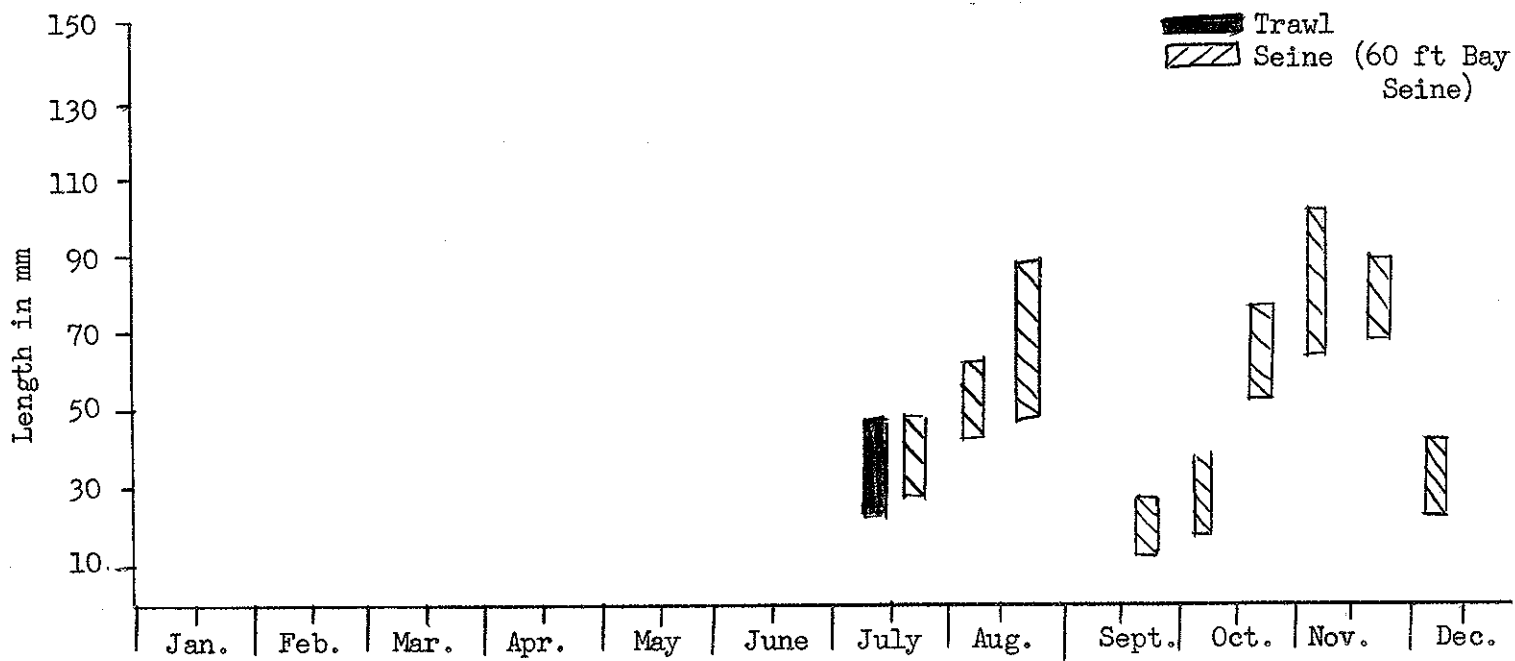
Population Mode by Month

Figure 23

Lower Laguna Madre - White Shrimp Population



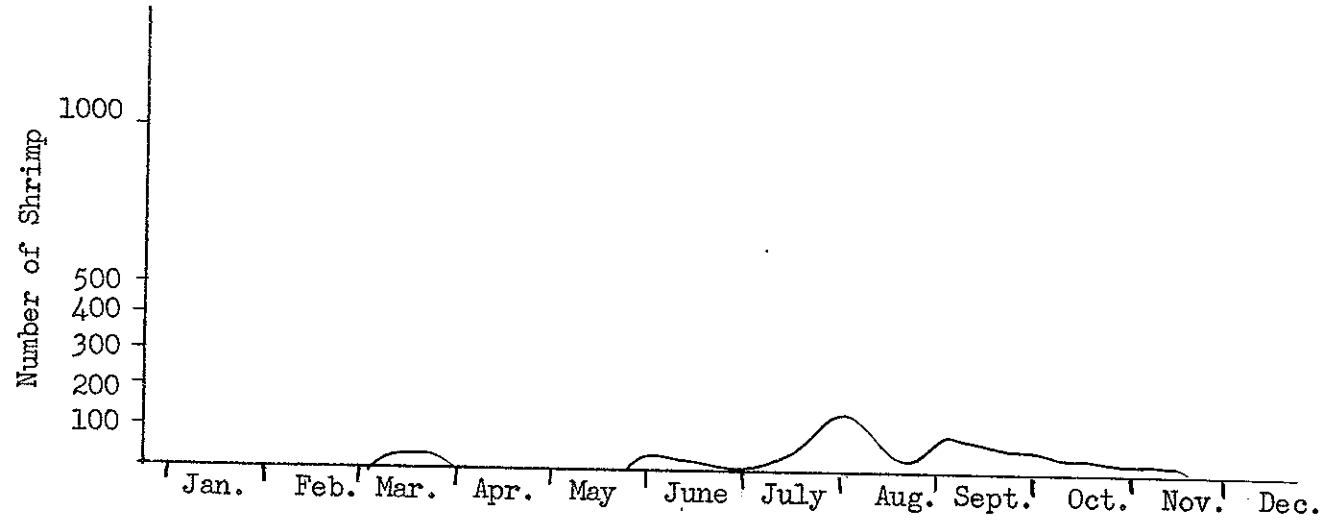
Average Number Per Sample by Month



Population Mode by Month

Figure 24  
Gulf - Brown Shrimp Population

42-foot Trawl



42-foot Trawl

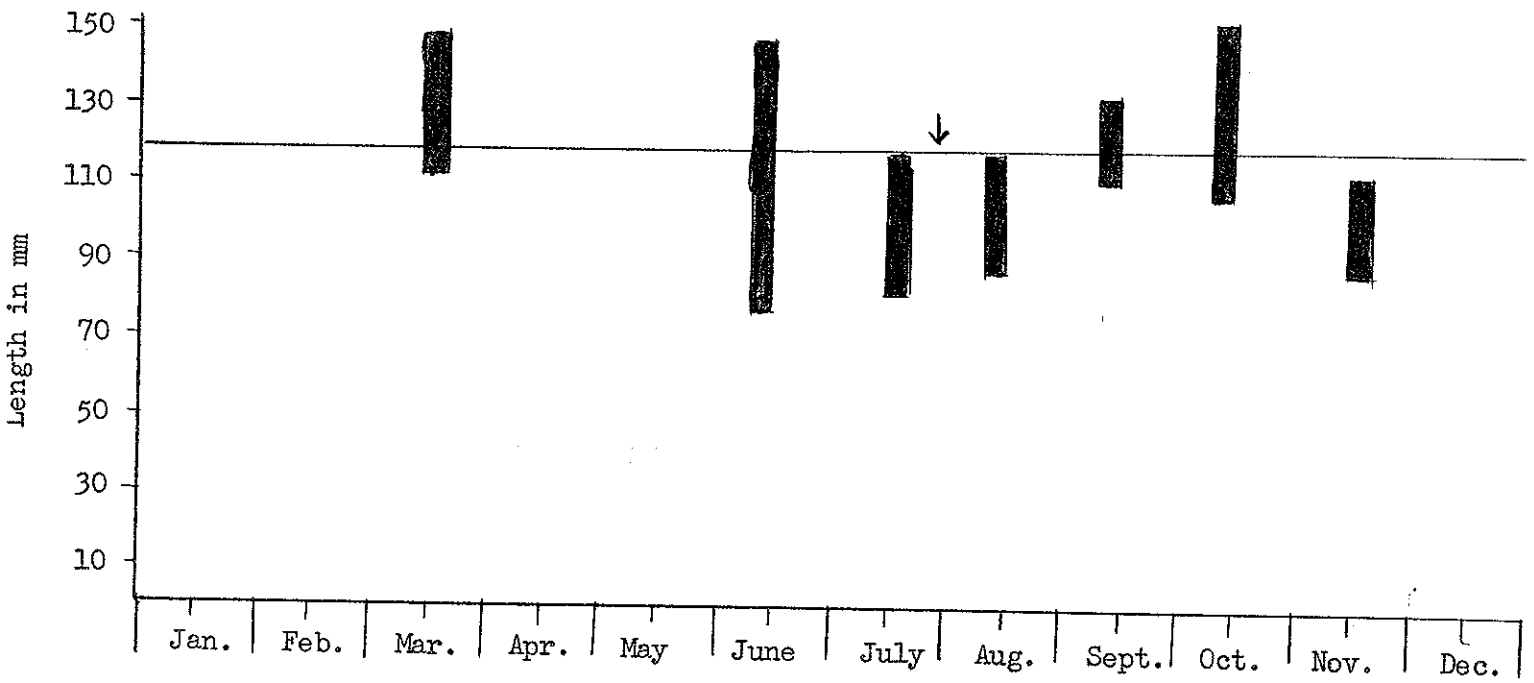


Figure 25

Gulf - White Shrimp Population

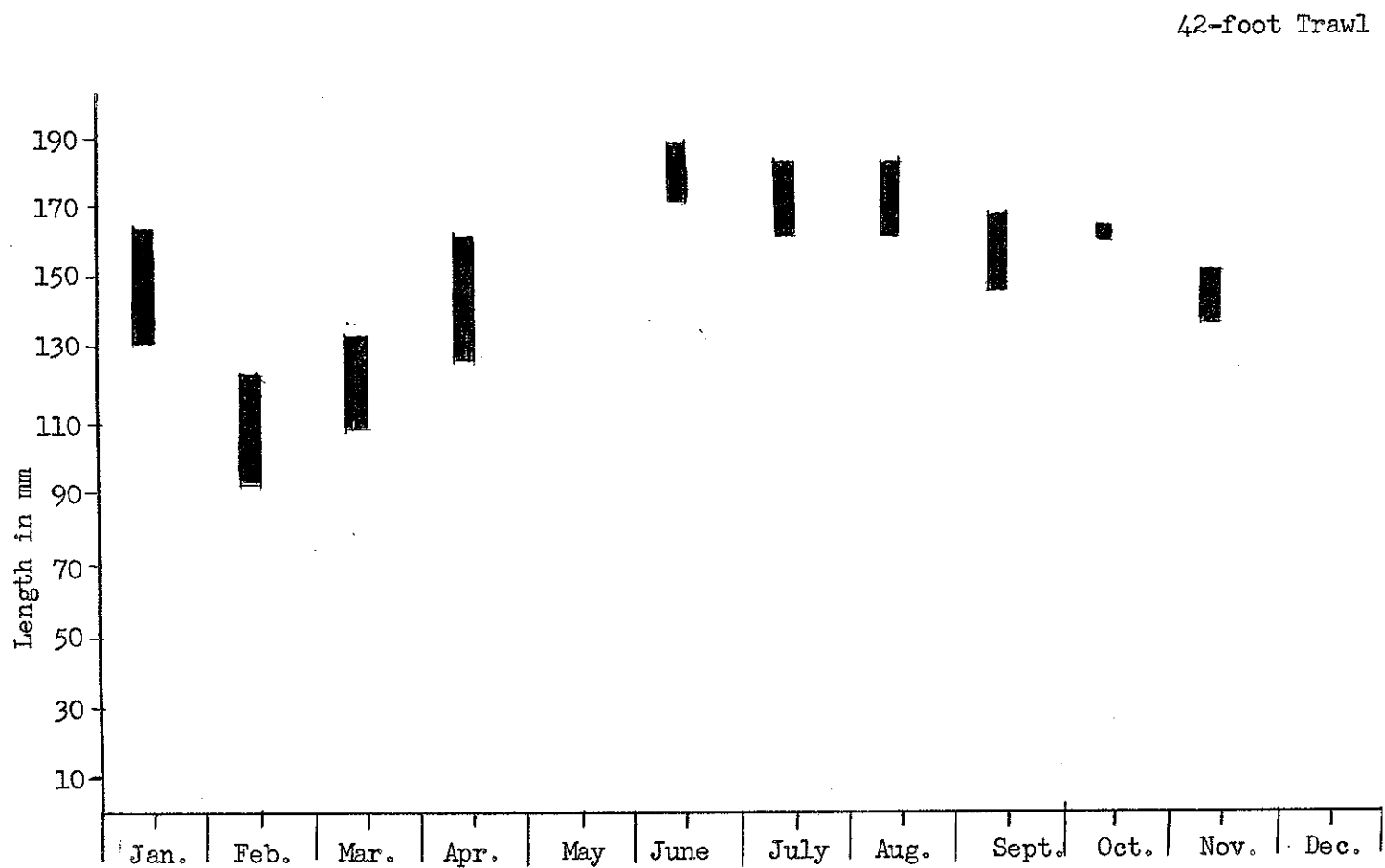
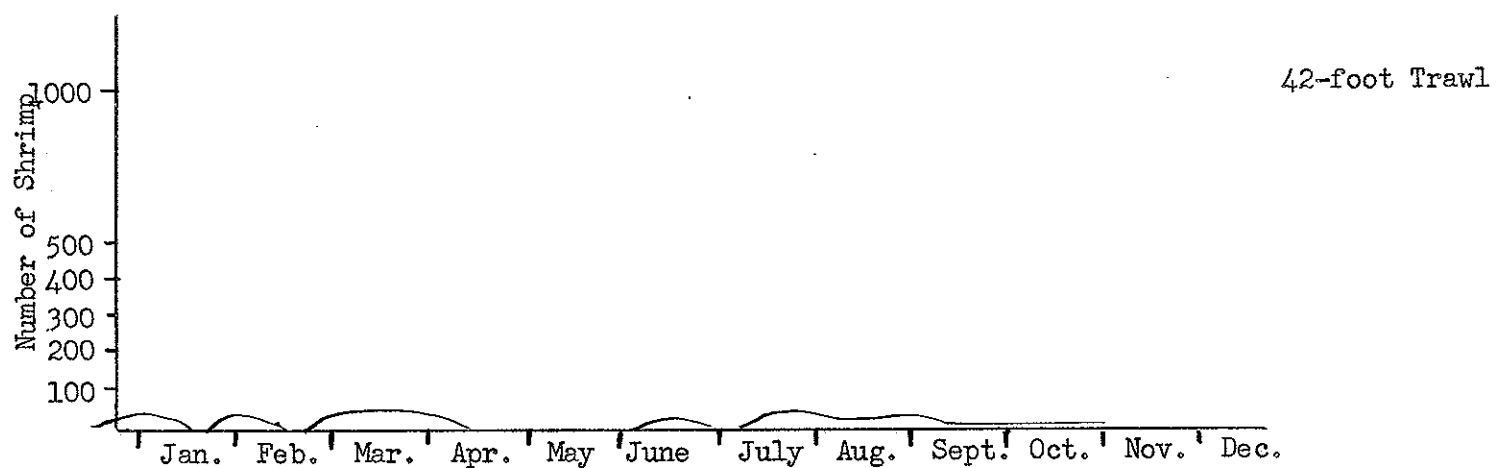


Figure 26

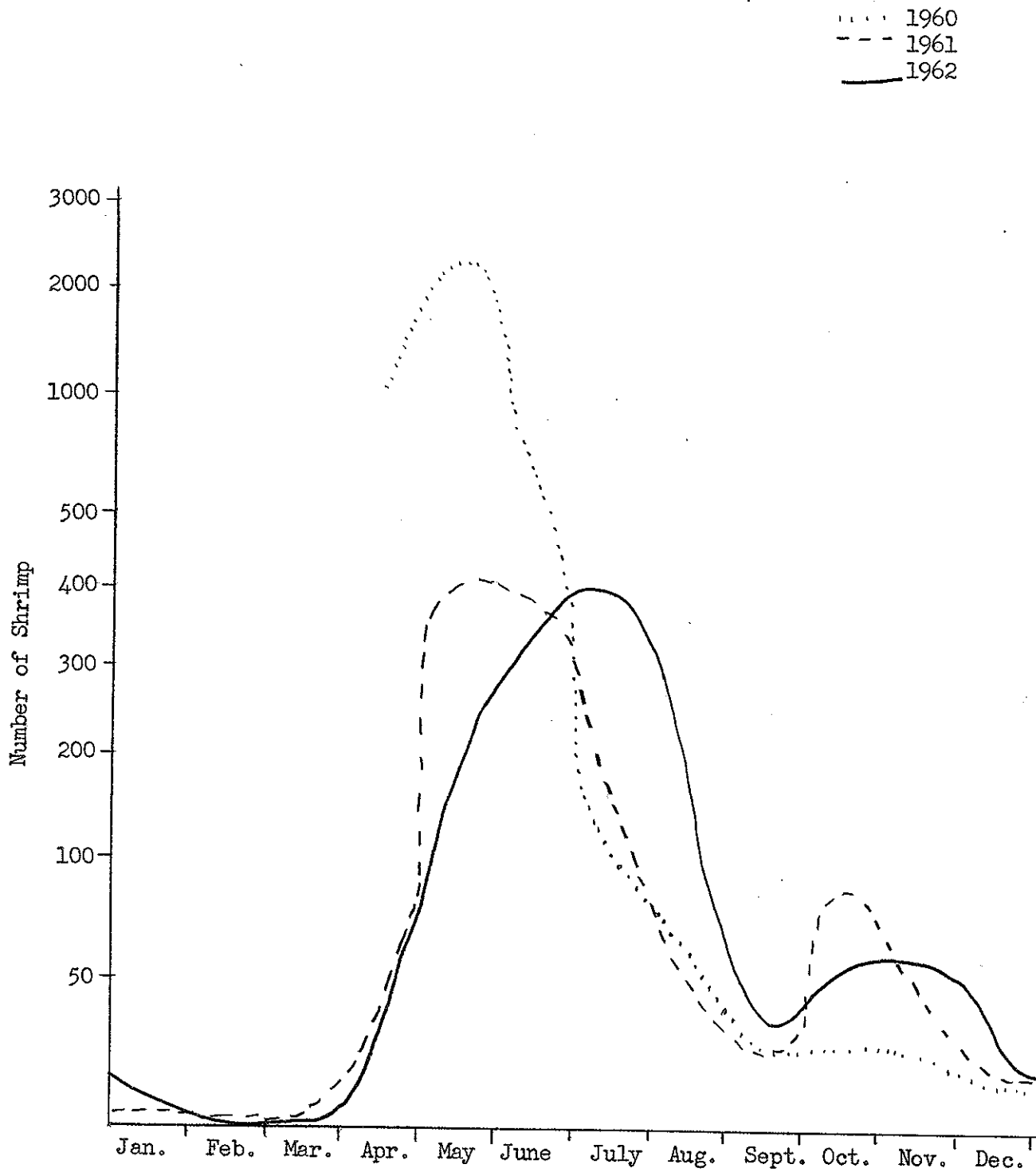


Figure 27

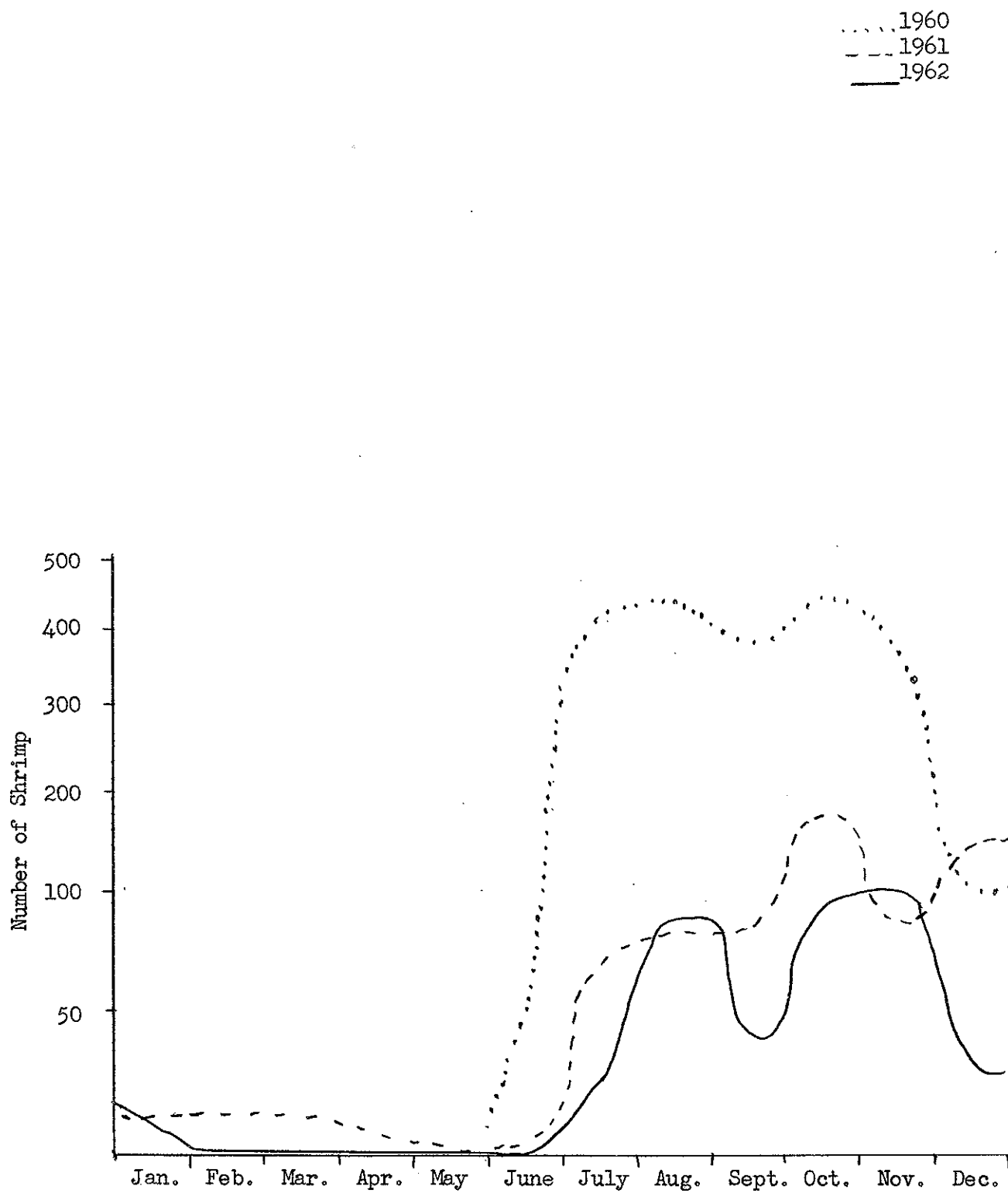
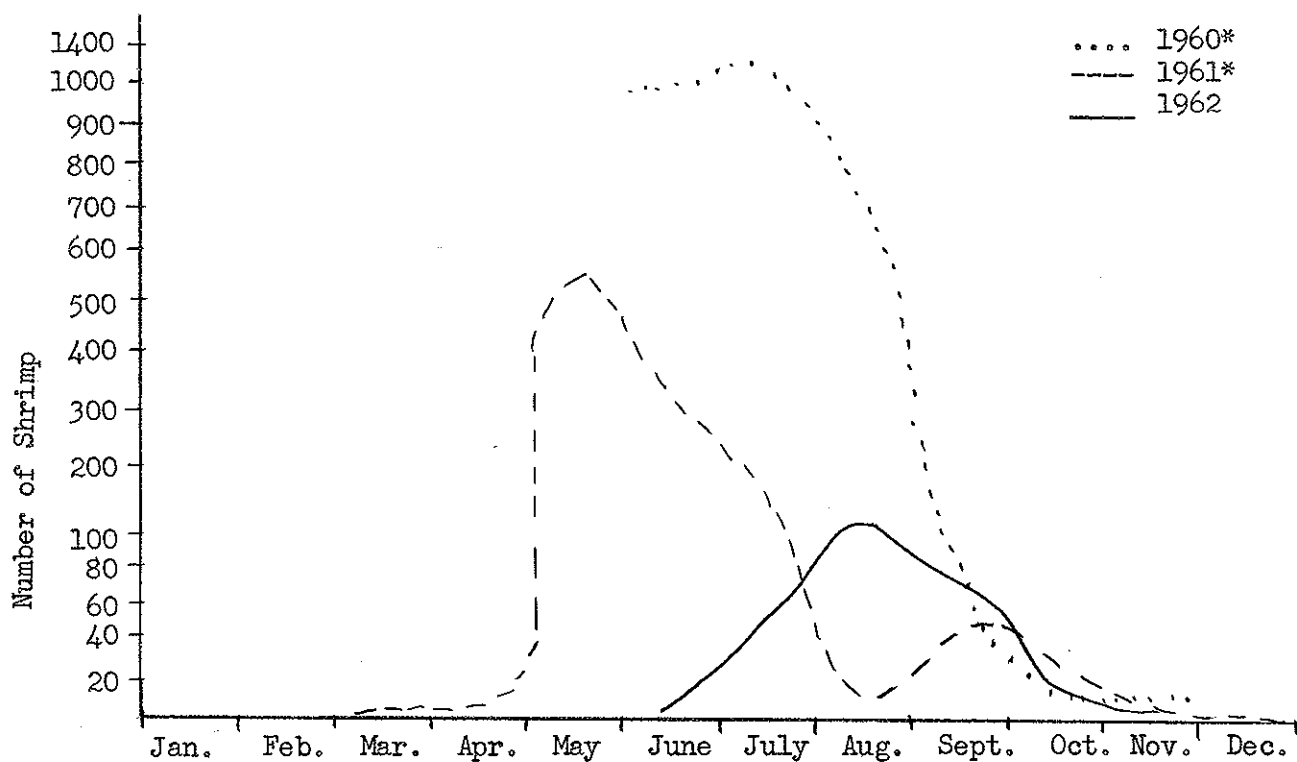
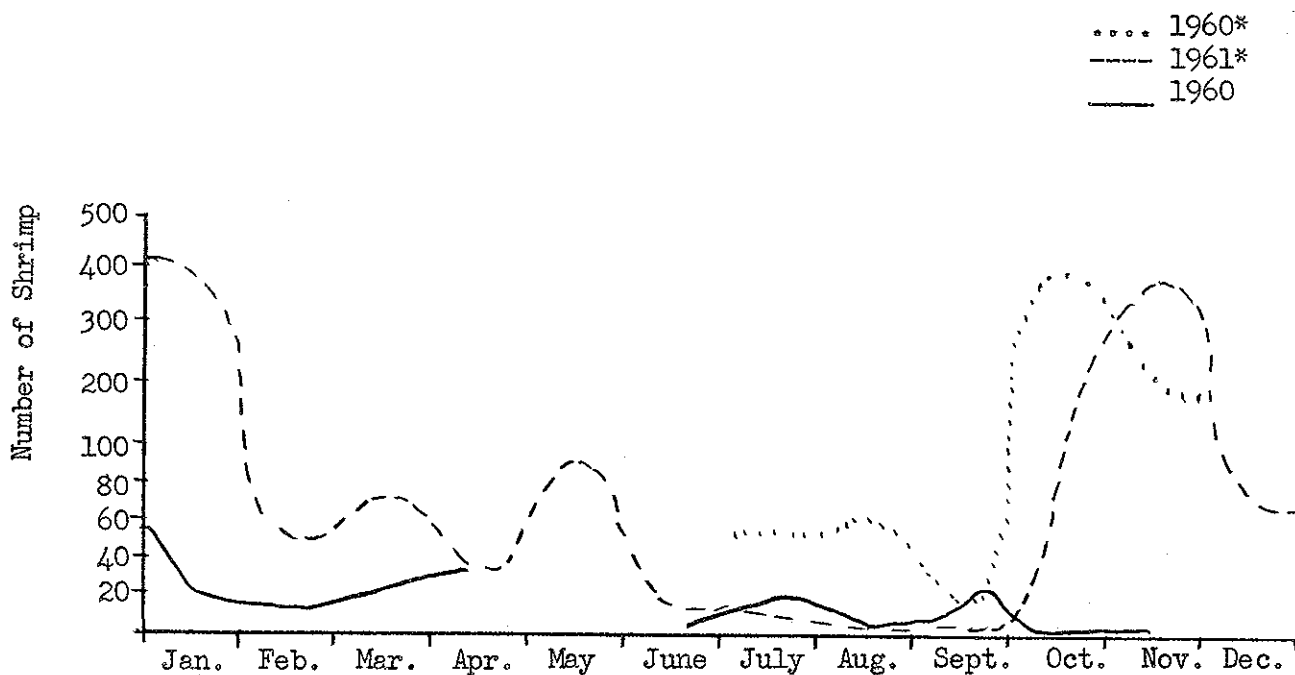


Figure 28

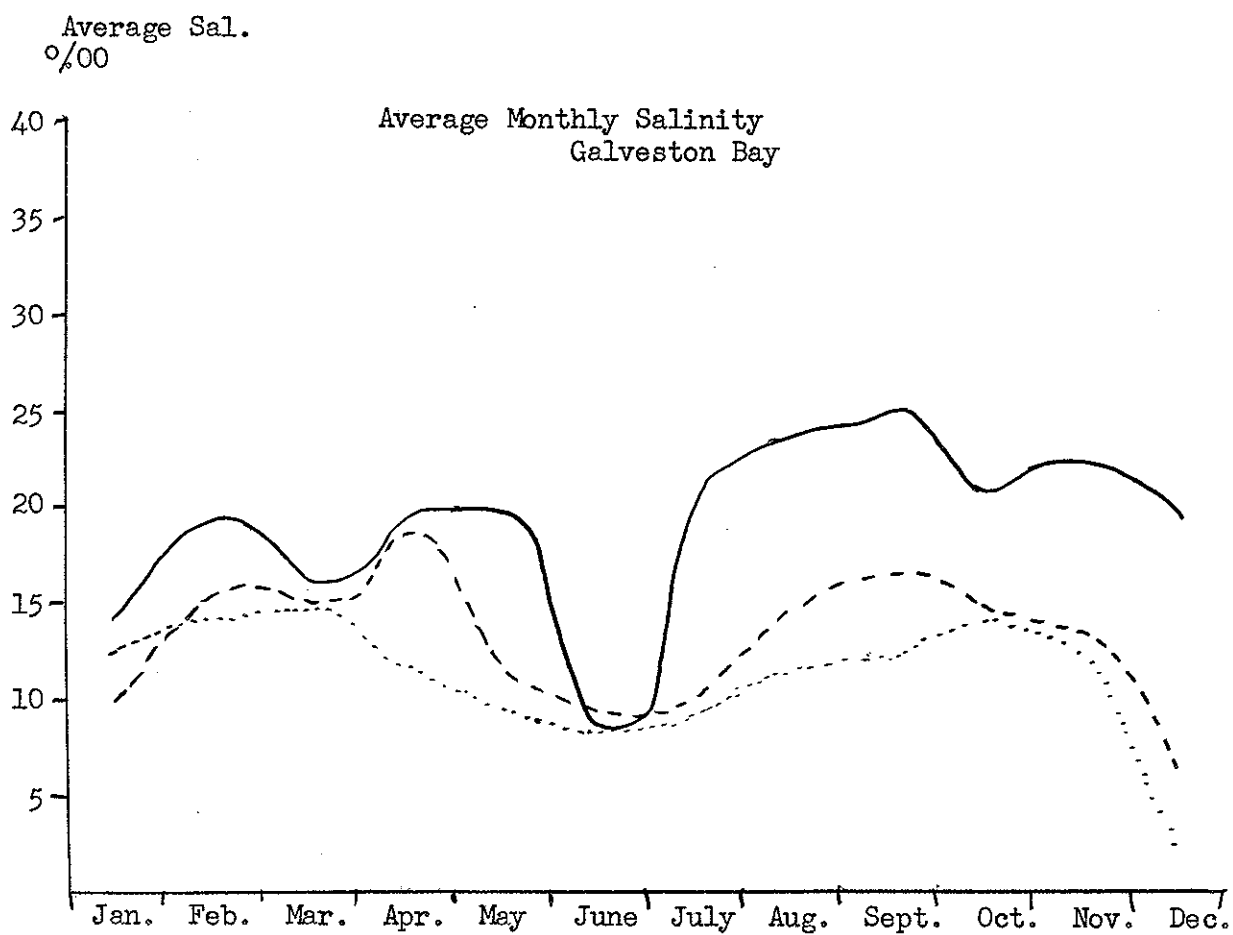
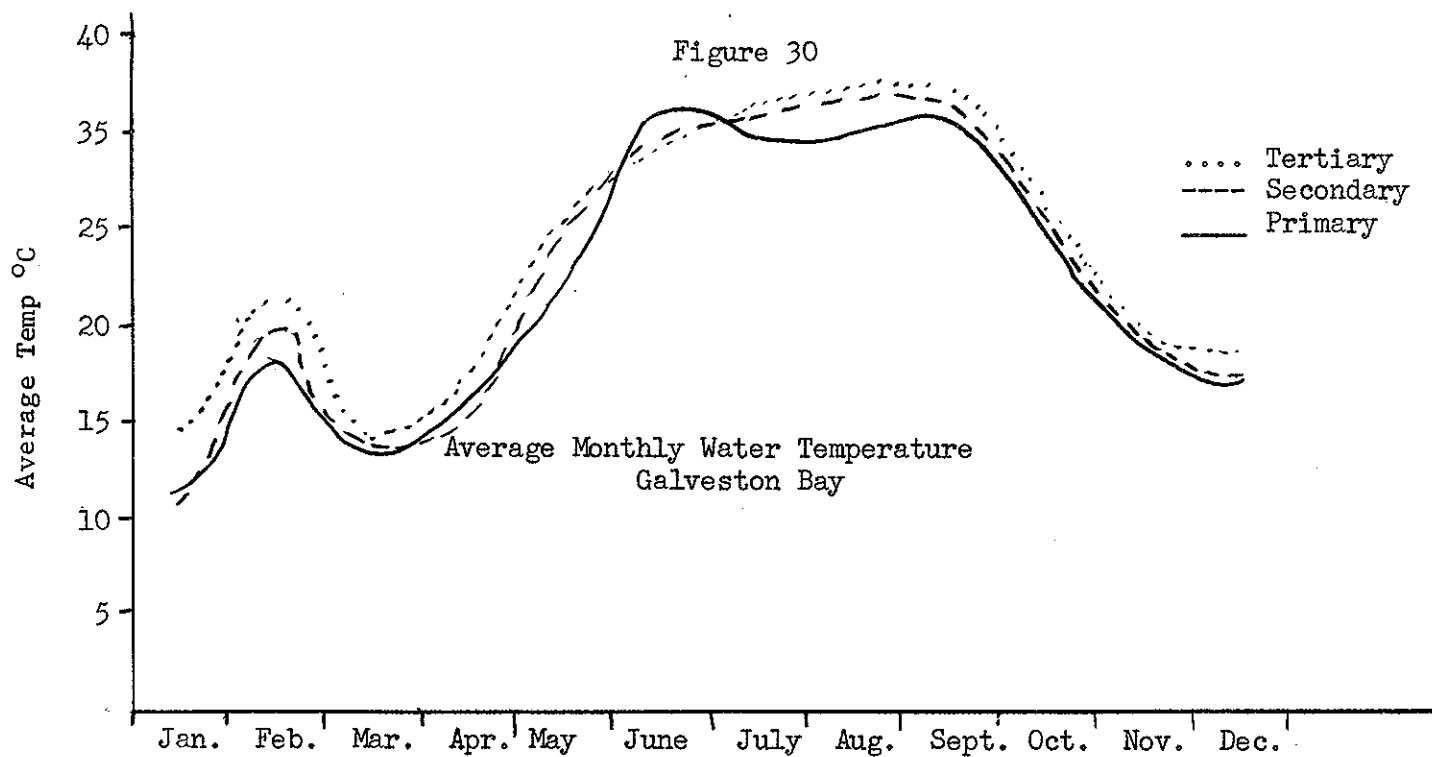


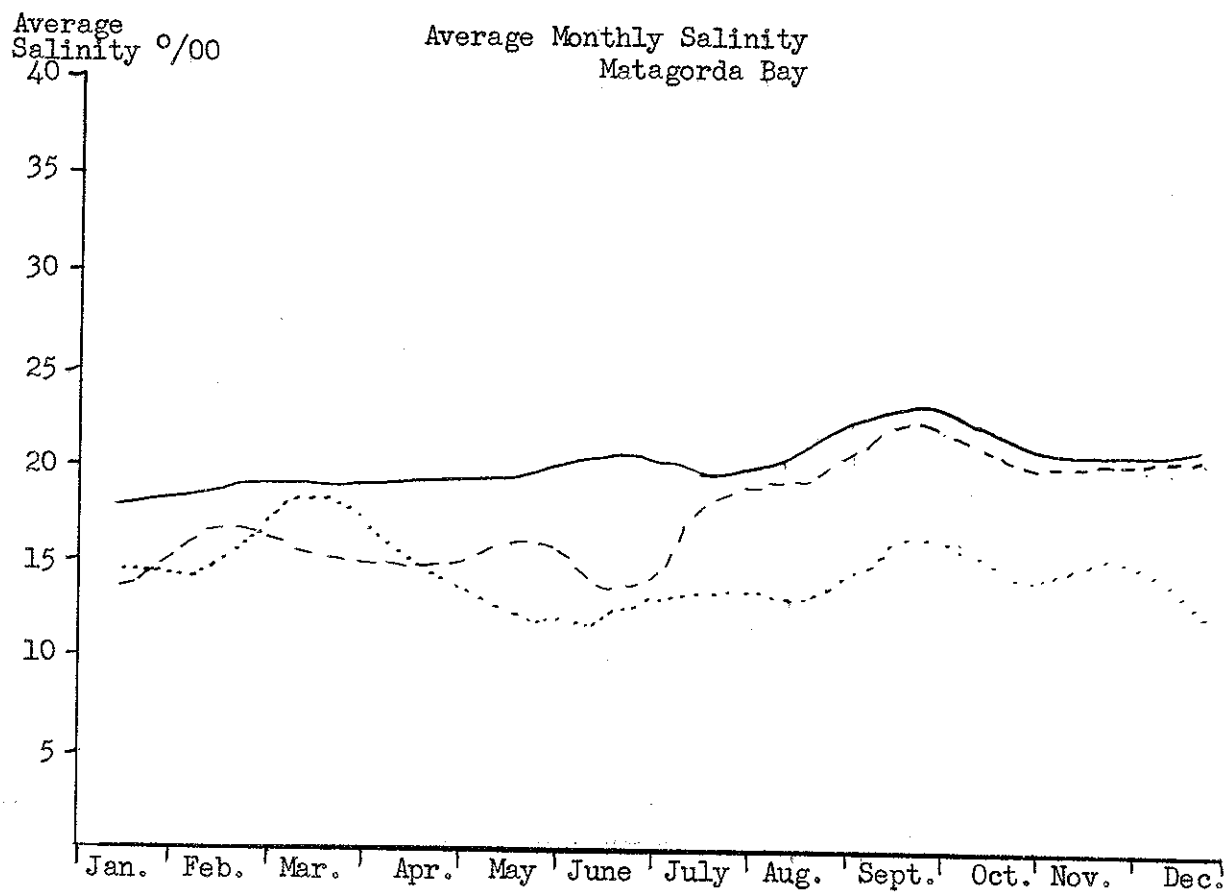
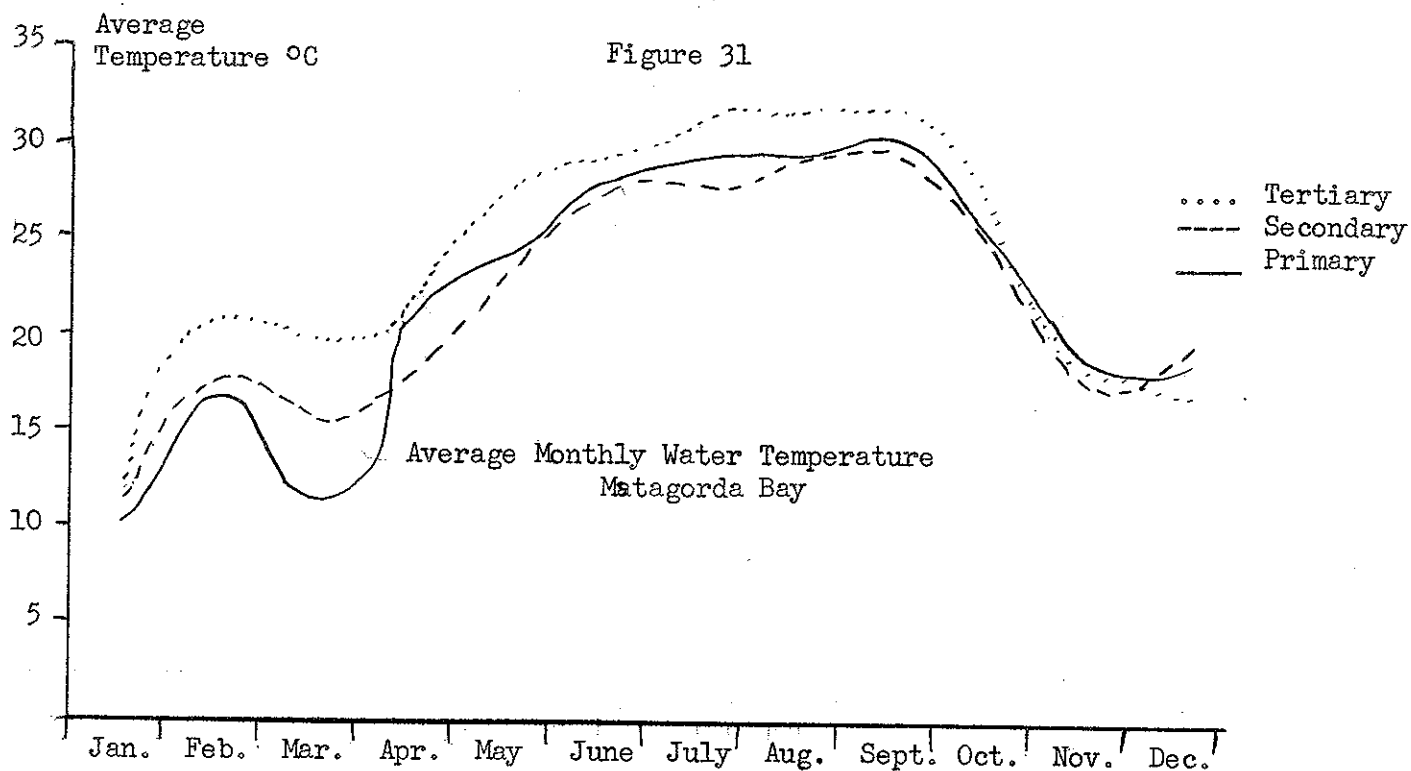
\*1960 and 1961 data taken from Compton's Gulf reports.

Figure 29



\*1960 and 1961 abundance data taken from Compton's Gulf reports.





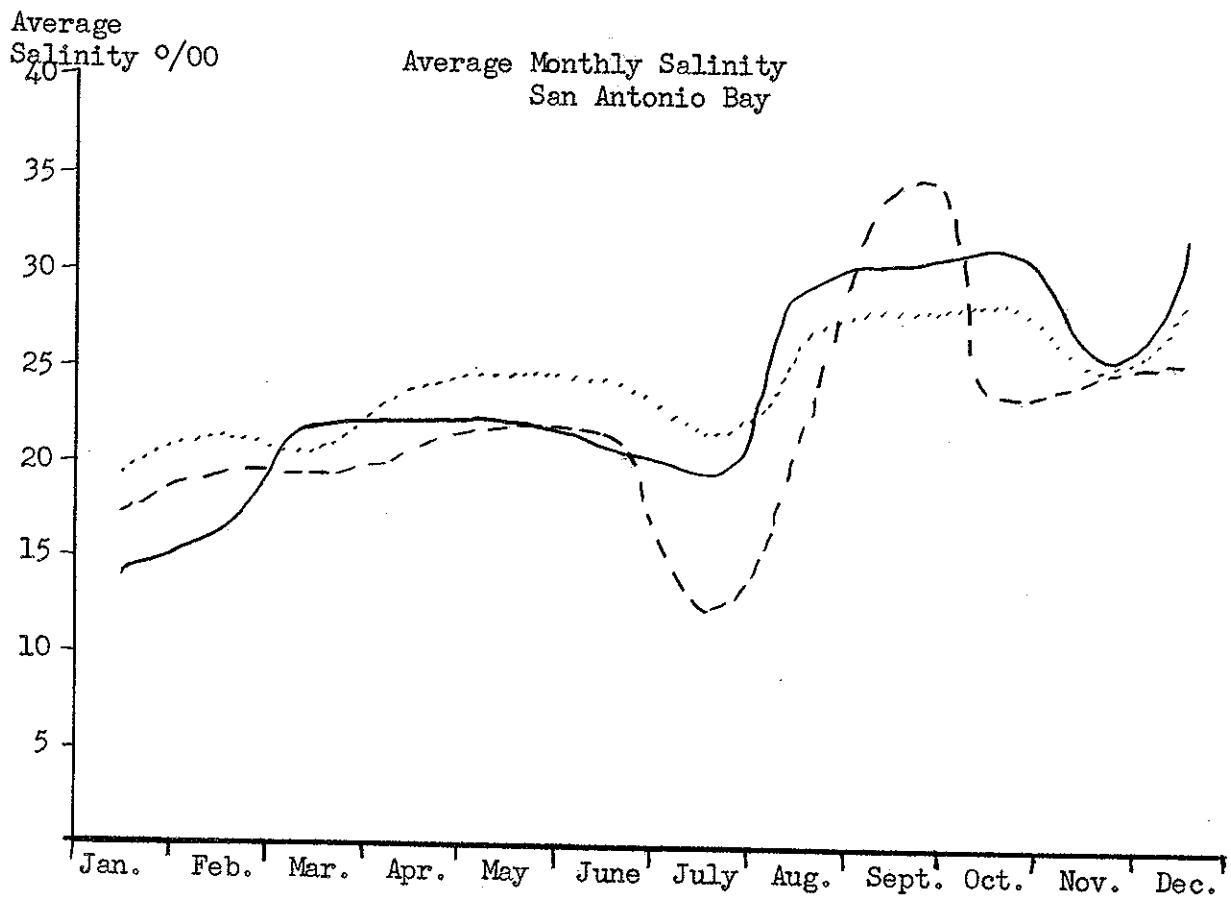
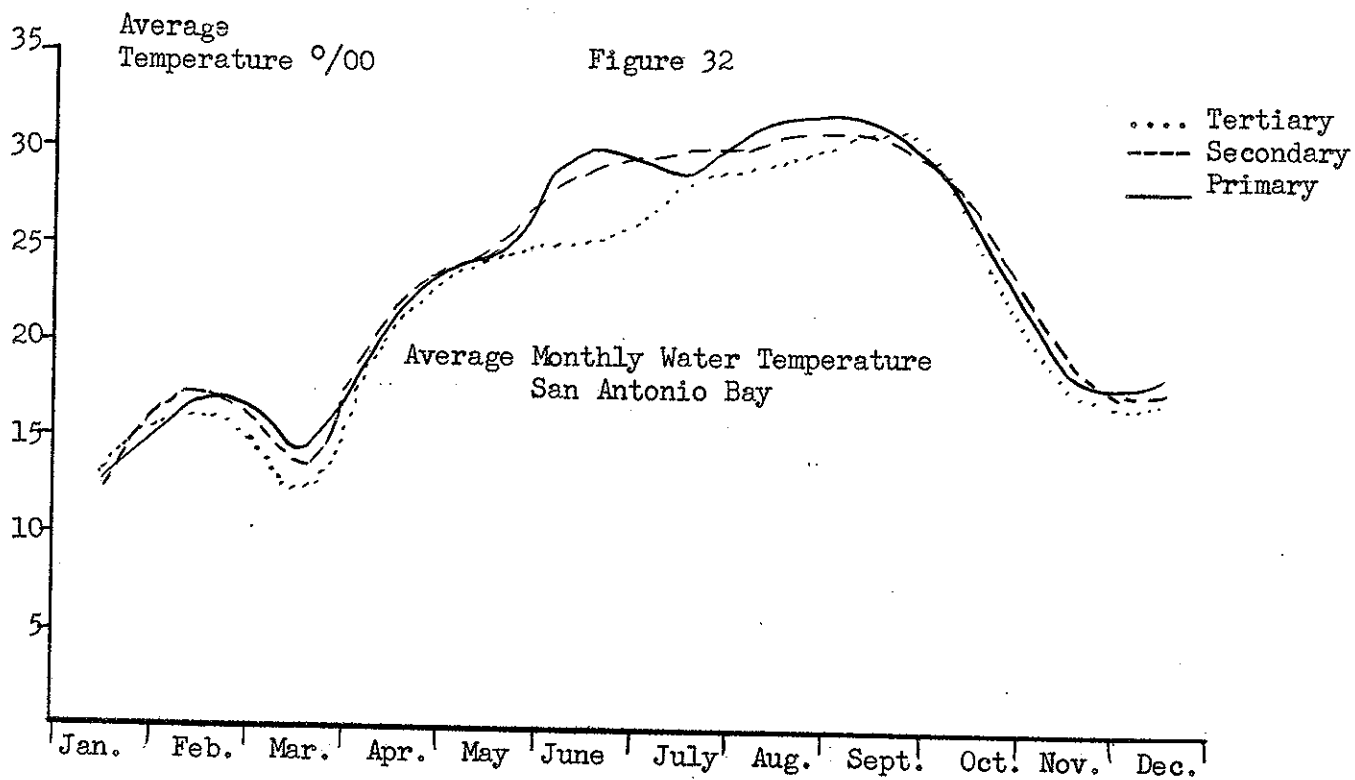
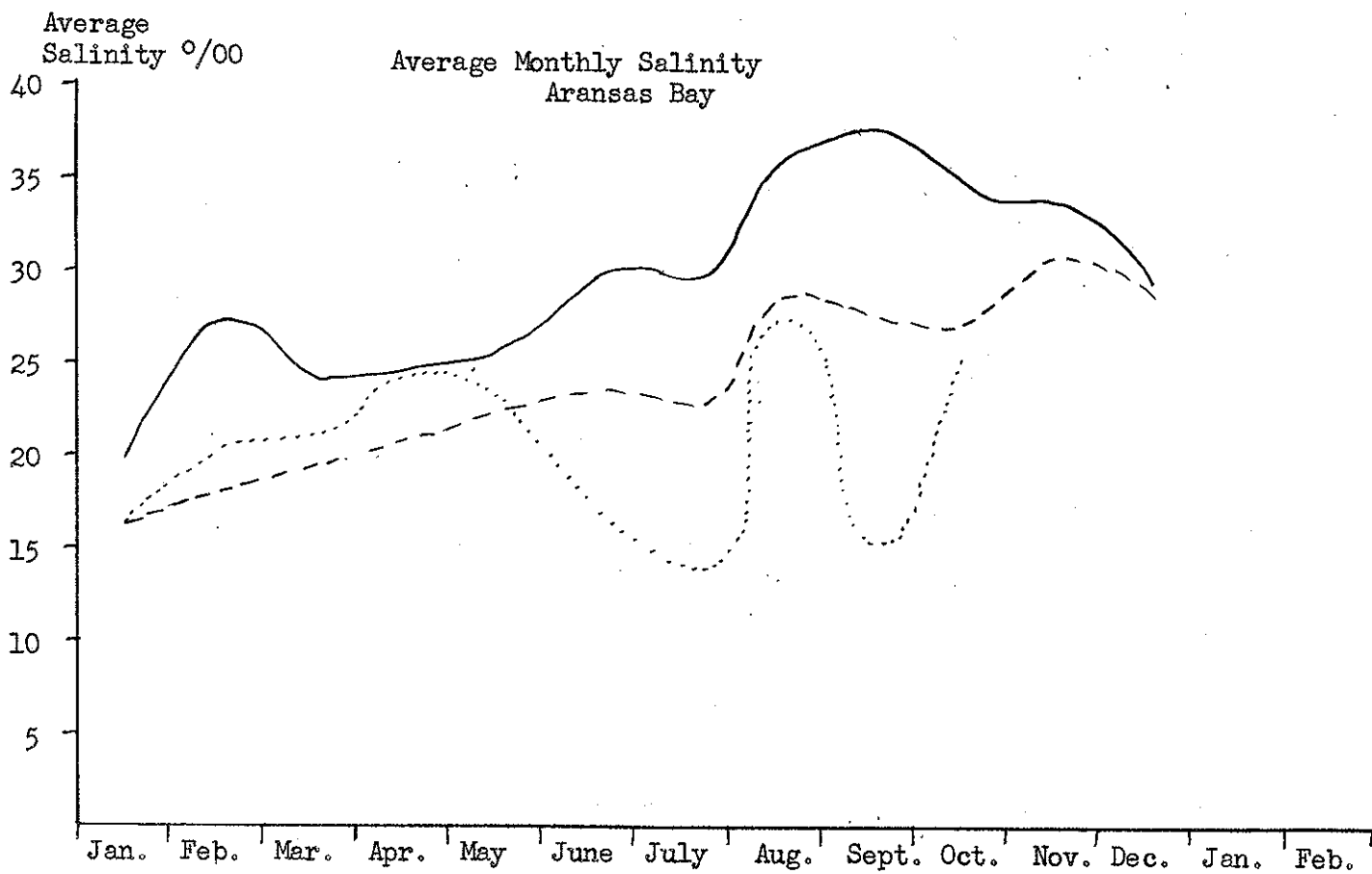
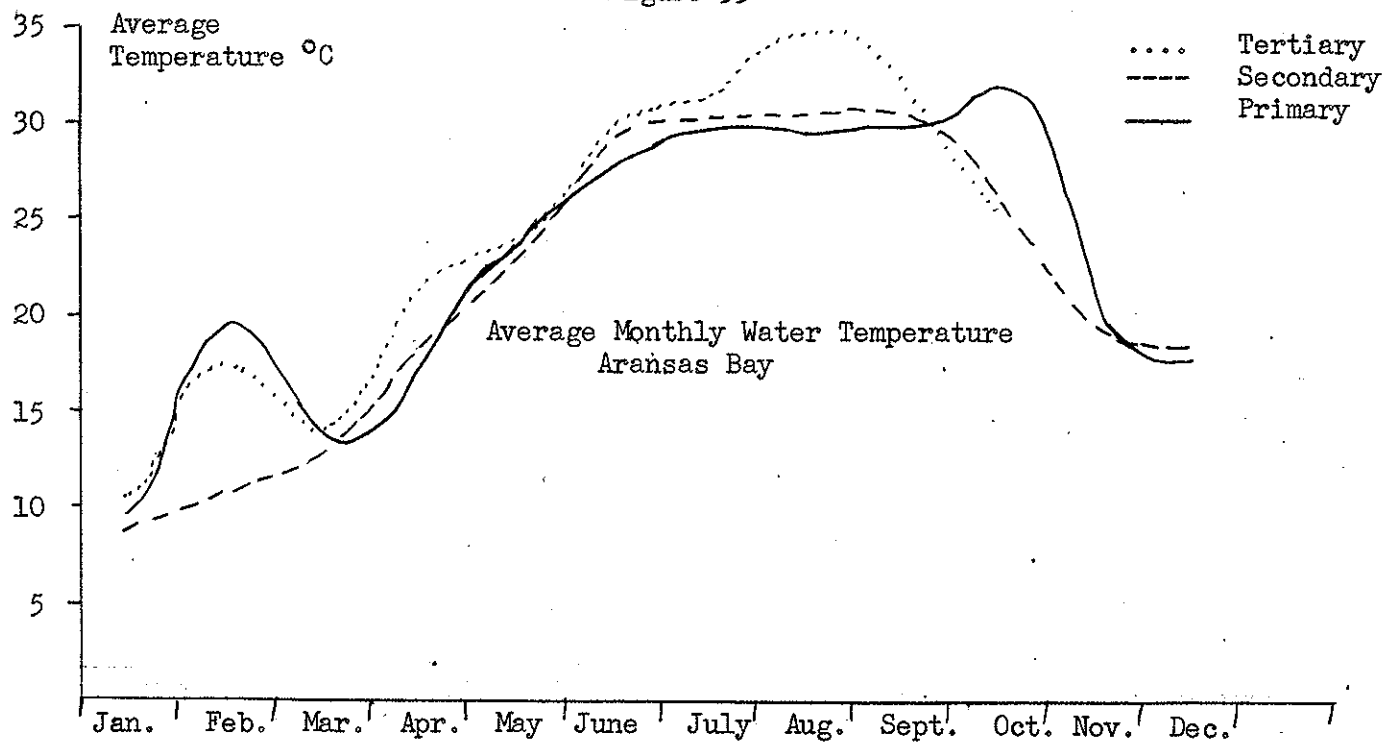
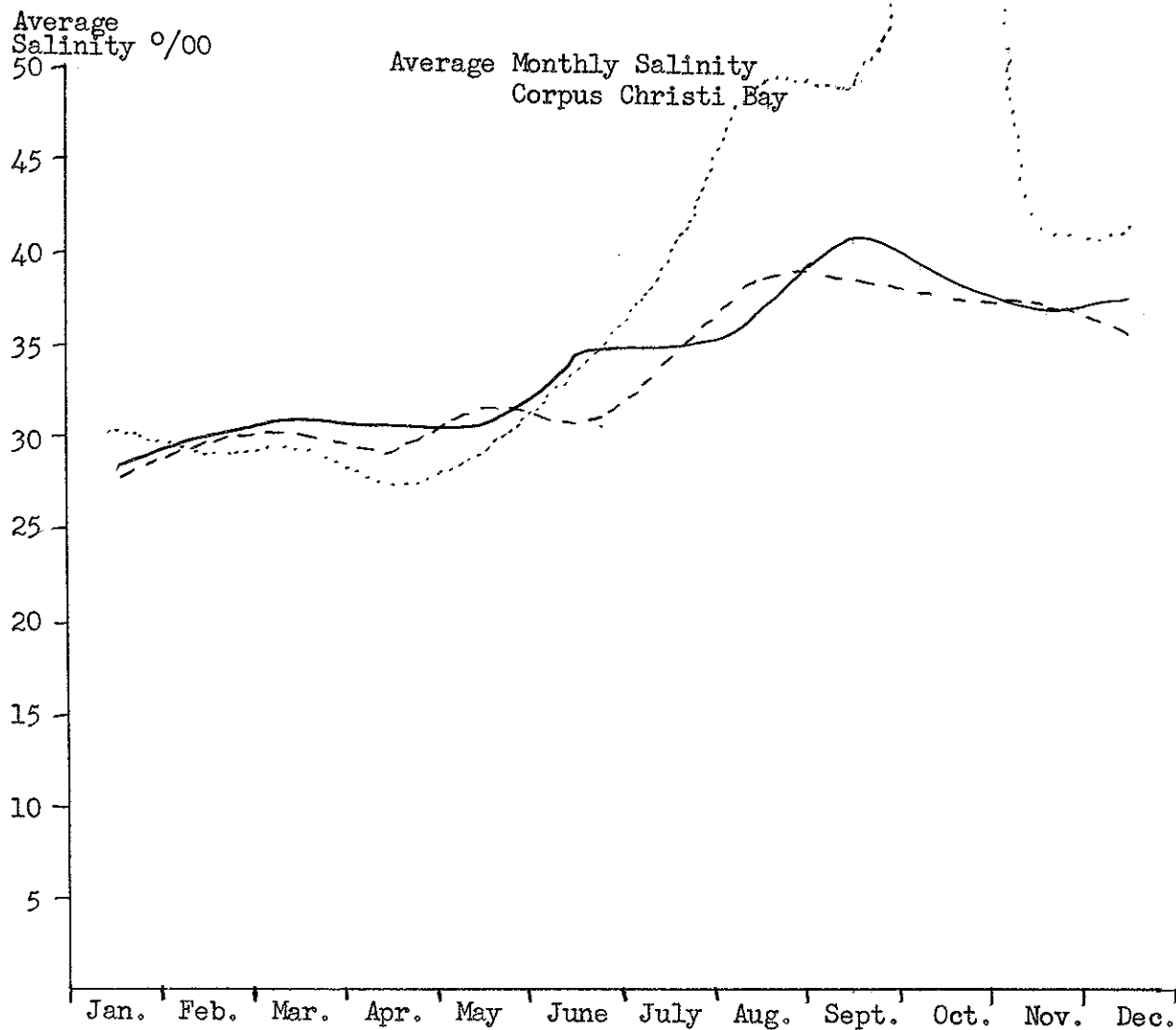
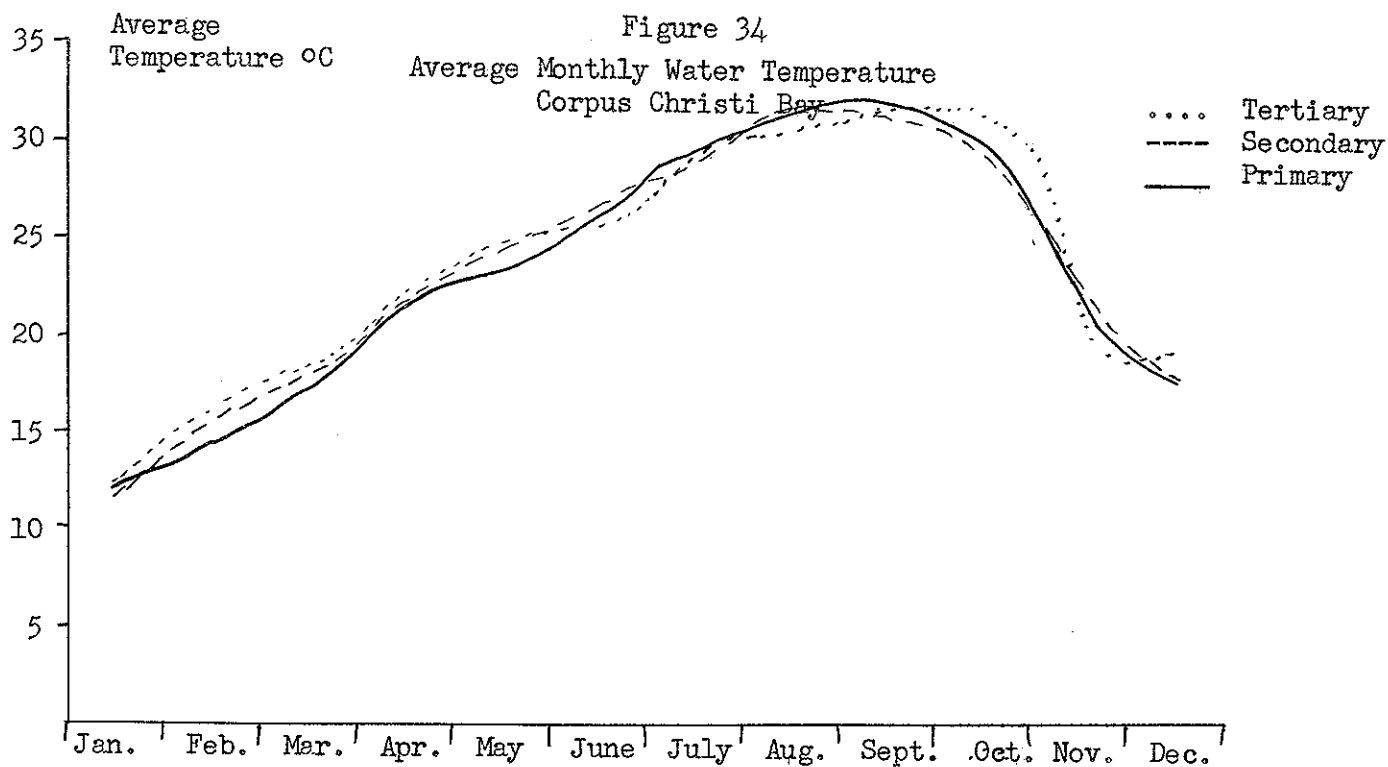


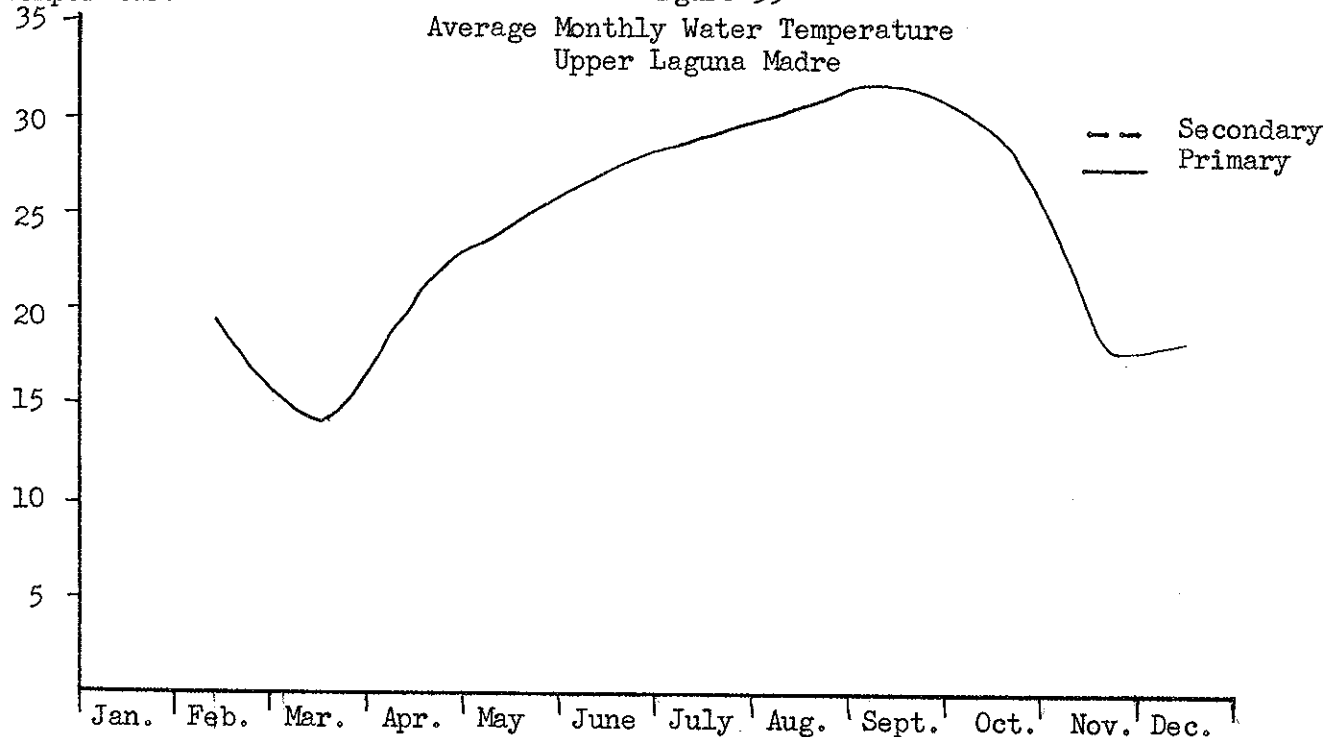
Figure 33





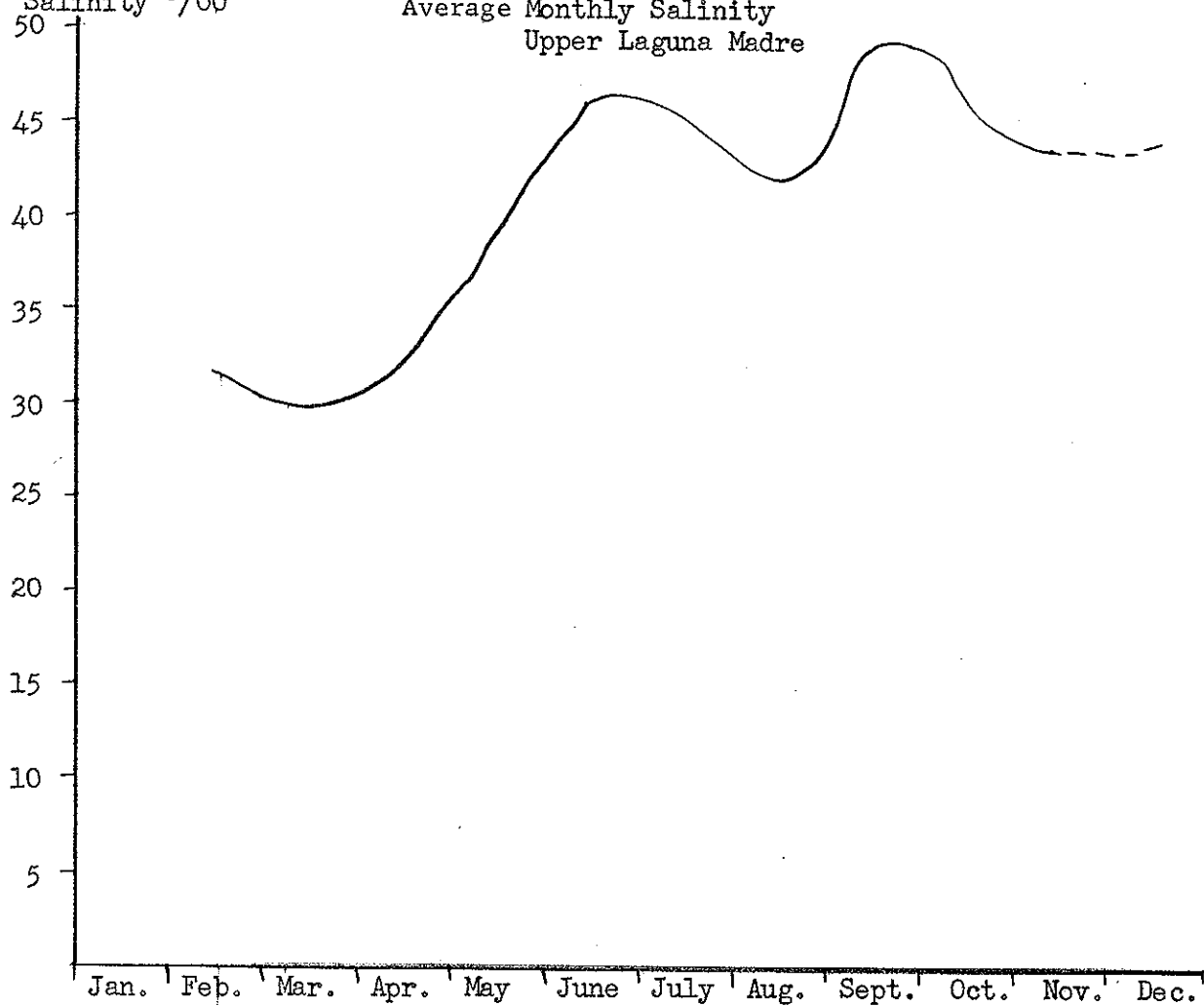
Average  
Temperature °C

Figure 35  
Average Monthly Water Temperature  
Upper Laguna Madre

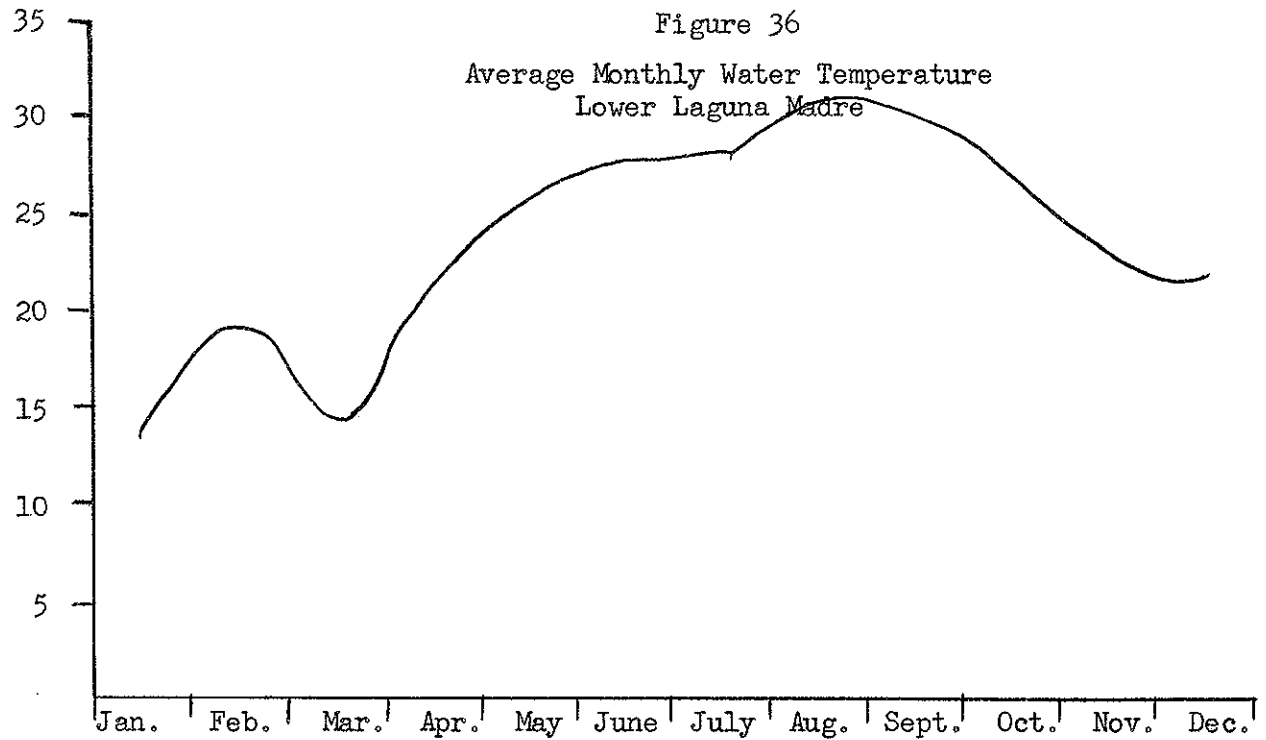


Average  
Salinity ‰

Average Monthly Salinity  
Upper Laguna Madre



Average Temperature °C



Average  
Salinity ‰

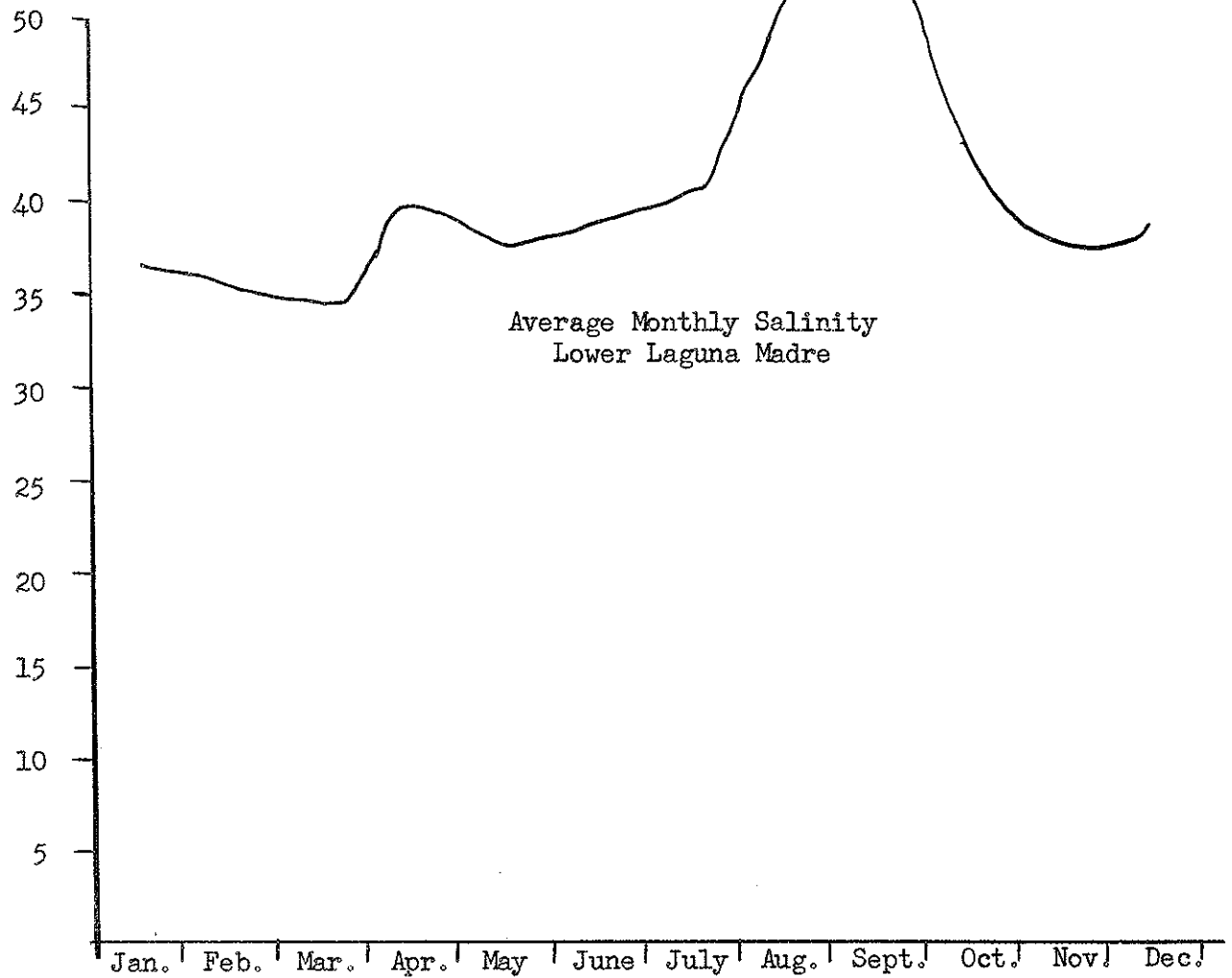
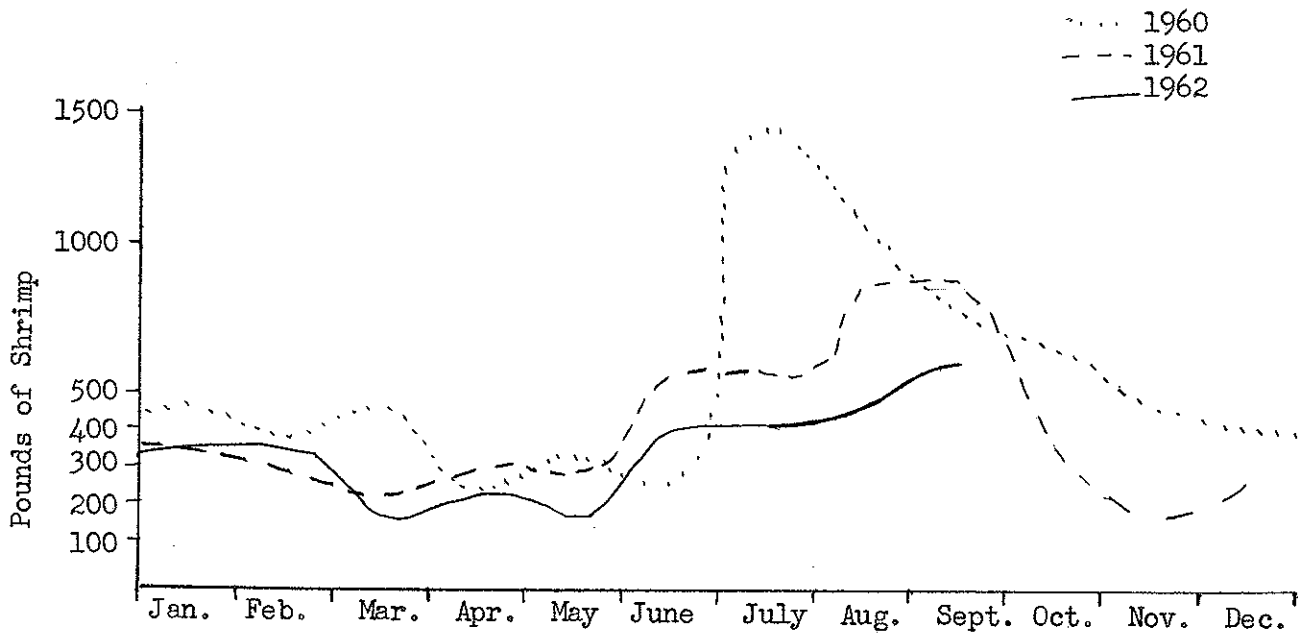


Figure 37

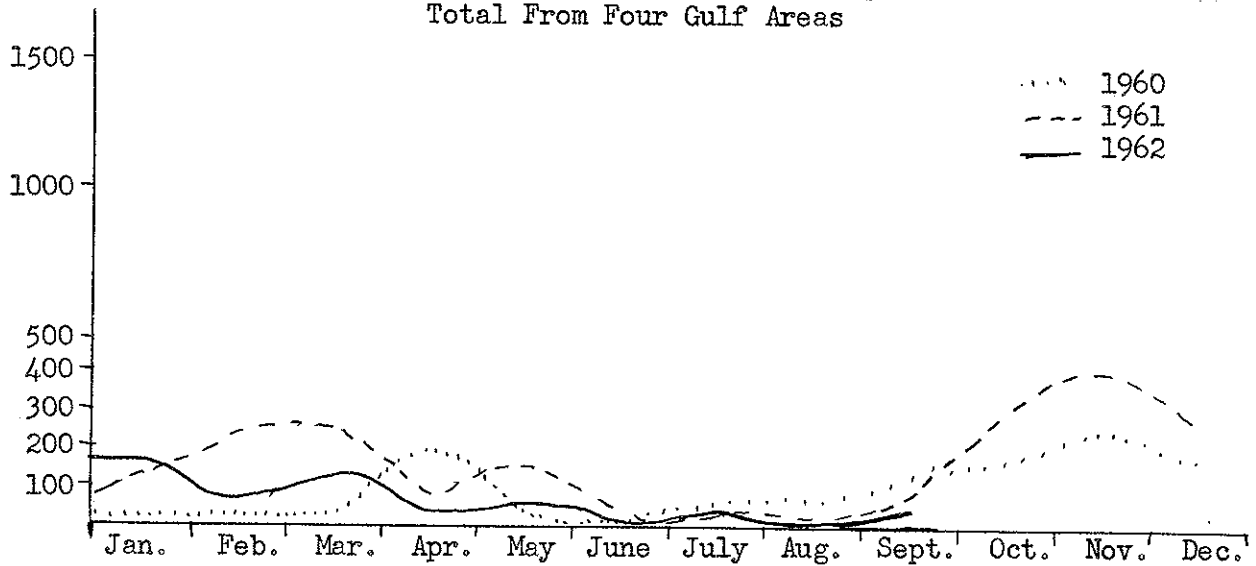
Texas Coast Brown Shrimp Landings  
Total From Four Gulf Areas



Pounds of Shrimp per Day Fishing Effort by Month

Figure 38

Texas Coast White Shrimp Landings  
Total From Four Gulf Areas



Pounds of Shrimp per Day Fishing Effort by Month

Figure 39

Texas Gulf Production  
Brown Shrimp Landings

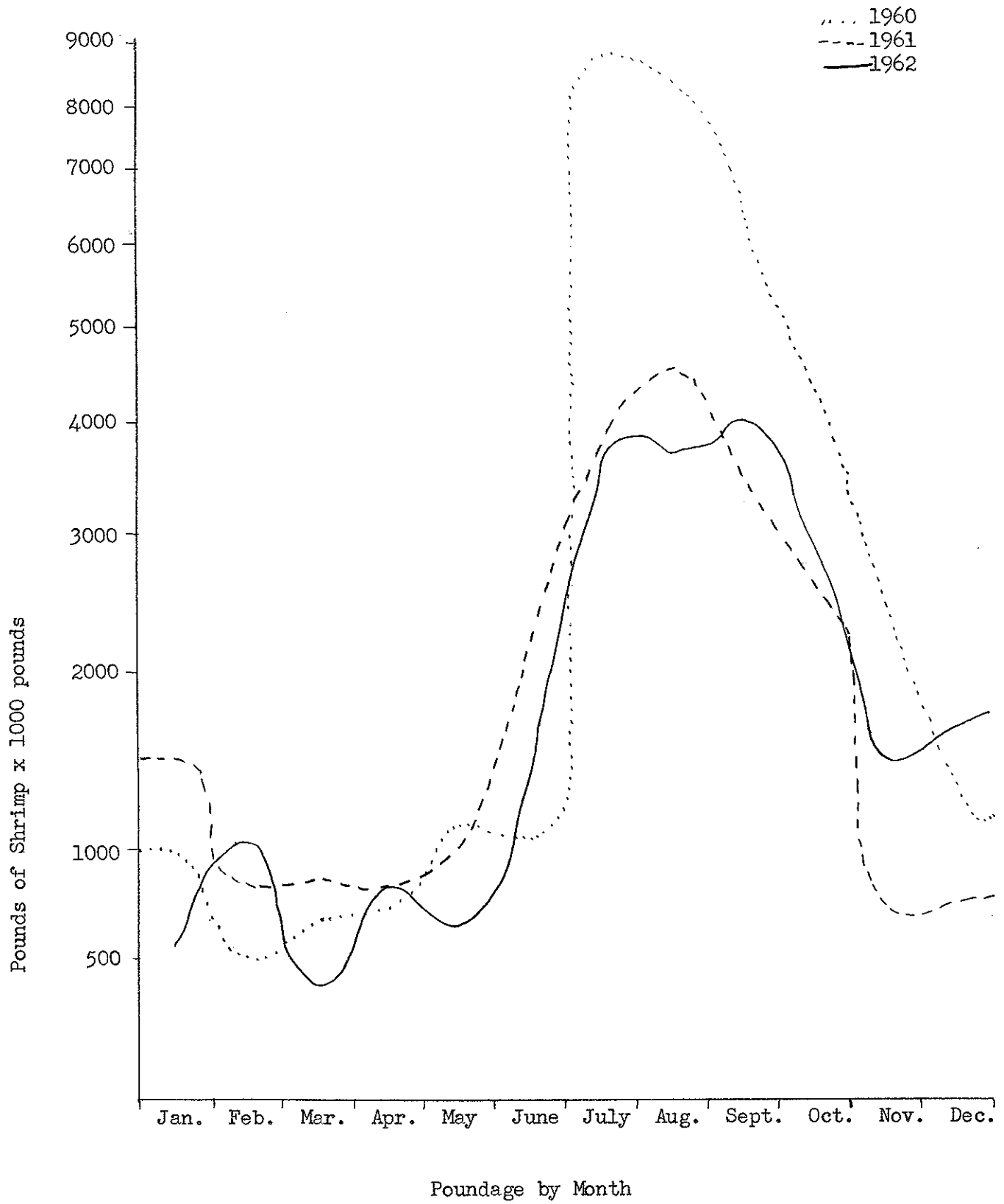


Figure 40

White Shrimp Landings  
Texas Gulf Production

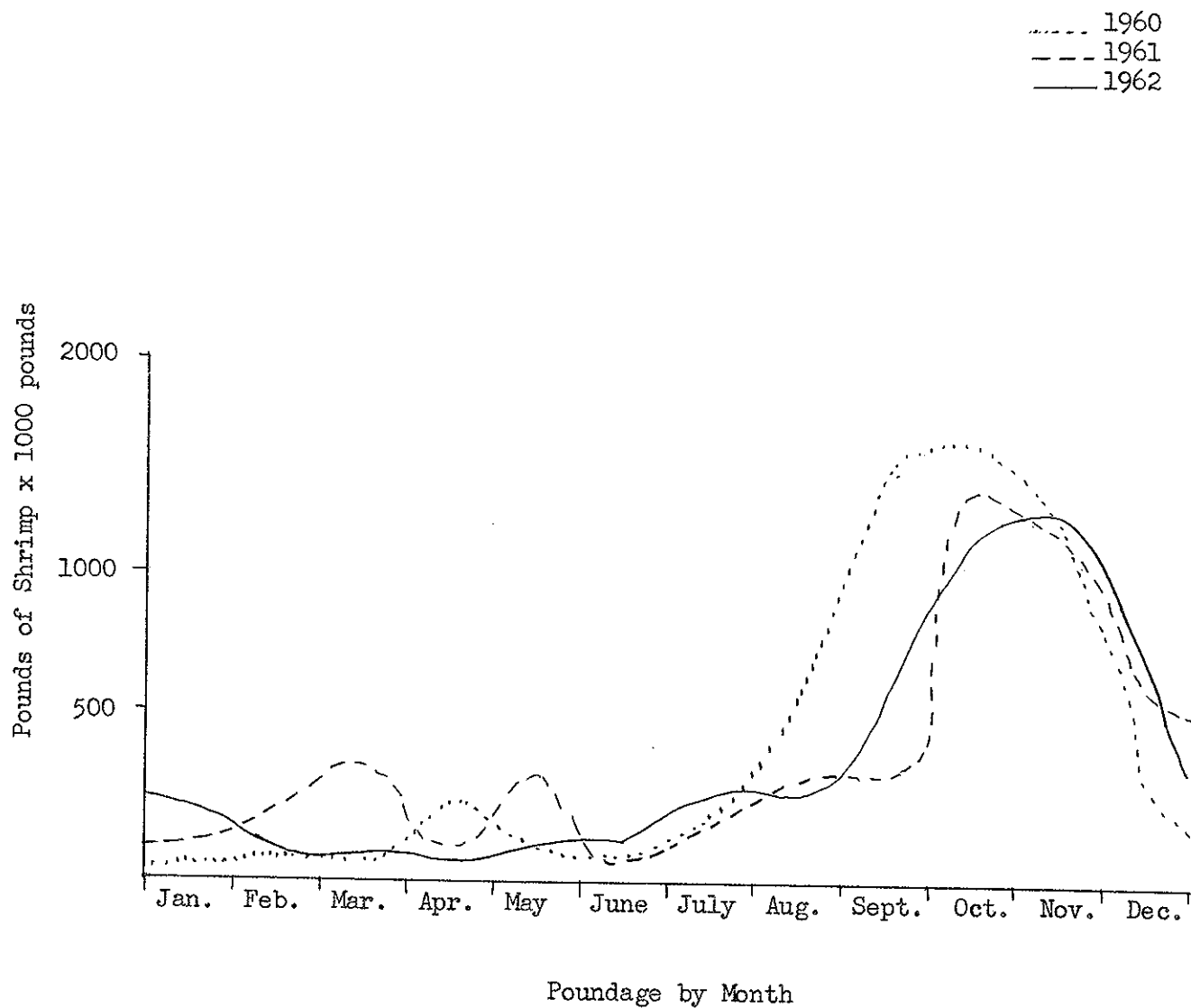


Table 1

## Post-larval Shrimp Data

<u>Date of Sample</u>	<u>Method of Sampling</u>	<u>Number Caught</u>	<u>Average Size</u> mm	<u>Species</u>	<u>W. Temperature</u>	<u>Salinity</u>
2-20-62	Beam Trawl	72	12	Penaeid	15.8	33.08
3-20-62	Sand flat sampler	17	11-15	Penaeid	17.9	23.41
3-27-62	Sand flat sampler	148	10-12	Penaeid	19.6	24.41
3-27-62	Beam Trawl	140	10-12	Penaeid	18.5	32.89
4-5-62	Sand flat sampler	2	12	Penaeid	18.4	30.58
4-5-62	Beam Trawl	1	12	Penaeid	19.1	30.58
4-10-62	Sand flat sampler	None	---	---	18.7	30.62
4-10-62	Beam Trawl	8	12	Penaeid	19.3	31.01
4-10-62	Beam Trawl	7	15	Grooved shrimp	19.0	30.03
5-3-62	Sand flat sampler	2	35	P. aztecus		
5-3-62	Beam Trawl	20	15	Grooved shrimp	19.7	30.67
5-9-62	Beam Trawl	2	19	Grooved shrimp	19.5	31.81
5-9-62	Sand flat sampler	None	---	---	18.8	30.53
5-21-62	Sand flat sampler	3	10-12	Grooved shrimp	20.0	30.63
5-21-62	Beam Trawl	8	15	Grooved shrimp	19.8	31.48
7-10-62	Sand flat sampler	1		P. aztecus	21.3	31.56
7-17-62	Sand flat sampler	None	---	---	22.6	31.87
9-11-62	Sand flat sampler	None	---	---	28.4	34.25
9-11-62	Sand flat sampler	24	15	Penaeid	29.9	36.81
9-11-62	Plankton Net	None	---	---	28.2	36.30
9-11-62	Beam Trawl	1	26	P. aztecus	27.1	29.38
10-2-62	Sand flat sampler	5	9	Penaeid		
10-2-62	Beam Trawl	9	16-25	P. setiferus	28.3	33.21
10-2-62	Beam Trawl	50	6	Penaeid		
10-25-62	Plankton Net	3	10	Penaeid	28.4	33.50
10-25-62	Beam Trawl	None			28.4	33.50
11-15-62	Plankton Net	80	8	P. duorarum	---	32.56
11-15-62	Beam Trawl	5	12	P. duorarum	---	32.50

Table 2

The Monthly Average of Pounds Per Day of White Shrimp  
Caught from Four Statistical Areas

1960

Area	J	F	M	A	M	J	J	A	S	O	N	D
18	0	10	291	365	83	51	34	57	263	398	549	267
19	9	1	22	157	46	21	35	28	134	171	301	291
20	6	0	4	34	14	2	3	3	24	35	150	72
21	0	0	0	0	1	1	1	1	1	0	22	43

1961

Area	J	F	M	A	M	J	J	A	S	O	N	D
18	256	4	251	90	69	23	35	10	256	465	388	226
19	136	213	248	81	99	19	31	25	71	355	397	315
20	85	36	249	51	166	8	16	2	3	274	526	333
21	29	130	105	33	78	3	8	5	2	28	71	153

1962

Area	J	F	M	A	M	J	J	A	S	O	N	D
18	113	14	154	33	54	30	61					
19	154	75	140	22	44	8	56					
20	111	63	23	52	83	4	6					
21	218	75	33	29	46	0	1					

Table 3

The Monthly Average of Pounds Per Day of Brown Shrimp  
Caught from Four Statistical Areas

1960

Area	J	F	M	A	M	J	J	A	S	O	N	D
18	602	578	112	23	276	237	1,520	1,019	643	414	195	209
19	508	445	515	246	295	254	1,460	1,060	753	659	399	244
20	364	298	361	244	333	307	1,358	1,064	870	749	519	450
21	390	276	275	320	364	278	1,145	970	818	782	700	556

1961

Area	J	F	M	A	M	J	J	A	S	O	N	D
18	205	279	136	256	247	291	460	550	217	55	138	261
19	290	247	196	282	287	407	516	542	483	207	138	156
20	280	326	180	323	250	797	662	571	484	235	9	158
21	450	337	321	393	357	732	599	535	711	667	362	283

1962

Area	J	F	M	A	M	J	J	A	S	O	N	D
18	383	480	181	279	178	415	355					
19	366	345	115	212	184	327	371					
20	374	330	301	51	138	509	597					
21	229	242	285	276	215	372	605					

