Job Report

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Project No. MS-R-4 Date May 23, 1963

Project Name: A Study of Texas Shrimp Populations

Period Covered: January 1, 1962 to December 31, 1962 Job No. 2

A Study of the Post-larval Penaeid Shrimp Entering Aransas Bay

Abstract: Preliminary steps were taken to set up types of sampling that would capture post-larval shrimp entering bay nursery grounds through the ship channel at Port Aransas, Texas. Due to the rather meager number of post-larval shrimp keys available, identification was accomplished only to genus. Sampling of the channel bottom on February 20 produced penaeids of 12 mm. length. Sampling on March 27, both in the main channel and in flats along an adjacent channel, produced 288 post-larval penaeids, the greatest number taken during the sampling period. Samples through November produced few shrimp, excluding 50 caught on October 2.

Mysids, hypoplanktonic crustacea living generally on or near the bottom, were numerous in the samples and displayed somewhat the same abundance pattern found for post-larval shrimp.

February water temperature averaged 15° C., rising to 18° C. in March, with a general warming trend through the sampling period to 28° C. in October. On the shallow sand flat sampled, salinity rose from 22 ppt in March to just above 30 ppt in April and remained fairly constant thereafter. At the channel bottom salinity stayed above 30 ppt.

Objectives: To determine the seasonal abundance and size of post-larval commercial shrimp species entering bay nursery grounds through Port Aransas Ship Channel. To record and evaluate associated organisms sampled and hydrographic factors pertinent to the movement of these shrimp.

Procedure: Sampling stations were established at the bottom of Aransas Ship Channel in 38 to 42 feet of water and on a sand flat at the east side of Lydia Ann Ship Channel in 6 inches to 3 feet of water.

A beam trawl with a rigid opening of 1-foot by 3 feet and a 6-foot bag of millimeter square mesh was used to sample the channel bottom with standardized 6-minute drags.

As a beginning for expansion of the post-larval shrimp study, tests were run with a large plankton net of millimeter square mesh. The mouth of the net was 1.064 square meters, a diameter of 45.83 inches. The net length was nine feet. This net was pulled for 2 minutes at the bottom of Aransas Channel, 2 minutes in mid-water about 20 feet below the surface and 2 minutes at the surface.

With this net was used a flow meter for plankton nets made by the Tsurumi-seiki Kosakusho, Co., Ltd., of Yokohama, Japan. Flow through the instrument revolves a four-winged impeller and indicates numbers of revolutions on three dials, in tens, hundreds and thousands, up to ten thousand. The flow meter, which has stops to eliminate metering when the net is backing into the water and when the net comes out of the water, was rigidly suspended in the center of the mouth of the net. The six-minute tows gave meter readings ranging from about 4400 to 4600 revolutions.

Tests for calibration of the meter in use on the net gave the figure of 216.07 millimeters as the average distance the net moved forward per round of the impeller. The formula submitted by the manufacturing company to calculate performance was:

$$\underline{Vs} \text{ equals } \underline{a} \times \underline{rd} \times \underline{A}$$

where Vs: the amount of water strained in cubic meters,
a: the distance of net travel, in meters, per round of the impeller
rd: the impeller revolutions by towing as produced on the dial counter, and
A: area of the net mouth straining water in square meters.

Using this formula it was found on the average that for each revolution of the impeller, .2299 cubic meters of water flowed through the net opening. Since the volume of water sampled by the sand flat sampler averaged 2,477 cubic feet, or 70.14 cubic meters, comparison values could be established for unit of effort between these nets.

Further work is needed on net and meter calibration to plot the most accurate figures for the performance of these larval nets, including the beam trawl used in the channel bottom. Difficulties certainly exist in accurately judging the effect of current direction and velocity as well as changing angle of attack of a net on the amount of water strained. Future sampling will be based as far as possible on corrected unit per effort figures for the nets concerned.

Equipment used to sample the shallow sand flat consisted of a 5-foot pull seine of a mesh having 50 holes per $cm.^2$, spread by a 6-foot pipe and opened by lead and cork lines, with a standard plankton net and removable bucket forming the cod end. This essentially small beam trawl was built to specification from one used by the United States Fish and Wildlife Service biologists for the same type of sampling in the Galveston area. The same method of operation was used. A stake was placed in the sand at the water line. A 150-foot nylon cord was attached to the stake and stretched parallel to the water line. Using the cord as a constant radius, the net was pulled by hand along the bottom in a half circle. On an average, the effective length of the tow was 426 feet, the volume of water sampled, 2,477 cubic feet and the area of bottom traversed, 1,958 square feet. Figure 1 shows the location of sampling stations. Temperature and salinity data were taken at the time of sampling.

<u>Findings and Discussion</u>: Figure 2 graphs the abundance of penaeid post-larvae and of mysid shrimp taken in the sand flat sampler and in the beam trawl. The sand flat was sampled in March, April, May, July, September and October. The greatest abundance of post-larval shrimp occurred on March 27 with 148 taken. Mysids were numerous on both March 27, with 302 specimens, and May 3, with 300; however, remaining samples produced only 24 specimens.

The Aransas Channel bottom was sampled by beam trawl in February, March, April, May, October and November. Peak abundance of post-larvae occurred in February, with 72 specimens, and March, with 140. Fifty post-larvae were taken on October 2. Mysids again showed a rather similar abundance pattern with 310 in March and April and 150 on October 2.

In the absence of reliable post-larval shrimp keys, post-larvae were merely classed as penaeids. The post-larval shrimp moving into the bay in February and March were probably Penaeus aztecus, since juveniles of this species became common in the bay toward the end of April. Young of the white shrimp, Penaeus setiferus, enter the nursery grounds later in the year, and the post-larval abundance of October was probably composed of this species.

Indications were that the occurrence of mysids for some reason paralleled the occurrence of post-larval shrimp. Most species of mysids are more bottom dwelling than strictly planktonic animals, and environmental conditions of current, light, temperature and salinity, should affect the abundance and movement of both adult mysids and post-larval shrimp in this zone. That the evaluation of the mysid population might help in evaluating post-larval shrimp movement in this area is evident.

The post-larvae sampled ranged between 8 and 15 mm. No growth indications were noted. The few shrimp sampled of 25 mm. and over were not considered as post-larval stages. Table 1 gives a breakdown of the crustacea sampled during this job, with pertinent hydrographic data.

Samples from the bottom of Aransas Channel were more abundant in organisms; however, the catch per unit effort was not corrected between nets. The channel bottom, affected by tidal currents, could be expected to produce a greater variety of animals. Depending on the season and tidal strength and movement, organisms ordinarily restricted to either the shallow Gulf or the bays could be swept into this area temporarily. On the sand flat would commonly be found only those animals from the adjacent bay area.

These differences were exemplified by certain animals in the catch. On the sand flat a number of the essentially grassbed shrimp, Tozeuma carolinensis, were taken at the end of the year; only a few were taken in the channel. In the channel, rock shrimp, a Gulf form, were taken occasionally. None reached the sand flat. One odd fact was the absence of crabs in the megalops stage on the sand flat as compared with the numbers of this migrating form taken in the channel on three occasions.

Both sampling areas could be characterized as lacking permanent inhabitants--the channel with its changing bottom affected by current and the sand flat without grass or cover. The migrating populations of post-larval shrimp moved through both areas.

Summary and Conclusions

(1) First samples made in the channel produced post-larval shrimp of 12 mm. in length; no particular indication of growth was found in succeeding samples. Bottom water temperature was 15.8° C. The greatest abundance of shrimp occurred at both stations on March 27 with a water temperature averaging 19° C. In the absence of samples prior to February 20, it cannot be stated if shrimp appeared with the water temperature below 15.8° C.

Salinity on the sand flat during the March abundance peak was 24.41 ppt. At the same time channel bottom salinity was 32.89 ppt. That this difference had no effect on the comparable number of post-larvae at each station indicates that, within limits, salinity may not be of great importance in controlling entrance of post-larval shrimp.

(2) Mysids to a great extent mirrored the post-larval shrimp in occurrence and abundance. Further research is needed to check the possible importance of these crustacea as indicator organisms in this area through which post-larval shrimp migrate.

(3) The number and variety of other crustaceans taken in the samples were rather restricted. Most were members of populations more abundant in areas adjoining the sampling grounds.

(4) Taxonomic work being accomplished by other agencies, in particular the Galveston Laboratory of the U. S. Fish and Wildlife Service, is expected to facilitate more exact identification of post-larval shrimp in future work.

(5) Use of, and further research on, unit of effort methods of evaluating samples in 1963 will produce more accurate information on the populations of post-larval shrimp entering the bays.

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Table 1
Larval Samples

(Temperature in degrees centigrade; salinity in parts per thousand)

SAND FLAT SAMPLE - LYDIA ANN CHANNEL

Date	Organisms Collected	Temp.	Sal.
3/20	17 Penaeid post-larvae (11-15 mm) 5 Mysids (6 mm) 1 *Palaemonetes* sp. (10 mm)	17.9	23.41
3/27	148 Penaeid post-larvae (10-12 mm) 302 Mysids (5-10 mm) 9 *Acetes* sp. (15 mm)	19.6	24.41
4/ 5	2 Penaeid post-larvae (12 mm)	18.4	30.58
4/10	None	18.7	30.62
5/ 3	7 Penaeid post-larvae (15 mm) 2 *Penaeus aztecus* (30 mm) 300 Mysids (3-10 mm) 8 *Acetes* sp. (8-30 mm) 1 *Lucifer faxoni* (10 mm)	19.0	30.03
5/ 9	None	18.8	30.53
5/21	3 Penaeid post-larvae (10-12 mm) 8 Mysids (10 mm)	20.0	30.63
7/10	1 *Penaeus aztecus* (30 mm) 1 Mysid (15 mm) 3 *Acetes* sp. (20 mm)	21.3	31.56
7/17	5 Mysids (12 mm) 6 *Acetes* sp. (25 mm)	22.6	31.87
9/11	1 Mysid (4 mm) 20 *Tozeuma carolinensis* (5 mm)	28.4	34.25
10/2	5 Penaeid post-larvae (9 mm) 1 *Penaeus aztecus* (26 mm) 4 Mysids (3-5 mm) 1 *Acetes* sp. (12 mm) 3 *Hippolytes* sp. (3-5 mm) 35 *Tozeuma carolinensis* (4-20 mm)	27.1	29.38

BOTTOM BEAM TRAWL SAMPLE - ARANSAS SHIP CHANNEL

Date	Organisms Collected	Temp.	Sal.
2/20	72 Penaeid post-larvae (12 mm) 9 Mysids (6 mm) 215 Crabs (Megalops stage)	15.8	33.08

BOTTOM BEAM TRAWL SAMPLE - ARANSAS SHIP CHANNEL
(Continued)

Date	Organisms Collected	Temp.	Sal.
3/27	140 Penaeid post-larvae (10-12 mm) 160 Mysids (5-12 mm) 11 *Acetes* sp. (15 mm)	18.5	32.89
4/ 5	1 Penaeid post-larvae (12 mm) 150 Mysids (8-12 mm) 1 *Acetes* sp. (10 mm) 1 *Hippolytes* sp. (10 mm)	19.1	30.58
4/10	8 Penaeid post-larvae (12 mm) 10 Mysids (10 mm) 2 *Trachypeneus* sp. (5 mm) 2 *Acetes* sp. (15 mm) 2 *Hippolytes* sp. (15 mm) 1 *Caprella* sp. (10 mm)	19.3	31.01
5/ 3	20 Penaeid post-larvae (15 mm) 20 Mysids (5-12 mm) 5 *Acetes* sp. (8-30 mm) 4 *Lucifer faxoni* (7 mm) 1 *Caprella* sp. (6 mm) 3 Pycnogonids 30 Crabs (Megalops stage)	19.7	30.67
5/ 9	2 Penaeid post-larvae (15 mm) 160 Mysids (8 mm) 50 *Acetes* sp. (15-25 mm)	19.5	31.81
5/21	8 Penaeid post-larvae (15 mm) 20 Mysids (8-12 mm)	19.8	31.48
10/2	50 Penaeid post-larvae (8 mm) 9 *Penaeus setiferus* (25-30 mm) 150 Mysids (4-12 mm) 4 *Sicyonia dorsalis* (17-18 mm) 7 *Acetes* sp. (10 mm) 2 *Tozeuma carolinensis* (20 mm) 1 *Hippolytes* sp. (5 mm) 8 *Latreutes* sp. (4-15 mm) 45 Crabs (Megalops stage)	28.3	33.21
10/25	4 Mysids (3-9 mm) 1 *Sicyonia* sp. (4 mm) 2 *Acetes* sp. (4-6 mm) 1 *Tozeuma carolinensis* (6 mm) 2 *Hippolytes* sp. (6 mm)	28.4	33.53

BOTTOM BEAM TRAWL SAMPLE - ARANSAS SHIP CHANNEL
(Continued)

Date	Organisms Collected	Temp.	Sal.
11/15	5 Penaeid post-larvae (12 mm) 50 Mysids (5-8 mm) 5 *Trachypeneus* sp. (8-24 mm) 1 *Palaemonetes* sp. (15 mm) 7 *Latreutes* sp. (2-15 mm) 1 *Lucifer faxoni* (10 mm) 1 *Portunus gibbesi* (25 mm)		32.56

Figure 1

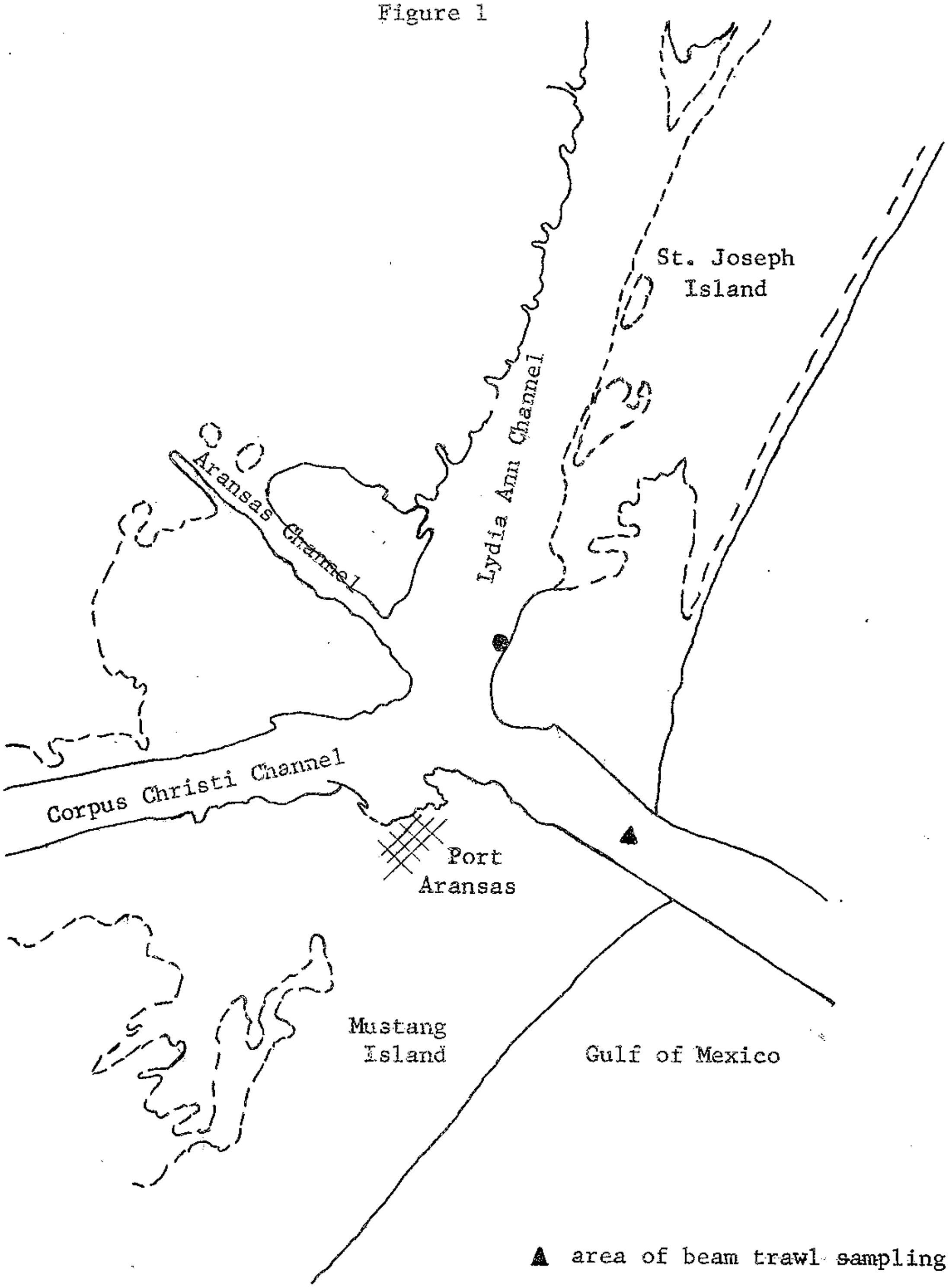
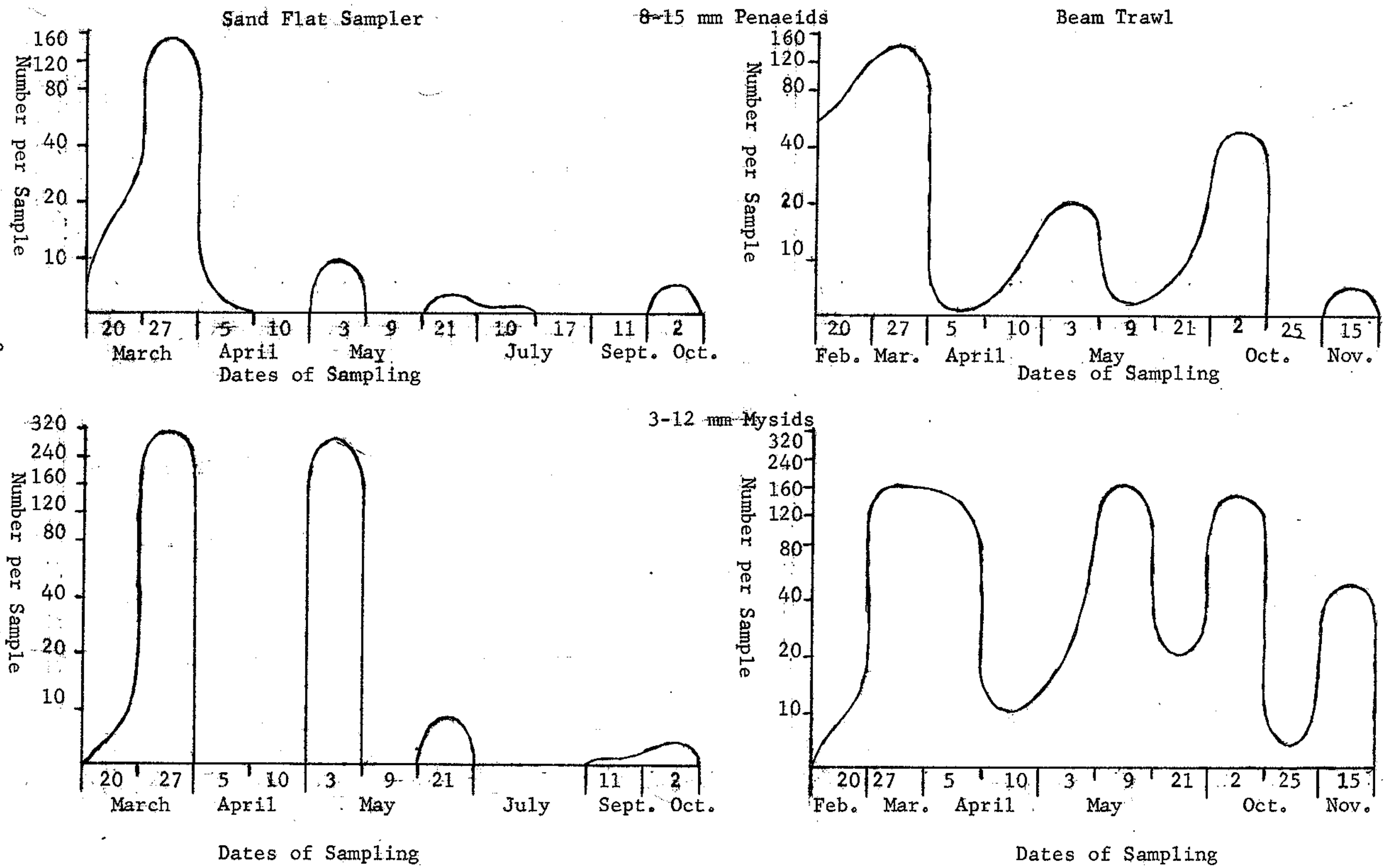

St. Joseph
Island
Lydia Ann Channel
Aransas Channel
Corpus Christi Channel
Port
Aransas
Mustang
Island
Gulf of Mexico
area of beam trawl sampling
area of sand flat sampling

Figure 2



Sand Flat Sampler
8-15 mm Penaeids
Beam Trawl
160
120
80
40
20
10
Number per Sample
20
27
5
10
3
9
21
10
17
11
2
March
April
May
July
Sept.
Oct.
Dates of Sampling
160
120
80
40
20
10
Number per Sample
20
27
5
10
3
9
21
2
25
15
Feb.
Mar.
April
May
Oct.
Nov.
Dates of Sampling
3-12 mm Mysids
320
240
160
120
80
40
20
10
Number per Sample
20
27
5
10
3
9
21
11
2
March
April
May
July
Sept.
Oct.
Dates of Sampling
320
240
160
120
80
40
20
10
Number per Sample
20
27
5
10
3
9
21
2
25
15
Feb.
Mar.
April
May
Oct.
Nov.
Dates of Sampling