

## Job Report

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Project Name: Analysis of Populations of Sports and Commercial Fin-Fish  
and of Factors Which Affect These Populations in the  
Coastal Bays of Texas  
Period Covered: January 1, 1963 to December 31, 1963 Job No. 1

### Coordination of Coastwide Fin-Fish Investigations Project

Abstract: This report is based on a total of 975 collections made during 1963. Two hundred and twelve of these were trammel net or drag seine collections for sampling adult game fish. Two hundred and fifty-four were seine collections for sampling juvenile game fish. Five hundred and nine samples were made with trawls to sample forage species.

Sampling stations and procedures established in September 1961 in all Texas bays from Galveston Bay to the lower Laguna Madre were continued throughout the period. While it was intended that data collected during this period be directly compared with similar data covered in the previous period, several factors, such as infrequent sampling, inadequate samples, and changes in sampling procedure made most comparisons impossible.

Adult and juvenile game fish sampled included speckled trout, Cynoscion nebulosus; redbfish, Sciaenops ocellata; black drum, Pogonias cromis; sheepshead, Archosargus probatocephalus; flounder, Paralichthys lethostigma; and croaker, Micropogon undulatus.

Adult game fish samples in the Galveston Bay area tend to indicate an increase in adult croaker over 1962 but a decrease in trout, redbfish, and drum.

Juvenile seine sampling indicates a sharp decrease in juvenile redbfish in all areas, an increase in trout in the Aransas Bay area, in redbfish and drum in the Galveston area, and in flounder in the Matagorda Bay area. Decreases were noted in juvenile sheepshead in Matagorda Bay.

Forage sampling continues to support statements made in the 1961-62 report that immature crabs, Callinectes sp.; shrimp, Penaeus sp.; and anchovies, Anchoa sp., are important forage items in all bays, and while the croaker is an important forage species in the northern bays, it is replaced by the pinfish, Lagodon rhomboides, in the southern bays.

Objective: To prepare for dissemination a report on the trends and developments of the fin-fish populations of the Texas Coast based on analysis of data received from area biologists.

Procedure: Monthly collections were made by biologists in each bay area with otter trawls, trammel nets or drag seines, and minnow seines. Collection stations were established in various parts of the bays so that all habitat types would be sampled. No changes were made in collection stations established in September 1961 so that valid annual comparisons could be made.

Otter trawls were used primarily for sampling forage species. These trawls measured 10 feet along the lead line, were constructed of  $1\frac{1}{2}$ -inch stretched mesh, and contained a liner of  $\frac{1}{2}$ -inch stretched mesh in the cod end. Each collection with the trawl was of 15 minutes duration except in cases where vegetation prohibited drags of this duration. All forage species collected were weighed and counted. The rough average size of each species was determined.

Trammel nets and drag seines were used to sample adult game species. These trammel nets were 1,200 feet long and 40 inches deep. The outer mesh measured 12 inches stretched, and the inner mesh measured 3 inches stretched. The drag seines used had comparable mesh size, but the length and depth varied. In the Galveston, Aransas, Corpus Christi, and upper Laguna Madre Bay areas the nets were pulled, and the area sampled was calculated. Experimental drag seines up to 3,600 feet long were used in the latter 3 areas during the last 4 months of the period. In the Matagorda, San Antonio, and the lower Laguna Madre bay areas, the nets were struck and the fish driven into the nets by creating a disturbance inside the net. All game species collected were counted and measured. All weights for those fish captured were determined through use of length-weight tables.

Juvenile game fish were collected with a sixty-foot minnow seine. The mesh of the seine measured three-fourth of an inch stretched and was equipped with a center bag which was 3.5 feet wide and 7 feet deep. The seine was pulled, and the area sampled was calculated. All juvenile game fish collected were counted and measured.

For each bay system, the total catch for each type of gear each month was divided either by the number of collections or by the total area sampled, depending on the gear and how it was employed. This resulted in the following monthly averages for the different gear used:

Otter Trawl	Average weight of forage species per 15-minute collection. Corrections were applied to those samples of less than 15-minute duration.
Trammel Net	Average weight of adult game fish per acre sampled.
Minnow Seine	Average number of juvenile game fish per acre sampled. Additional computations were made to determine species and size composition of stock.

In the treatment of data and in the preparation of this report, every effort was made to duplicate the report by the previous project leader in the 1961-62 project reports so that valid comparisons could be made between periods.

#### Findings and

#### Discussion:      Adult Game Species

##### A. Discussion by Bay

GALVESTON BAY - Monthly collections were made with drag seine throughout the period except in January. Supplementary collections were made with trammel and gill nets. The sampling effort and results of sampling are shown in Table 1 and Figure 1.

Cynoscion nebulosus (Cuvier) Speckled Trout

Three periods of small peak abundance were noted in April, June, and November. The average weight per acre during these months was between 1.0 and 1.5 pounds. Samples from the previous year indicated a significant peak in March, April, and May, with an average catch in the peak month of April of over six pounds per acre. The key month for sampling in 1963 appeared to be May, but since only one sample was collected in this month, no accurate comparison of periods of greatest abundance can be made.

Of the 11 months sampled during 1963, 8 averaged less than 1.0 pound per acre in yield compared to only 3 of 10 months sampled in 1962.

The average size tended to follow the abundance as it did in the previous year. The comparison of average size of 1962 and 1963 samples, however, shows a significant disagreement for the summer months. The 1962 samples indicated a steady decline from the peak in April to the low average size in October, which was accredited to the gradual entry of Year Class II fish into the catch. The 1963 samples indicate the sudden appearance of small trout in June followed by a gradual increase in average size through the rest of the year. This reversal of the 1962 picture could be accredited to an absence of a significant trout population of marketable size in the bay when the Year Class II trout appeared. This would indicate that no significant trout population was present in May 1963.

Sciaenops ocellata (Linnaeus) Redfish

The two extreme peaks of abundance noted in March and December 1962 were not noted in 1963. No samples averaging as much as 2.0 pounds per acre were made; only 2 months, August and December, had catches over 1.0 pound per acre. In May, June, and November, no redfish were taken. No samples were taken in January.

The entry of Year Class 0 redfish became evident in the catch in June, as it did in July of 1962.

Pogonias cromis (Linnaeus) Drum

The first sample of the year, taken in February, was just over 1.0 pound per acre sampled. In all other months, the catch was less than 1.0 pound per acre. The two peaks of over 2.0 pounds per acre observed in March and December 1962 were not noted in 1963. Year Class 0 drum entered the catch in July, one month earlier than in 1962. The minimum size declined from 180 mm in May to 120 mm in September, which compares generally with the results obtained in 1962.

Paralichthys lethostigmus Jordan & Gilbert - Southern Flounder

While 1962 flounder catches never exceeded 0.2 pound per acre, 1963 samples showed yields of 0.5 pound in June and July. Of the 11 months in which samples were made, however, 7 failed to produce.

Archosargus probatocephalus (Walbaum) Sheepshead

Catches of sheepshead were good throughout the period as they were during the previous study. The peak of 11.2 pounds per acre average occurred in April (compared to 12.6 pounds in December 1962). Only in February and March of the eleven months sampled did yields average below 2.0 pounds per acre.

Minimum and average standard lengths remained mostly steady throughout the period sampled, except for lower average lengths in April when Year Class 0 sheepshead entered the catch.

An extended spawning season is indicated by the lack of variation in minimum average length.

Micropogon undulatus (Linnaeus) Golden Croaker

Croaker yields were zero in February when sampling commenced and continued low until June when yields increased to 2.5 pounds per acre, rose to over 7.0 pounds in July, dropped to 3.0 pounds in August, to 2.0 pounds in September, and declined to zero in November and December. The peak in 1962 also occurred during the summer months but never exceeded 2.1 pounds per acre which occurred in September.

Minimum and average standard lengths show little variation throughout the period and do not indicate the variations exhibited in 1962. Extended spawning is again indicated by the lack of variation in minimum standard length during the period.

MATAGORDA BAY - Collections were made with trammel net in all months of the period. The sampling effort and results of sampling are shown in Table 1 and Figure 2.

Speckled Trout:

A primary peak occurred in September and October with yields averaging 0.9 and 1.1 pounds per acre, respectively. Secondary peaks of 0.5 pound occurred in February and December. All other months sampled yielded less than 0.3 pound per acre with the yield in March being zero. Peak yield in 1962 occurred in January.

Redfish:

No redfish were caught in January, February, March, April, July, October, or December. The peak month in 1962 (October) corresponds

to a "zero" month for 1963. July and August, the peak months for 1963, compare favorably in yield with the June and July peak for 1962.

Drum:

The primary peak occurred in July with an average yield of 9.2 pounds per acre. A secondary peak of 4.0 pounds per acre occurred in September. January and March catches were zero. All other samples averaged less than 1.5 pounds per acre. This July peak may be misleading, however, considering that one of the three samples included two drum over one meter in length and estimated at 40 and 50 pounds in weight.

Flounder:

Flounder were taken in only 2 of the 12 months in which collections were made and in neither of these collections was a significant number taken.

Sheepshead:

Only 2 sheepshead were taken in the 47 collections made, 1 in July and 1 in October.

Croaker:

No croaker were taken from January through May. The June catch amounted to one fish. Croaker yield then rose to a peak of 1.5 pounds per acre in October. No croaker were taken the remaining two months of the year. The 1962 samples indicated light croaker populations from May through September with no discernible peak.

Year Class 0 croaker entered the catch in July, compared to May in 1962. A steady increase in growth was noted from July through October. Similar growth was noted in 1962 from May through September.

SAN ANTONIO BAY - Collections were made in all months except January, February, and December. The sampling effort and results of sampling are shown in Table 1 and Figure 3. A 1,200-foot trammel net was used in all samples except in November, when the length was increased to 2,100 feet.

Speckled Trout:

Trout were captured in every month in which samples were taken. Peak trout yield occurred in October with an average yield of 1.6 pounds per acre, although yields were erratic throughout the entire period. Year Class II fish entered the catches in July.

#### Redfish:

Redfish were taken in only 4 of the 9 months sampled. The June catch was only 1 specimen; July's catch was only 2. The only significant catches occurred in September (2.9 pounds per acre) and November (1.3 pounds per acre). Both September and November catches indicated the influx of Year Class 0 redfish into the catch.

#### Drum:

While 1962 peak occurred in May and July, the 1963 peak occurred in November, when samples averaged 2.75 pounds per acre. All other months yielded drum, but no average catch exceeded 0.5 pound per acre.

All drum taken ranged from 160 to 320 mm standard length. The minimum size remained fairly constant, indicating an extended spawning season.

#### Flounder:

As in 1962, few flounder were taken. A slight peak existed in July, with an average yield of less than 0.5 pound per acre. Also as in 1962, Year Class 0 entered the catch in July.

#### Sheepshead and Croaker:

Consistent with 1962 samples, catches of these two species were too small to warrant comment.

ARANSAS BAY - Collections were made or attempted during all months except November. A 600-foot seine was used for the first half of the year. A number of drags with a 2,400-foot seine were experimental in nature and were not considered valid quantitative samples. The sampling effort and results of sampling are shown in Table 1 and Figure 4.

#### Speckled Trout:

During the first 6 months, sampling with a 600-foot seine, trout were taken in only 3 months. Only in one of these did the average yield exceed 1.0 pound per acre. Only one valid sample was obtained with the 2,400-foot seine; that in August. These trout samples in August, averaging over 5.0 pounds per acre, compared with the August peak the previous year although the vast difference in seine lengths made comparisons difficult. Year Class II fish were a part of the catch by August.

#### Redfish:

Redfish were caught in only 4 months in which valid samples were taken. These catches indicate a peak exceeding 4.5 pounds per



acre in March. The meager sample indicates Year Class 0 fish had entered the catch by August.

Drum:

The drum catches ranged from zero in February to a peak of 6.8 pounds per acre in June. July and August samples, averaging 7.0 and 11.1 pounds per acre, respectively, were made with the 2,400-foot seine and may not be comparable to the 600-foot seine sample. No comparable samples were obtained after this peak. This picture does not conform to the 1962 catches, which indicate a peak in March declining throughout the remainder of the year.

Flounder:

Few flounder were taken.

Sheepshead:

While 1962 sampling recorded peaks in September and November, the current samples indicate one peak in April; however, no comparable samples were obtained during the last four months. Year Class 0 sheepshead entered the catch in August as they did in 1962.

Croaker:

No croaker were taken in 1963.

CORPUS CHRISTI BAY - No samples were taken until April when the 1,200-foot drag seine was used. In July, the length of this seine was tripled. In August, the seine was reduced to 2,400 feet, which remained standard for the rest of the period; although no samples were made in October and November. As in the case of the Aransas Bay area, the change in length of sampling seine makes comparisons difficult. The sampling effort and the results of sampling are shown in Table 1 and Figure 5.

Trout:

A decided peak is indicated in August; however, one of the two samples made in this month involved a 2,400-foot net. This catch, an average of two samples, indicates a yield of over 7.0 pounds per acre. A secondary peak of just over 2.0 pounds per acre in June was also indicated. Since 1962 yields exceeded one pound per acre only in May, an increase in trout population over 1962 is indicated.

Year Class II trout entered the catches in August in both years.

Redfish:

While 1961 and 1962 peaks both occurred in the month of October, 1963 peaks occurred in May and August. These peak yields averaged 2.1 and 1.7 pounds per acre, respectively.

The number of redfish taken was insufficient to determine growth or age.

Drum:

The major peak in October and minor peak in May 1962 was not noted in 1963. Drum sampling, commencing in April, started with the peak yield of 16.4 pounds per acre, dropped to 2.0 pounds in May, rose to 3.0 pounds in June and dropped to zero in July. August yield rose to 4.0 pounds, dropping to almost zero in September. No samples were obtained in October and November. The single sample taken in December yielded no drum. Year Class 0 drum entered the catch in August as in 1962. Average standard length clearly indicated growth from 200 mm in May to 250 mm in September.

Flounder:

While flounder catches occurred in May, July and August, they were absent from samples in April, June, September, and December. No samples were taken in January, February, March, October, and November. Yield never exceeded 0.2 pound per acre, which is less than the 1962 peak of 0.5.

Year Class 0 flounder appeared to enter the catch in July.

Sheepshead:

The 1963 samples indicate sheepshead taken in all seven months when samples were taken. A primary peak of 2.0 pounds per acre occurred in May with a secondary peak in August. The lowest average yield (July - 0.1 pound) compares with the 1962 peak (July) of 2.1 pounds.

Year Class 0 sheepshead entered the catch in May.

Croaker:

No croaker were taken in 1963. No samples were made during the fall period when peaks occurred in 1961 and 1962.

UPPER LAGUNA MADRE - Samples were taken in every month except January and February. As in the Aransas Bay and Corpus Christi Bay areas, the length of the sampling seine was changed in mid-year. Seines used were 600, 1200, 2400, and 3600 feet. This variation in length of net and area covered within the year makes comparison difficult. The sampling effort and results of sampling are shown in Table 1 and Figure 6.



#### Trout:

Speckled trout, taken in significant numbers in every month, started at 2.5 pounds per acre in March, dropped to 1.5 pounds in April, then rose again to 2.5 in May. The June sample showed a drop to 1.2 pounds followed by a steady rise to the peak of 4.5 pounds in September. This peak was followed by a decline to the year's low average of 1.5 pounds per acre in November and December. This September peak may be caused by the use of a longer seine. The secondary peak in May matches the primary peak for 1962. Average standard lengths remained fairly constant throughout the period. Minimum lengths indicate Year Class II fish entered the catch in July.

#### Redfish:

Two peaks occurred during the year; the first peak in June averaged just over 2.0 pounds per acre and a second larger peak averaged just under 3.0 pounds per acre in August. Six of the remaining eight months averaged less than one pound per acre in yield. These peaks and average yields are similar to the 1962 results. Two-year-old redfish contributed significantly to the June peak, while Year Class 0 redfish dominated the August peak.

The influx of Year Class 0 redfish can easily be seen in the steady decline of average standard length from 420 mm in April to 250 mm in August. As in 1962, the largest redfish taken was caught in late spring (May in 1962, June in 1963).

#### Drum:

While drum yields never exceeded 5.5 pounds per acre in 1962, 14 pounds per acre were exceeded in seven consecutive months in 1963. Sampling commenced in March with an average of 15.0 pounds per acre. This yield increased slowly to 20.0 pounds in June, then rose rapidly to a peak of 94.3 pounds per acre in August, which declined steadily to the year's low of 2.5 pounds in December. This single significant peak is in contrast to an erratic catch in 1962 resulting in five peaks. The 1963 August peak compares with the fourth 1962 peak.

Minimum, average, and maximum sizes remain generally constant throughout most of the period.

#### Flounder:

The first flounder taken was a single specimen captured in April. The yield then rose to the peak, occurring in June, which then declined to zero in August. The 1962 catches never exceeded a single fish in many months. Year Class 0 flounder entered the catch in May.

Sheepshead:

The entire yearly catch constituted two peaks in 1962. The largest peak started with 1.0 pound per acre in March, increasing to 23.4 pounds in May, and declining to 2.5 pounds in July. This peak corresponds to a peak of 1.5 pounds in 1962. A secondary peak occurred with an average yield of 4.0 pounds per acre in November.

Croaker:

Insignificant croaker catches occurred in May and September with a single fish taken in March.

LOWER LAGUNA MADRE - No change was made in type or length of net used or in location of stations. No samples were taken in February or March. For sampling effort and results of sampling in the area, see Table 1 and Figure 7.

Trout:

The collections averaged 2.5 pounds per acre in April and dropped to less than 1.0 pound per acre in May. The period high peak occurred in June with 3.5 pounds per acre, declining to 1.2 pounds per acre in July. A third peak occurred in September when 2.4 pounds per acre was the average yield. From this peak, yield declined to almost zero in December.

Year Class II trout did not enter the catch until October.

Redfish:

One significant peak occurred in 1963, that in August of an average 7.0 pounds per acre. Several large redfish approaching 700 mm standard length contributed to this peak. All other samples yielded less than 1.0 pound per acre. Year Class 0 fish entered the catch in September.

Drum:

This species was taken in every month in which collections were made. The peak yield averaged 3.6 pounds per acre in October, declining to 2.8 pounds in November. No other collection exceeded 2.0 pounds per acre. All specimens taken were of Year Class II and III. This limitation as to year classes is due to the sampling location, which, in turn, is dictated by the sampling equipment.

Flounder:

Catches of this species were low as in other areas, with small catches in the summer months. A slight peak existed in July, compared to August of 1962. As in the case of drum, these low catches are due not only to the selectivity of the collecting gear, but to location of sampling area.

Sheepshead:

As in 1962, this species was seldom taken. The peak occurred in November both in 1963 and 1962.

Croaker:

Catches averaged just over 1.0 pound per acre in June and July. Croaker were not taken in any other months.

Juvenile Game Fish

Table 2 gives the number of seine collections and total area sampled for each month in each bay system. The results of these collections in average number of each species per acre sampled are shown in Figures 8 through 14. The maximum, minimum, and average standard length for each species each month are also shown in these figures.

GALVESTON BAY

Speckled Trout:

Juvenile trout first appeared in July when the average sample yielded 20 specimens per acre. This yield decreased to 5 per acre in September, then increased to the year's maximum of 60 per acre in November. In general, 1963 results compare favorably with those for 1962.

Redfish:

The few specimens taken in February and March were Year Class 0 fish, born the previous fall, and indicate a reduction from the spring of 1961. Those taken in November and December were from the 1963 spawn. The latter samples, averaging 12 per acre in November and 22 per acre in December, indicate a successful 1963 spawn when compared with the completely negative results obtained in the same months of 1962.

Drum:

The few drum taken during the first four months were from the hatch of the previous spring. The current 1963 crop appeared in large numbers in May and occurred in all samples through November in decreasing numbers. As in 1962, growth could be easily followed. Comparison of results indicate a more successful spawn in 1963 than in 1962.

Flounder:

Juvenile flounder appeared in only two months, April and July. Numbers were far too small for comparison, although 1963 catches appeared to be less than those of 1962.

Sheepshead:

Juvenile sheepshead were present in small numbers in June, July, and August. No significant change was noted from samples taken in 1962.

A general comparison of all species for 1963 and 1962 indicate that drum increased in number, redfish were reduced in number in the spring, and sheepshead, trout, and flounder show little change.

MATAGORDA BAY

Speckled Trout:

January and April samples contained trout hatched ~~the~~ the previous year. Fish of the 1963 hatch first appeared in July, reached a peak in September of 18 specimens per acre and were present through November. During this five-month period, there was a continual entry of small fish. The picture presented is much the same as in the previous year.

Redfish:

Small numbers of Year Class 0 redfish appeared in January through April and again in September. Average numbers per acre appear reduced when compared with results of sampling in 1962.

Drum:

While all specimens taken in the period were Year Class 0 fish, two separate spawns were present, those of the fall of 1962 and of the spring of 1963. The picture shows little change over results of 1962 sampling.

Flounder:

Juvenile flounder were present in samples taken in all months but December, with peak abundance noted in May and June. January and February samples contained only fish hatched in 1962. April, July, August, September, October, and November samples were of fish hatched in 1963. Both year groups were present in March and May samples. A comparison of results indicate an increase in abundance in 1963 over 1962 samples.

Sheepshead:

No juvenile sheepshead were taken in 1963, a definite decline in abundance from 1962.

A general comparison of all species for 1963 appears to indicate an increase in abundance of flounder, a decrease in sheepshead, and no significant change in trout, redfish, and drum over samples taken in 1962.

SAN ANTONIO BAY - No juvenile seine samples were taken in January, February, April, May, September, and December. Samples taken during the remaining six months indicate too few fish were taken to allow valid comparisons except that the poor results obtained in 1963 duplicate results in 1962. Small numbers of trout, flounder, and redfish were taken in only two months; drum in only one. Sheepshead were taken in 4 months, but in 1 of these months, catches consisted of a single fish.

ARANSAS BAY

Trout:

Juvenile trout of the 1962 spawn appeared in small numbers in March and April. Fish of the 1963 spawns appeared in June and continued through November with a definite peak in September. This period of relative abundance and peak month is comparable with sample results obtained in 1962. The average yield in numbers per acre in 1963 shows an increase over 1962 samples.

Redfish:

Juvenile redfish born the previous winter were taken in small numbers in February and April. All other samples were negative. Results of these samples indicate a definite decline in numbers from 1962.

Drum:

Seine samples for juvenile drum were successful only in April with a light catch of drum hatched the previous fall. Samples contained no drum from a 1963 hatch, indicating a definite decline from 1962.

Flounder:

Only one sample (May) produced juvenile flounder. These low numbers are comparable with those of 1962.

Sheepshead:

A few specimens were taken in September only, too few on which to comment, although sampling appeared to be less successful than in 1962.

In general, trout show an increase in abundance over 1962, redfish declined sharply, and all others show little or no change over the previous year. The trout was the only species taken in quantity.

CORPUS CHRISTI BAY

Speckled Trout:

Juvenile trout were taken in every month but May. As in 1962, the peak occurred in November. Comparison of samples for 1963

and 1962 indicates significant juvenile trout present in both years with only a slight decrease in average numbers noted in 1963.

Redfish:

All juvenile redfish taken in 1963 were fish of the year and were taken in February, March, and April, with peak abundance in April. The population decreased from 1962 samples.

Drum:

With only a single fish taken, a definite decline in abundance is noted over 1962.

Flounder:

Juvenile flounder were taken in small numbers in April, May, June, and October. Peak abundance was less than in 1962 samples.

Sheepshead:

This species was present in 6 of the 12 months with peak catches in September and October. Peak abundance was comparable to that of 1962.

UPPER LAGUNA MADRE

Speckled Trout:

As in 1962, samples never contained more than a single specimen and, while 1963 results are comparable, yield was very low in both years.

Redfish:

Small numbers appeared in March and April. The significant February peak in 1962 did not appear, and a reduction in redfish in 1963 is indicated.

No juvenile flounder, drum, or sheepshead were taken in seine samples in 1963, which represents little significant change from 1962. In general, juvenile samples in 1963 were as sparse as those in 1962.

LOWER LAGUNA MADRE

Speckled Trout:

Juvenile trout were taken by seine in only one month. Since none were taken in 1962, no comparison can be made.

Redfish:

Samples in 1963 were negative, representing little change from 1962.



#### Drum:

Juvenile drum were taken in quantity in June, July, September, and November, which compares favorably with results from 1962 sampling. Peak abundance of 162 specimens per acre represents a decline from the 230 per acre average in 1962.

No flounder or sheepshead were taken in 1963, no change from 1962. Generally, juvenile samples were as sparse in 1963 as in 1962.

#### Forage Species

Table 3 gives the number of 15-minute trawl collections made in each bay each month to obtain the data presented in this section of the report.

The two methods of presenting the catch of forage species used in the 1961-62 report were also used in this report so that an accurate comparison of the two periods could be made. The first method involved the plotting of the average catch in pounds of all forage species per 15-minute collection with the 10-foot otter trawl for each month. These data are shown in Figures 15 through 18. This year, however, the figures include both 1962 and 1963 calculations for comparative purposes. The average catches of adult game fish, plotted on the figures in the 1962 report, are not included in the 1963 figures, since no relationship was found to exist between predator and prey.

The second method was used to present species composition of the forage catch. This method, as in 1962, involved the determination of the percentage of each total monthly catch by number that was made up by each of ten categories selected. The results of these determinations are shown in Figures 19 through 26. The categories presented in these figures and the species involved in each are given below.

<u>Category No. &amp; Name</u>	<u>Species</u>
1. Pinfish	<u>Lagodon rhomboides</u> (Linnaeus)
2. Croaker	<u>Micropogon undulatus</u> (Linnaeus)
3. Anchovy	<u>Anchoa mitchilli</u> (Valenciennes)
4. Menhaden	<u>Brevoortia patronus</u> Goode
5. Silverside	<u>Menidia beryllina</u> (Cope)
	<u>Menidia martinica</u> (Valenciennes)
6. Mullet	<u>Mugil cephalus</u> Linnaeus
	<u>Mugil curema</u> Valenciennes
7. Pigfish	<u>Orthopristis chrysopterus</u> (Linnaeus)
8. Crab	<u>Callinectes sapidus</u> Rathbun
	<u>Callinectes danae</u> Smith
9. Shrimp	<u>Penaeus setiferus</u> Linnaeus
	<u>Penaeus aztecus</u> Ives
10. Other	Includes all other forage species

These figures tend to substantiate the conclusions drawn in previous reports: that fluctuations in abundance of forage species are related primarily to seasonal temperature changes.

A comparison of Figures 19 through 26 which show species composition of forage catch by per cent, with the comparable figures in the 1961-62 report,

indicates no significant variation in these data. This report can only restate the comments made in the previous report; that shrimp, crabs, and anchovies are important forage items in all bay areas, that croaker are important in the northern bays and the pinfish their counterpart in the southern bays.

Further observations indicate that the menhaden never exceeded 2 per cent of the total by number in any sample collected, nor did pigfish ever exceed 10 per cent.

#### Comments:

Adult game fish samples indicate that populations of speckled trout were at a lower ebb in 1963 than in 1962 except in Aransas Bay, Corpus Christi Bay, and the Upper Laguna Madre. The pounds per acre sampled were as follows:

Trout (pounds/acre)		
<u>Area</u>	<u>1962</u>	<u>1963</u>
Galveston	1.69	0.48
San Antonio	2.88	0.71
Aransas*	0.60	0.62
Corpus Christi*	0.41	1.60
Upper Laguna*	1.24	2.10
Lower Laguna	2.14	1.62

Redfish standing crops were also reduced as follows:

<u>Area</u>	<u>1962</u>	<u>1963</u>
Galveston	2.07	0.45
San Antonio	43.50	0.50
Aransas*	1.23	1.67
Corpus Christi*	0.80	0.61
Upper Laguna*	1.04	1.03
Lower Laguna	2.74	1.15

For drum, a marked increase was noted for the lower coast and a decrease on the upper coast.

<u>Area</u>	<u>1962</u>	<u>1963</u>
Galveston	1.11	0.37
San Antonio	12.00	0.63
Aransas*	1.29	2.70
Corpus Christi*	1.41	1.68
Upper Laguna*	1.15	4.25
Lower Laguna*	1.71	20.10

Sheepshead continued to be fairly abundant, although this species was only infrequently captured in those bays where the net could not be pulled. These areas are excluded as follows:

<u>Area</u>	<u>1962</u>	<u>1963</u>
Galveston	2.78	4.44
Aransas*	7.00	9.04
Corpus Christi*	0.56	1.34
Upper Laguna Madre*	0.34	8.62

\*In those bays where the net length was changed in August 1963, only the first six months catch was used in the calculations. Matagorda Bay values were not used since these data for 1962 were plotted as pounds per strike rather than pounds per acre.

The decline in trout catch in Galveston Bay can be attributed to absence of large fish in April and May 1963 in direct contrast to 1962. The overall redfish decline in San Antonio Bay was partly due to the fact that a series of large catches in September, October, and November 1963 were not duplicated in 1963.

Part of the cause for the coast-wide decline in redfish abundance was the failure of the spawn of late 1961 to survive the rigorous winter of 1962. An extremely low crop of juveniles was noted in every bay area. These juveniles would normally contribute heavily to late summer and fall catches.

Although there was a general increase in salinity along the entire Coast, salinity, per se, does not appear to be the only limiting factor, except perhaps for redfish. Catches increased in the very areas where hypersalinity was most pronounced (Aransas Bay, Corpus Christi Bay, and the Upper Laguna Madre). The fact that these areas were affected strongly by heavy freezes in 1962 might have resulted in reduced catches that year and a subsequent buildup in 1963.

There seems to be little correlation between the amount of forage present and the standing crop of game fish.

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Table 1

Number of Adult Game Fish Collections and Area Sampled Per Month Per Bay

Month	<u>Galveston Bay</u>		<u>Matagorda Bay</u>		<u>San Antonio Bay</u>		<u>Aransas Bay</u>	
	<u>Coll.</u>	<u>Acres</u>	<u>Coll.</u>	<u>Acres</u>	<u>Coll.</u>	<u>Acres</u>	<u>Coll.</u>	<u>Acres</u>
January	0	0	7	-	0	0	2	1.50
February	4	20.00	3	-	0	0	1	.75
March	3	14.10	3	-	3	11.10	3	3.00
April	4	16.40	3	-	2	7.40	4	3.75
May	1	4.10	3	-	4	14.80	4	4.00
June	4	16.40	3	-	4	14.80	4	4.00
July	5	18.90	3	-	4	14.80	2	25.00
August	4	16.60	3	-	4	14.80	2	33.00
September	4	23.50	5	-	3	11.10	2	33.00
October	4	30.50	4	-	3	11.10	1	10.50
November	3	23.40	5	-	3	11.10	0	0
December	<u>2</u>	14.10	<u>5</u>	-	<u>0</u>	0	<u>2</u>	27.00
Total	38		47		30		27	

Table 1--Continued  
Number of Adult Game Fish Collections and Area Sampled Per Month Per Bay

Month	<u>Corpus</u> <u>Coll.</u>	<u>Christi Bay</u> <u>Acres</u>	<u>Upper</u> <u>Coll.</u>	<u>Laguna</u> <u>Acres</u>	<u>Madre</u> <u>Acres</u>	<u>Lower</u> <u>Coll.</u>	<u>Laguna</u> <u>Acres</u>	<u>Madre</u> <u>Acres</u>
January	0	0	0	0		2	8.20	
February	0	0	0	0		0	0	
March	0	0	4	13.00		0	0	
April	2	8.20	4	13.00		4	16.40	
May	3	12.30	3	10.50		4	16.40	
June	2	8.20	3	13.50		4	16.40	
July	2	75.00	2	52.50		3	12.30	
August	2	33.00	2	33.00		2	8.20	
September	2	33.00	2	33.00		4	16.40	
October	0	0	1	16.50		4	16.40	
November	0	0	2	24.50		4	16.40	
December	<u>1</u>	16.50	<u>2</u>	33.00		<u>0</u>	0	
Total	14		25			31		

Table 2  
Number of Juvenile Game Fish Collections and Area Sampled Per Month Per Bay

Month	<u>Galveston Bay</u>		<u>Matagorda Bay</u>		<u>San Antonio Bay</u>		<u>Aransas Bay</u>	
	<u>Coll.</u>	<u>Acres</u>	<u>Coll.</u>	<u>Acres</u>	<u>Coll.</u>	<u>Acres</u>	<u>Coll.</u>	<u>Acres</u>
January	4	.43	7	.80	0	0	3	.31
February	4	.57	6	.69	0	0	4	.28
March	4	.34	4	.46	1	.11	4	.41
April	1	.11	4	.46	0	0	4	.41
May	3	.34	4	.46	0	0	4	.41
June	2	.29	4	.46	4	1.38	4	.41
July	4	.56	4	.46	3	.34	4	.41
August	6	1.00	5	1.31	3	.69	4	.35
September	6	.38	5	.79	0	0	4	.41
October	5	.41	5	.85	3	.34	4	.41
November	4	.25	5	.87	3	1.03	4	.41
December	<u>5</u>	.23	<u>3</u>	.36	<u>0</u>	0	<u>3</u>	.31
Total	48		56		17		46	



Table 2--Continued  
Number of Juvenile Game Fish Collections and Area Sampled Per Month Per Bay

<u>Month</u>	<u>Corpus</u> <u>Coll.</u>	<u>Christi Bay</u> <u>Acres</u>	<u>Upper</u> <u>Coll.</u>	<u>Laguna</u> <u>Acres</u>	<u>Madre</u> <u>Acres</u>	<u>Lower</u> <u>Coll.</u>	<u>Laguna</u> <u>Acres</u>	<u>Madre</u> <u>Acres</u>
January	4	1.38	0		0	0		0
February	4	1.38	4		1.10	0		0
March	4	1.38	4		1.10	2		.53
April	4	1.38	3		.83	2		.41
May	4	1.38	0		0	1		.09
June	3	1.03	3		.83	2		.37
July	2	.41	0		0	3		.30
August	4	.82	3		.83	2		.29
September	4	.82	3		.83	1		.23
October	4	.82	3		.83	0		0
November	4	.82	3		.83	1		.11
December	<u>4</u>	.82	<u>0</u>		0	<u>0</u>		0
Total	45		26			14		

Table 3  
Number of Forage Collections Per Month Per Bay

<u>Month</u>	<u>Sabine Lake</u>	<u>Galveston Bay</u>	<u>Matagorda Bay</u>	<u>San Antonio Bay</u>
January	0	4	3	0
February	0	5	3	4
March	0	8	3	4
April	0	7	4	4
May	0	8	4	4
June	5	8	4	8
July	10	9	4	8
August	10	9	4	8
September	5	9	4	6
October	10	9	4	9
November	10	7	4	4
December	<u>0</u>	<u>6</u>	<u>4</u>	<u>3</u>
Total	50	89	45	62

Table 3--Continued  
Number of Forage Collections Per Month Per Bay

<u>Month</u>	<u>Aransas Bay</u>	<u>Corpus Christi Bay</u>	<u>Upper Laguna Madre</u>	<u>Lower Laguna Madre</u>
January	8	10	0	1
February	8	10	4	5
March	4	10	4	4
April	4	5	0	4
May	8	9	5	4
June	8	10	5	4
July	8	10	3	4
August	8	10	3	4
September	8	12	5	4
October	8	12	4	4
November	4	9	2	4
December	<u>4</u>	<u>5</u>	<u>0</u>	<u>4</u>
Total	80	102	35	46

Figure 1  
Adult Game Fish - Galveston Bay Area

Standard Length (Range and Mean) in Decimeters

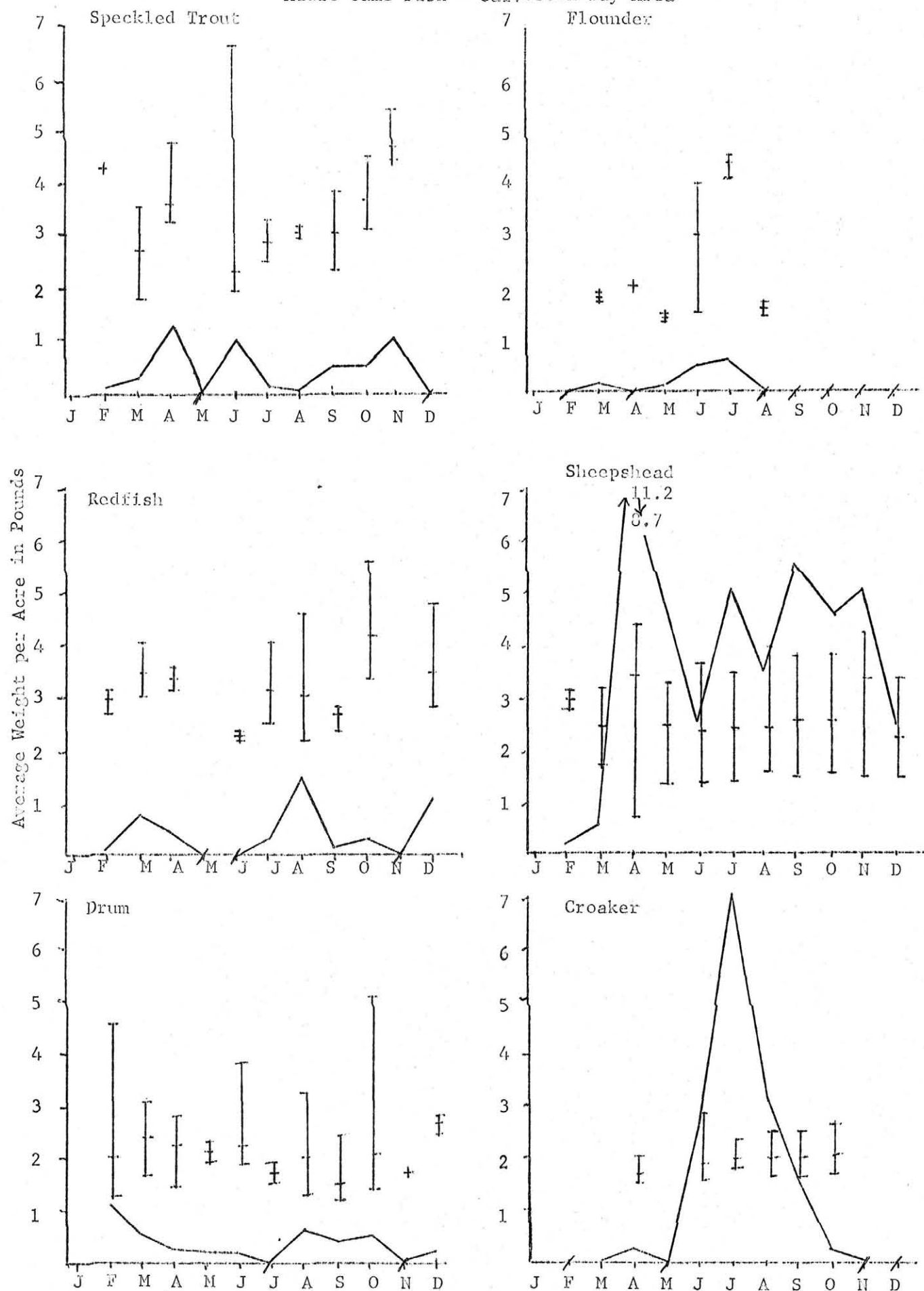


Figure 2

Adult Game Fish - Matagorda Bay Area

Standard Length (Range and Mean) in Decimeters  
Average Weight per Acre in Pounds

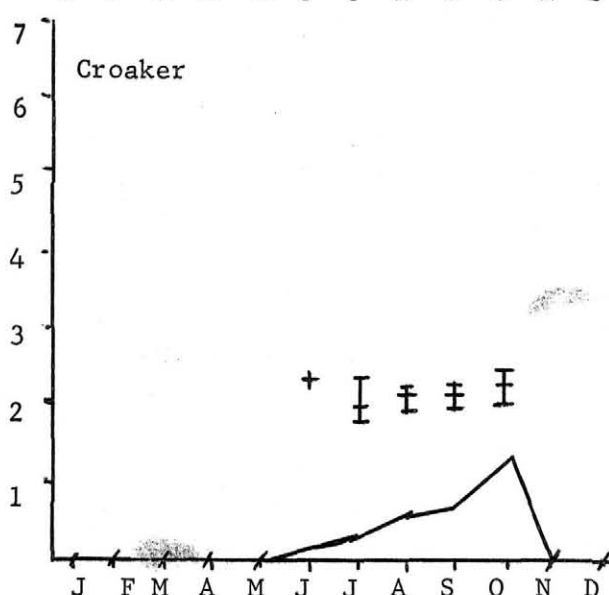
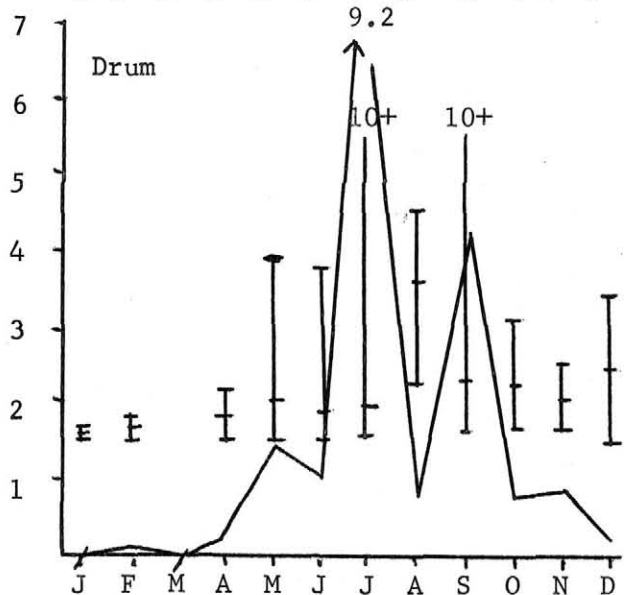
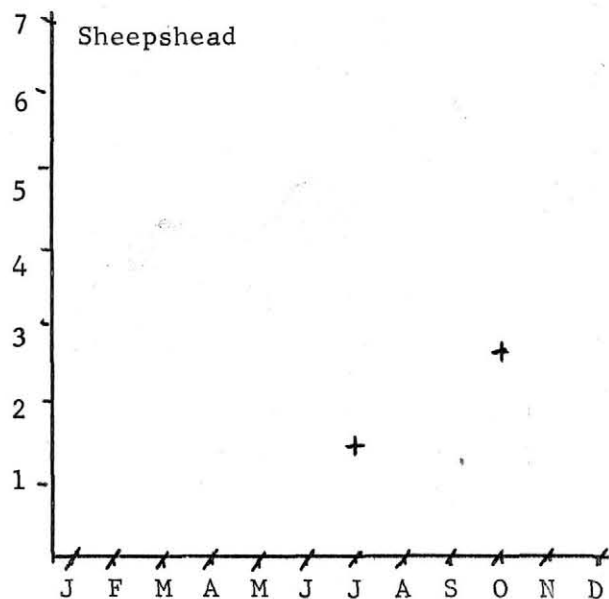
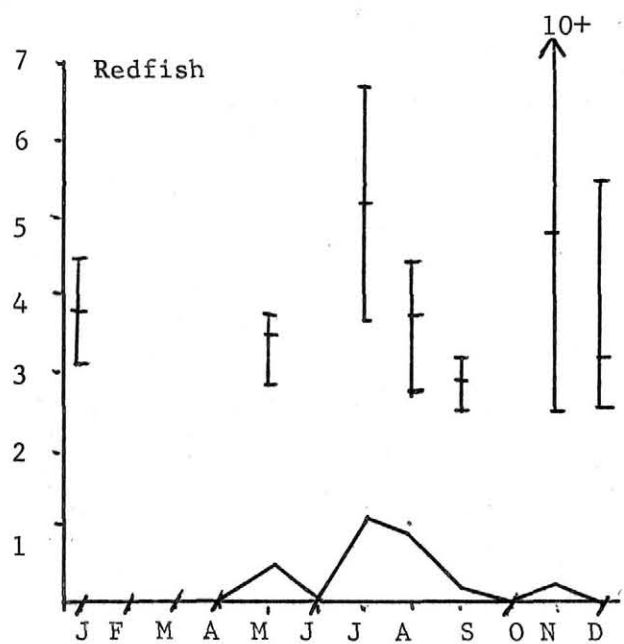
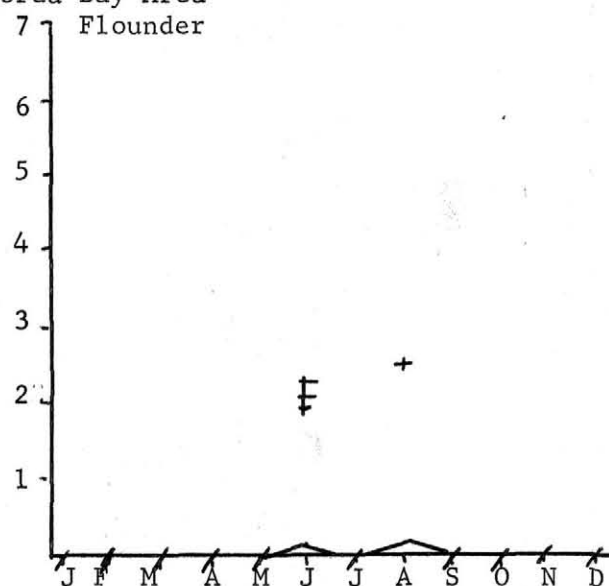
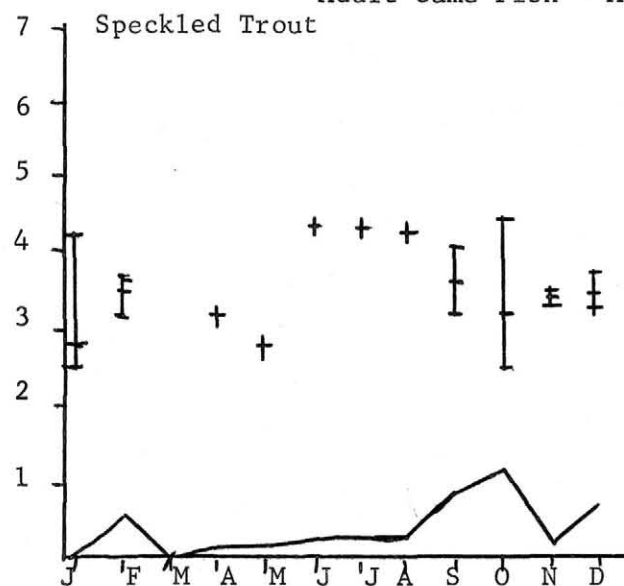


Figure 3  
Adult Game Fish - San Antonio Bay Area

Standard Length (Range and Mean) in Decimeters

Average Weight per Acre in Pounds

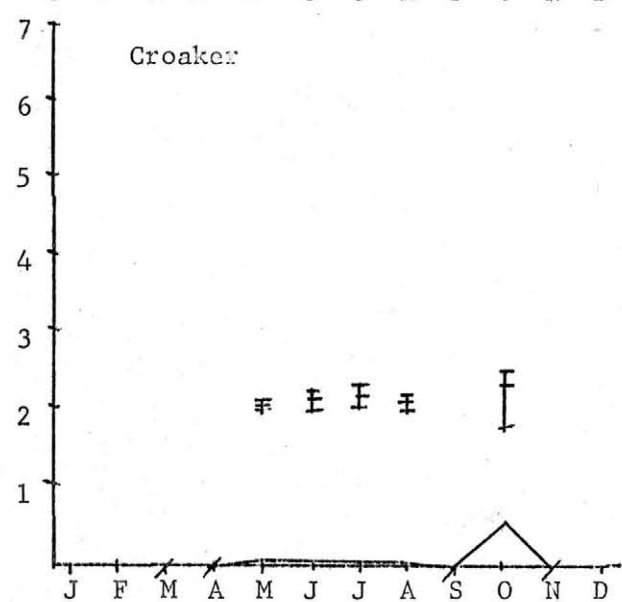
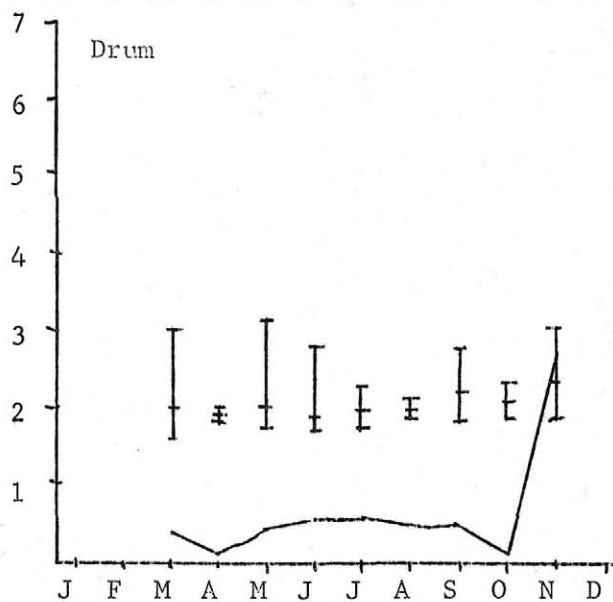
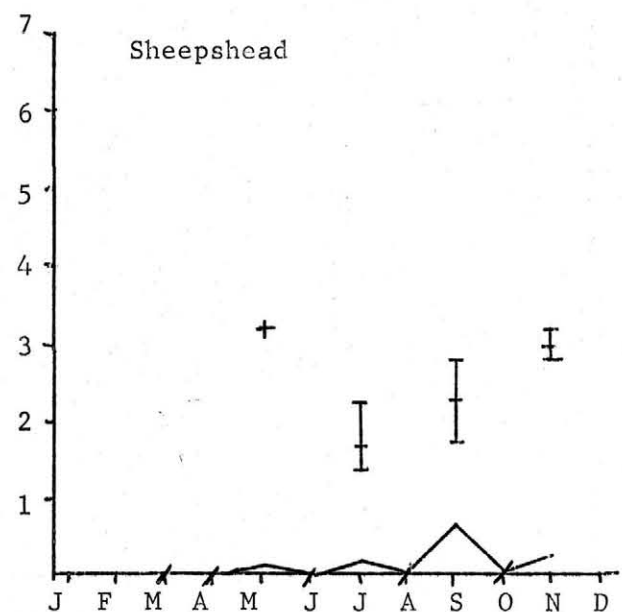
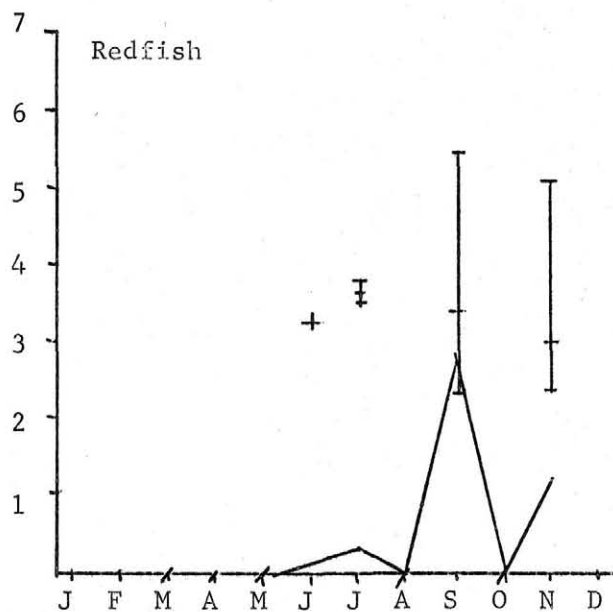
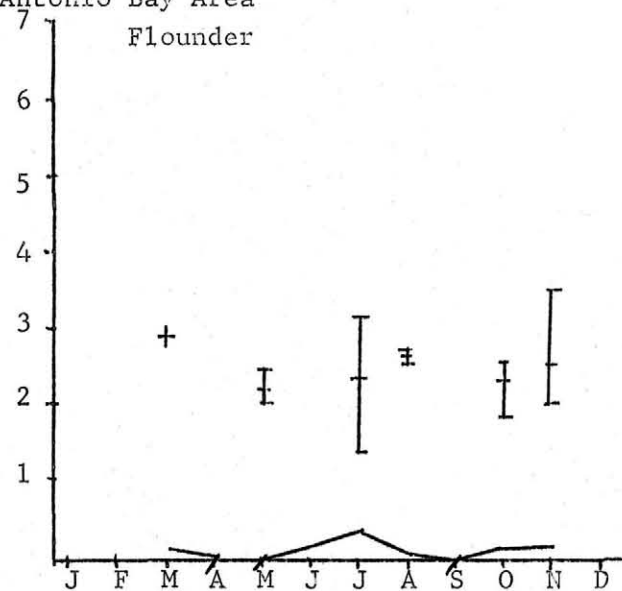
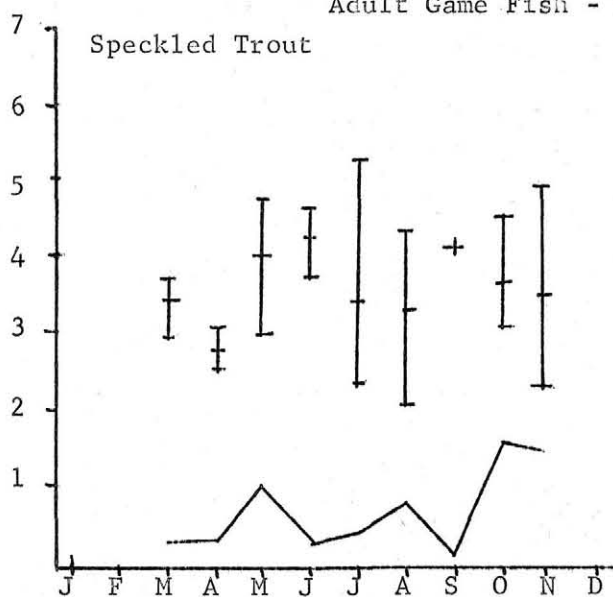




Figure 4  
Adult Game Fish - Aransas Bay Area

Standard Length (Range and Mean) in Decimeters

Average Weight per Acre in Pounds

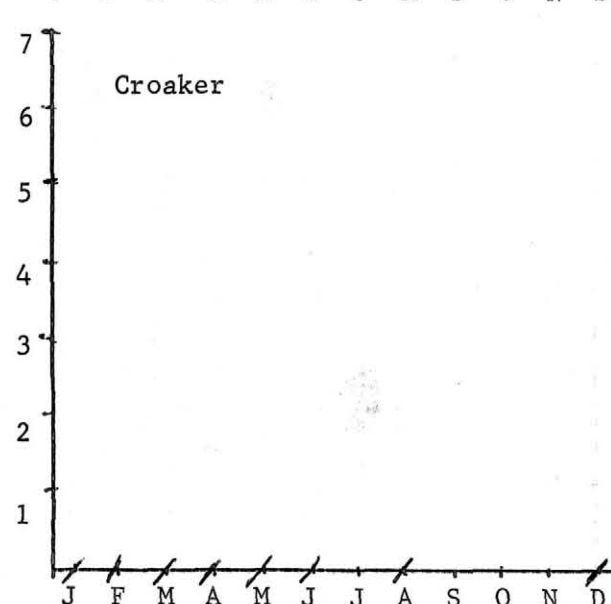
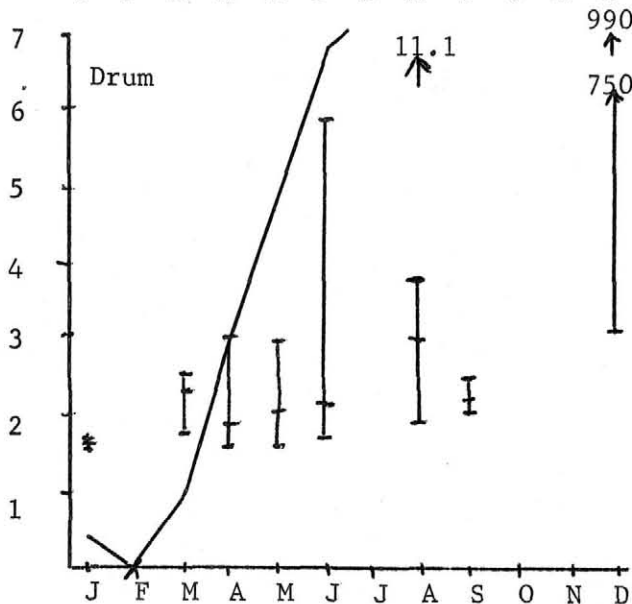
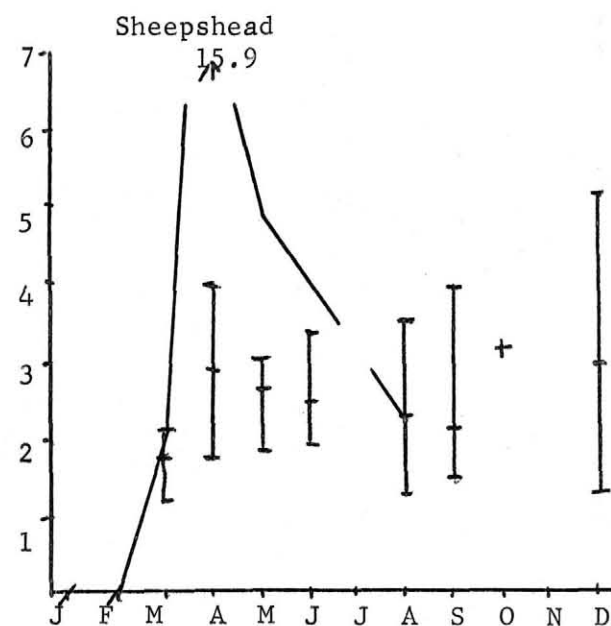
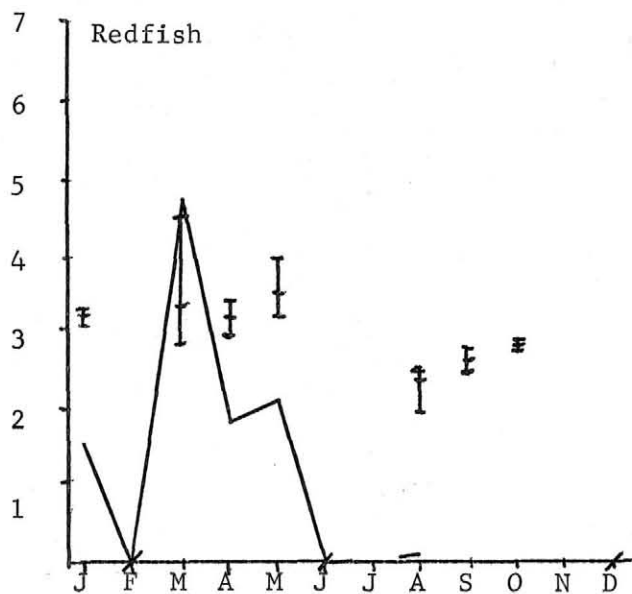
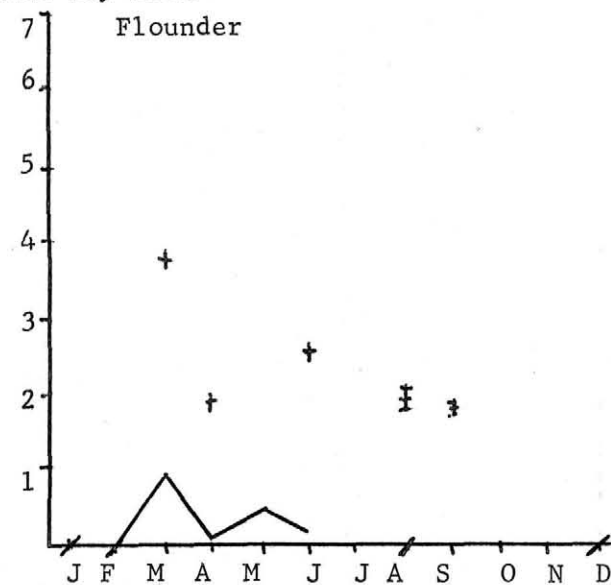
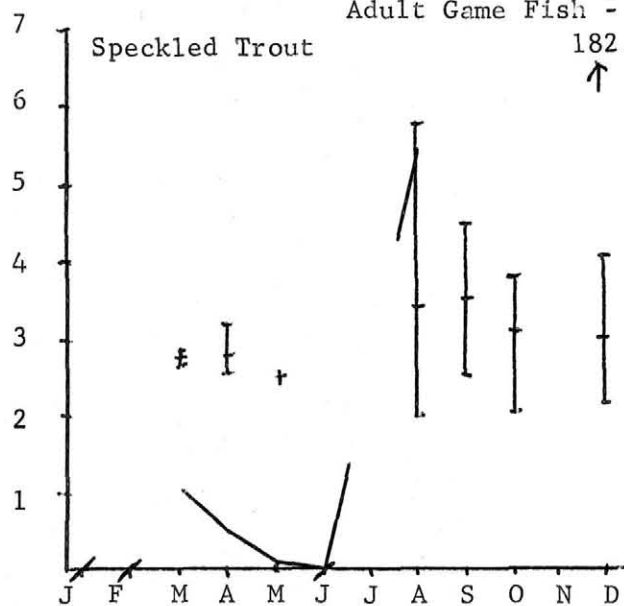


Figure 5

## Adult Game Fish - Corpus Christi Bay Area

Standard Length (Range and Mean) in Decimeters

Average Weight per Acre in Pounds

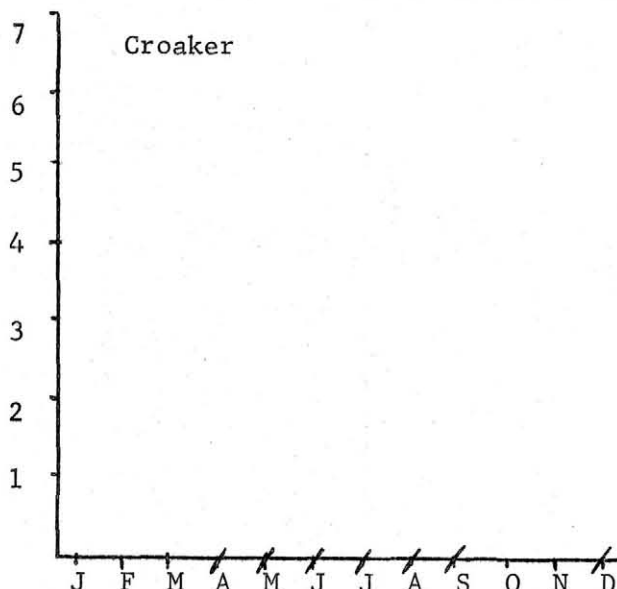
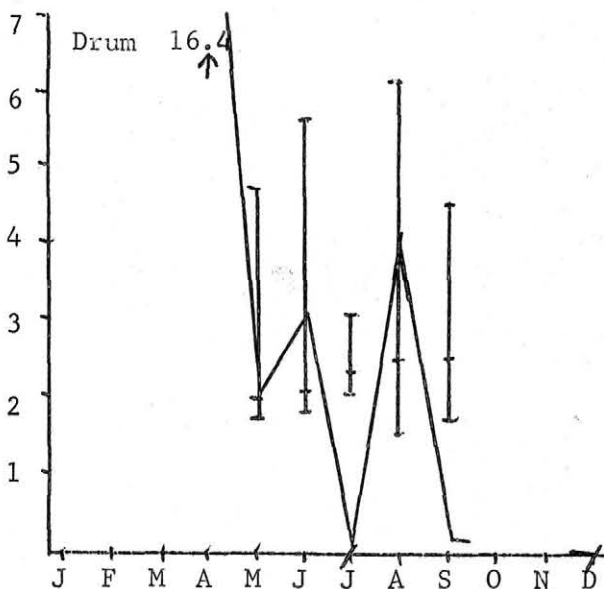
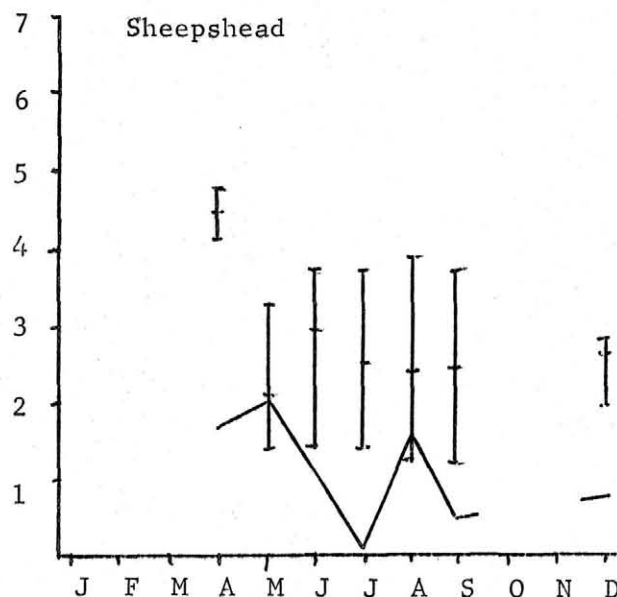
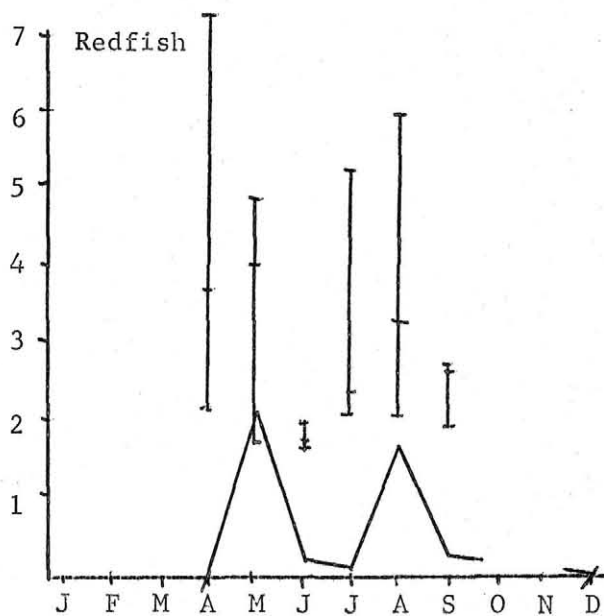
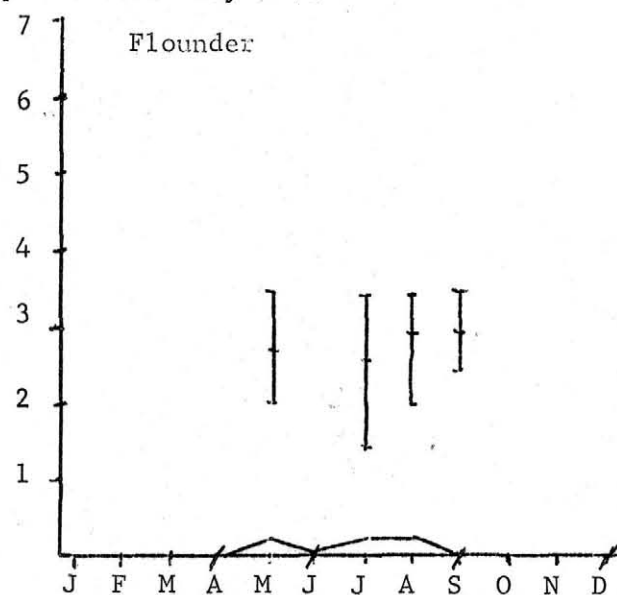
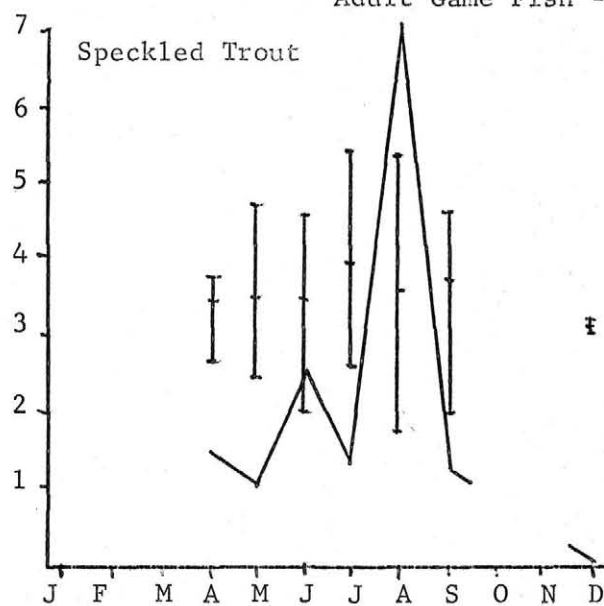


Figure 6

## Adult Game Fish - Upper Laguna Madre Area

Standard Length (Range and Mean) in Decimeters

Average Weight per Acre in Pounds

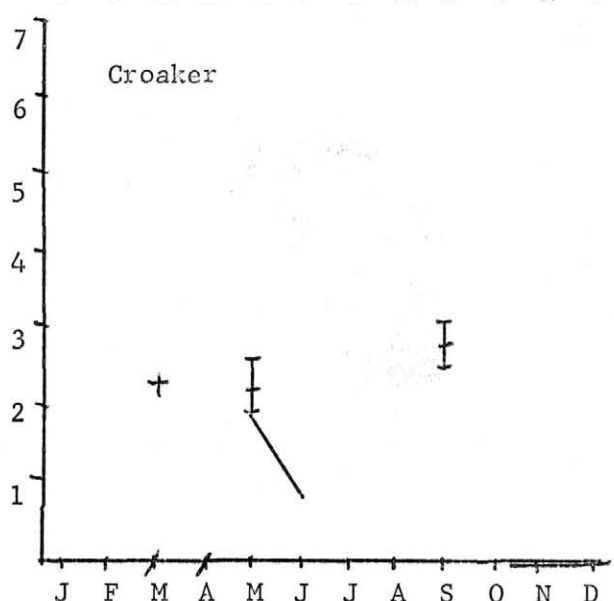
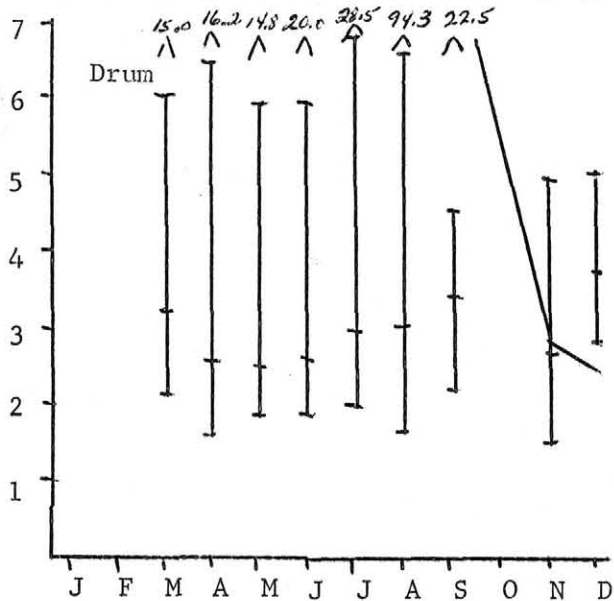
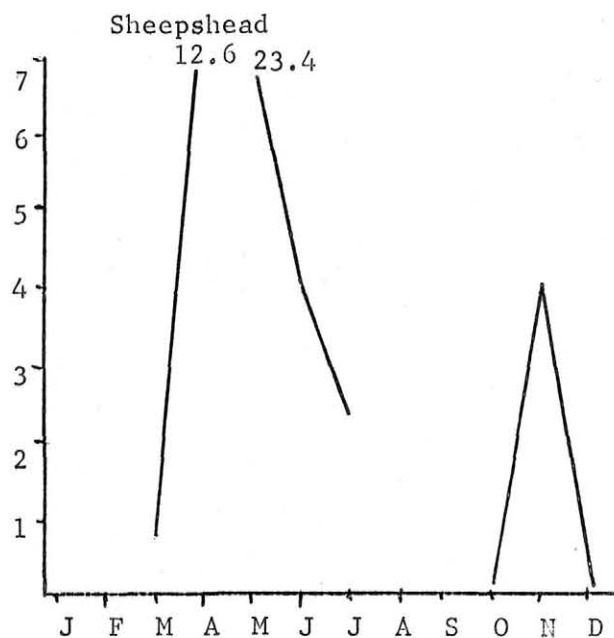
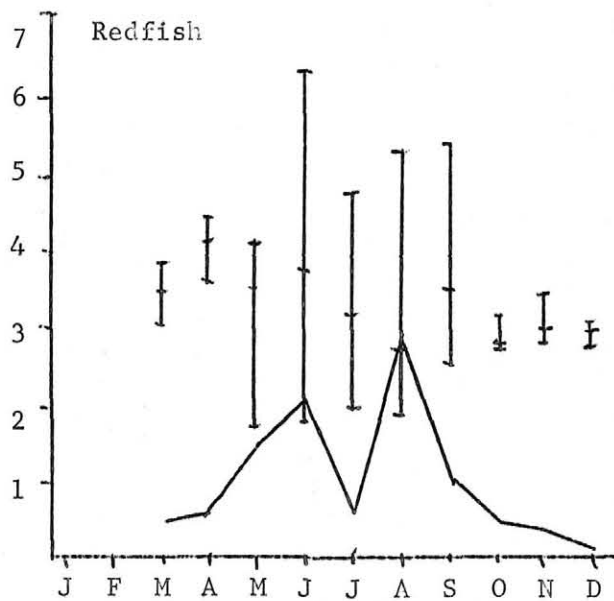
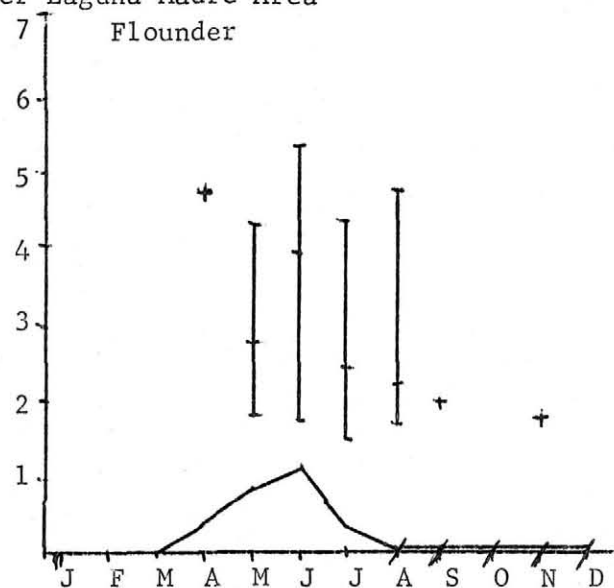
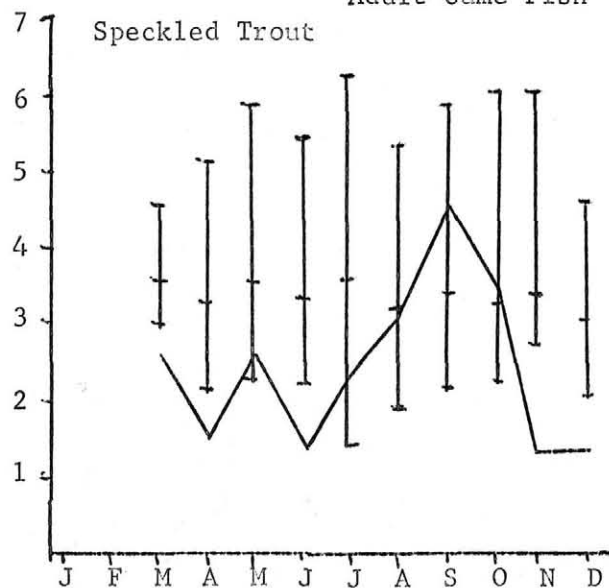


Figure 7

## Adult Game Fish - Lower Laguna Madre Area

Standard Length (Range and Mean) in Decimeters

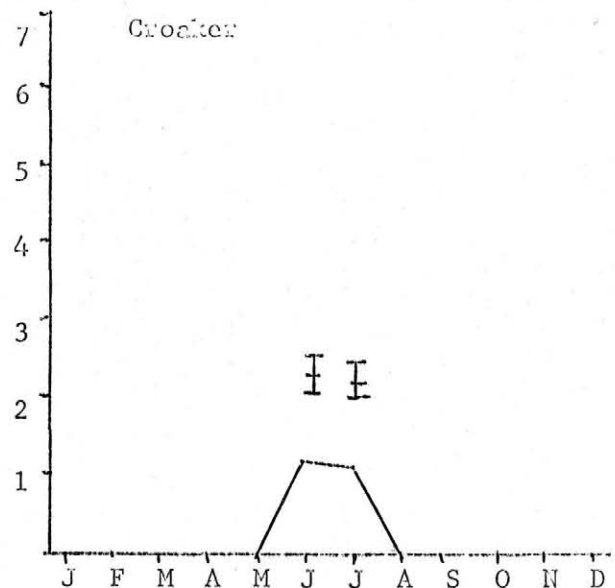
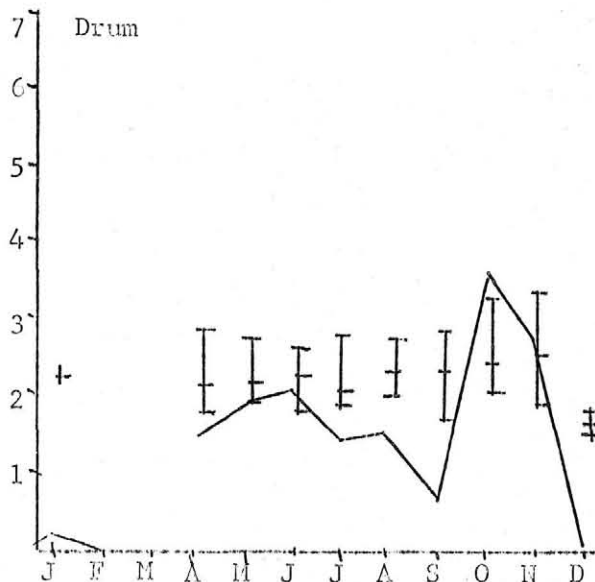
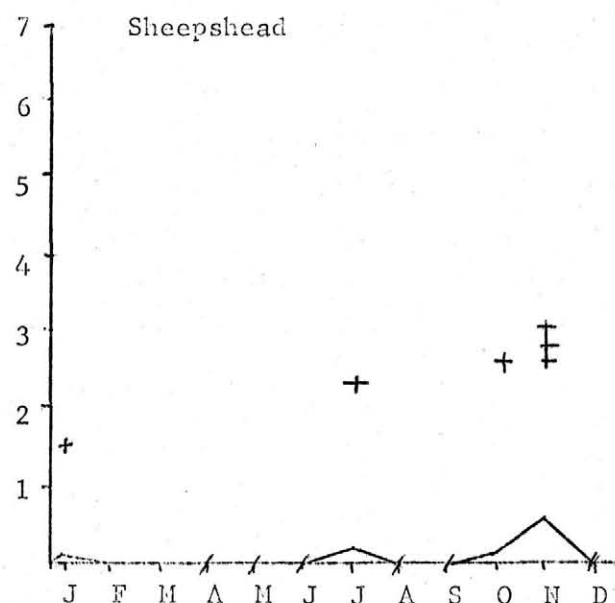
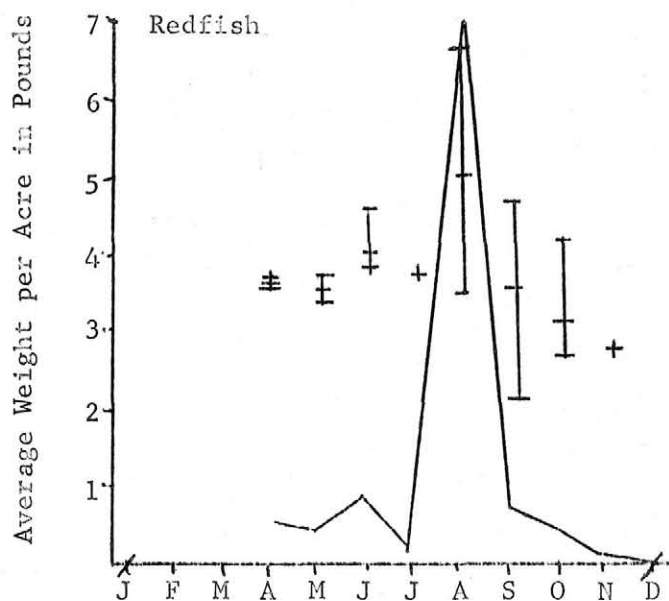
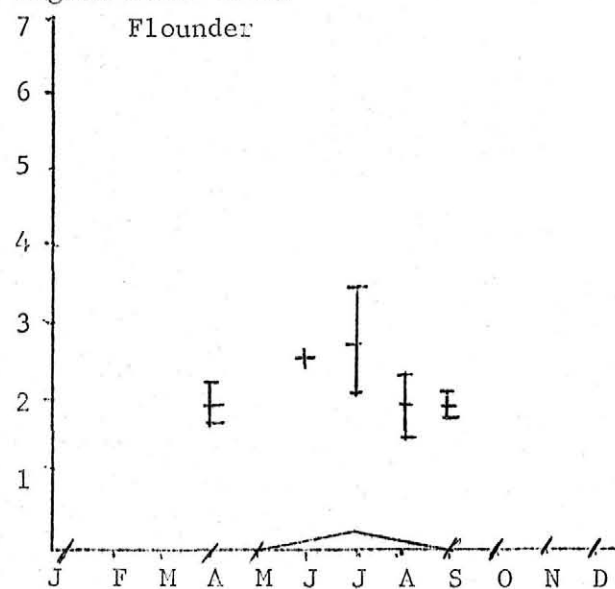
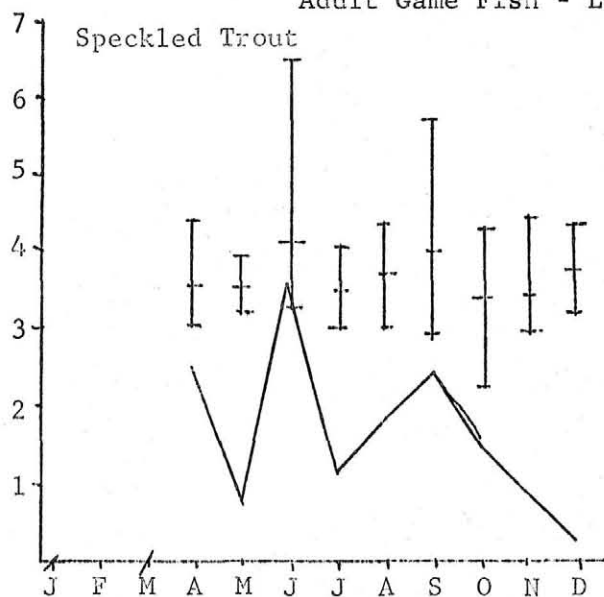


Figure 3  
Juvenile Game Fish - Galveston Bay Area

Standard Length (Range and Mean) in Millimeters

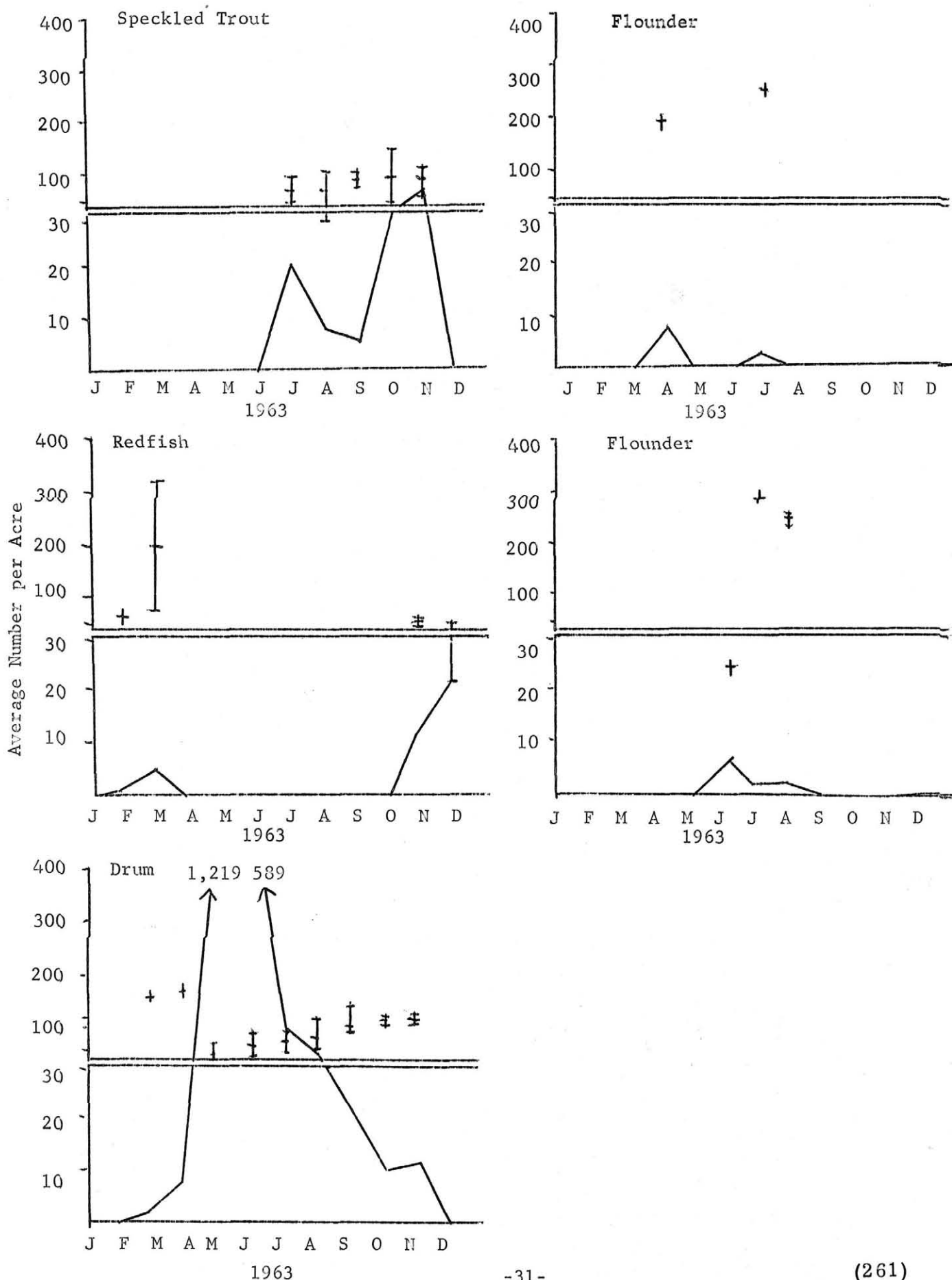


Figure 9  
Juvenile Game Fish - Matagorda Bay Area

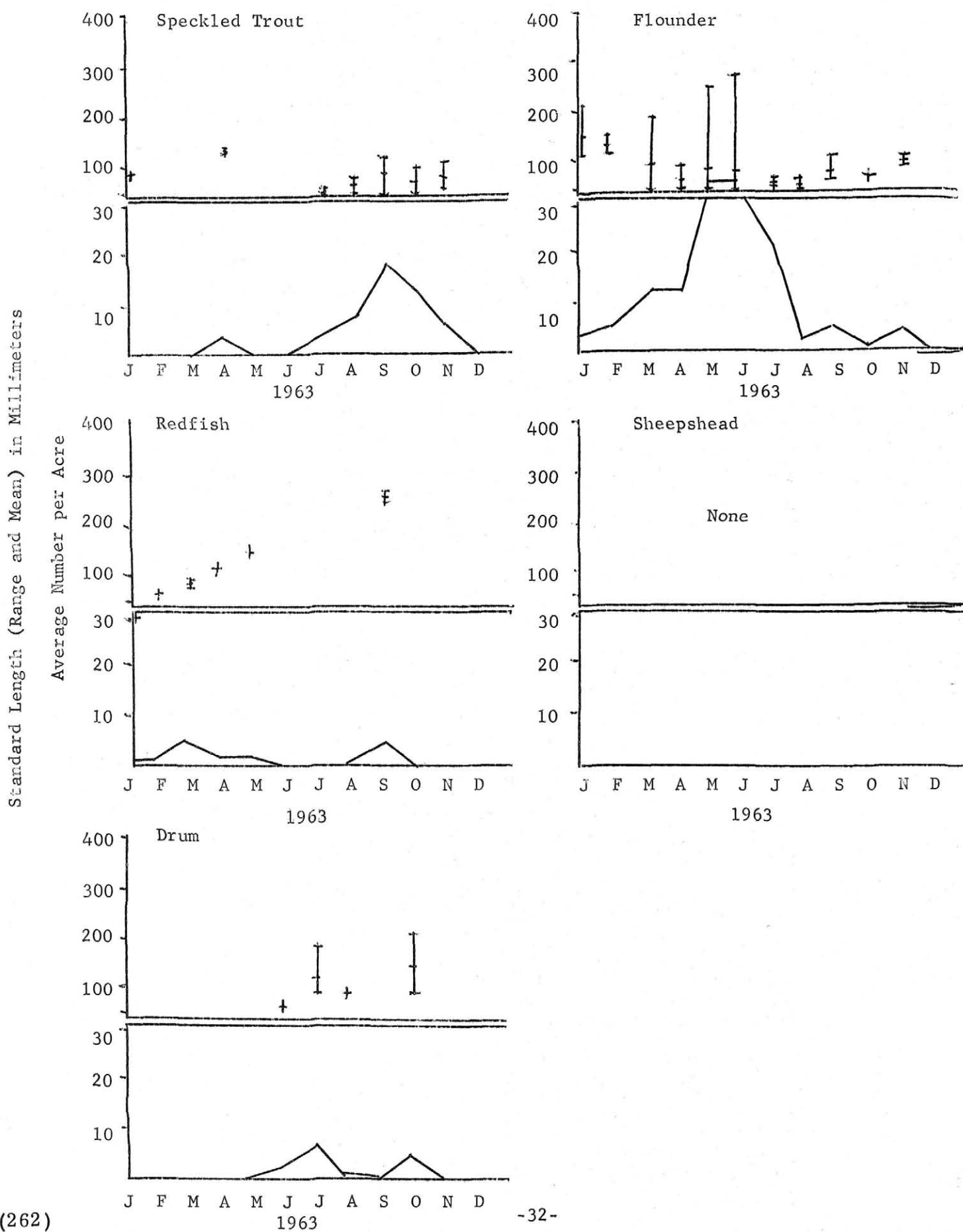




Figure 10  
Juvenile Game Fish - San Antonio Bay Area

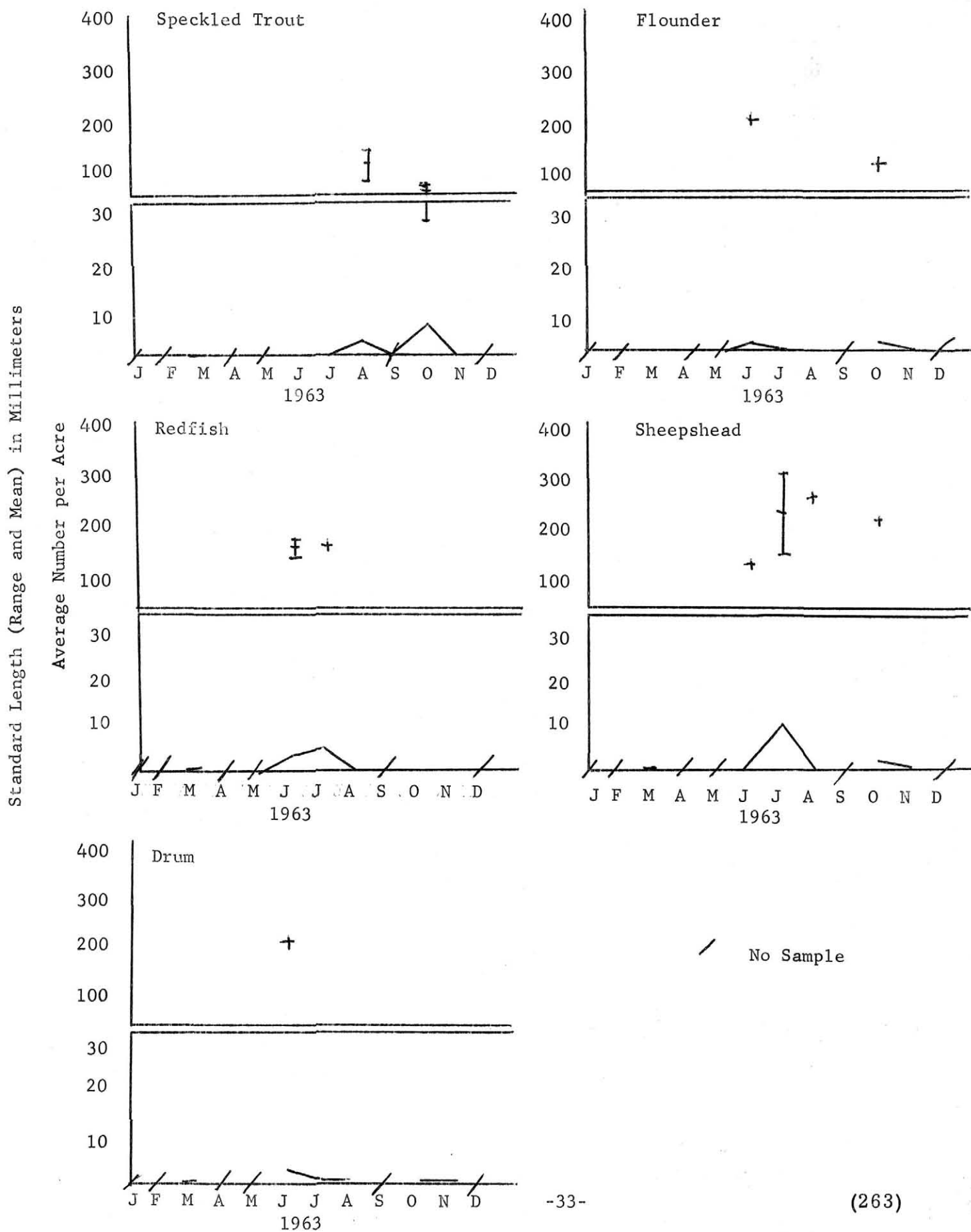


Figure 11  
Juvenile Game Fish - Aransas Bay Area

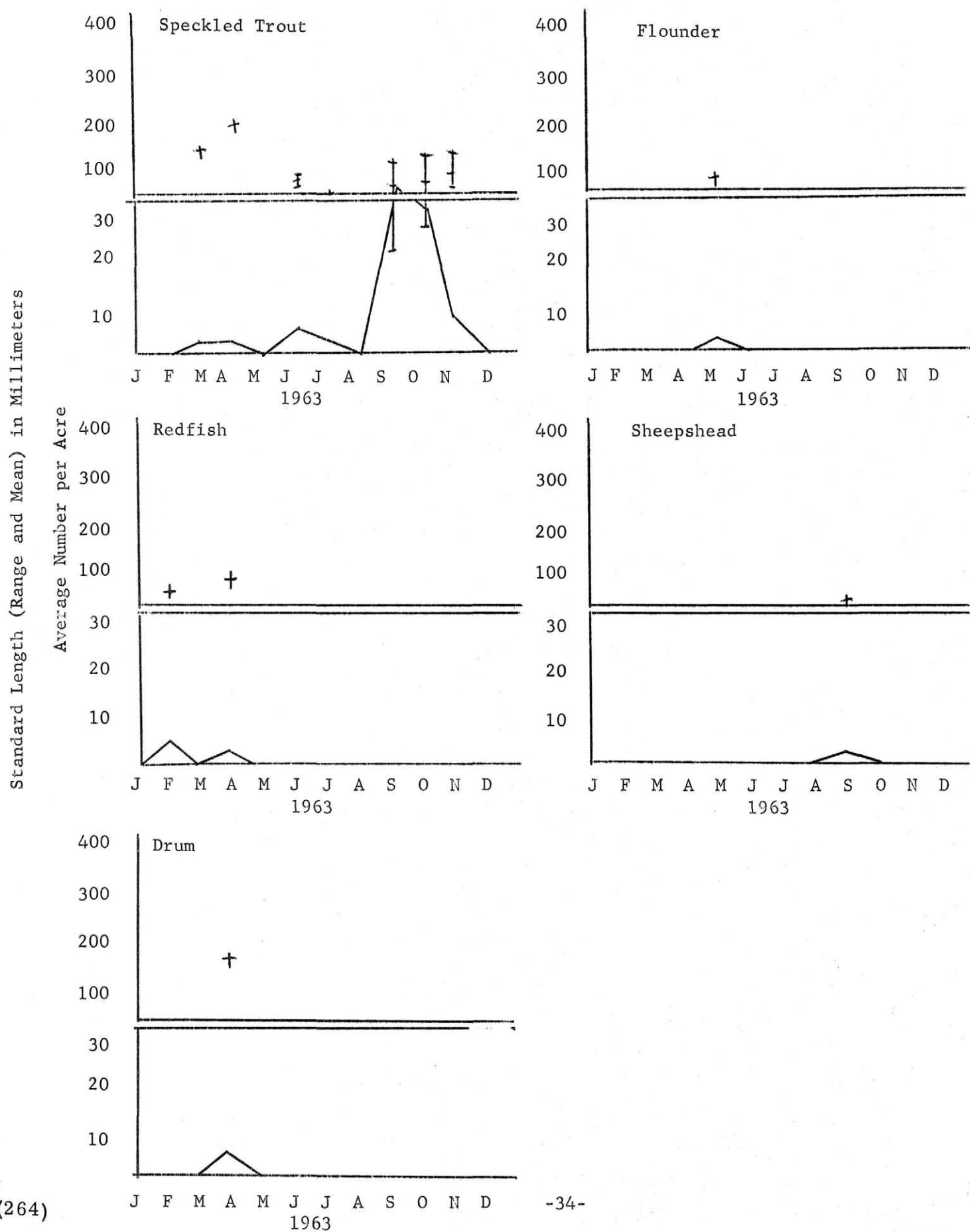


Figure 12  
Juvenile Game Fish - Corpus Christi Bay Area

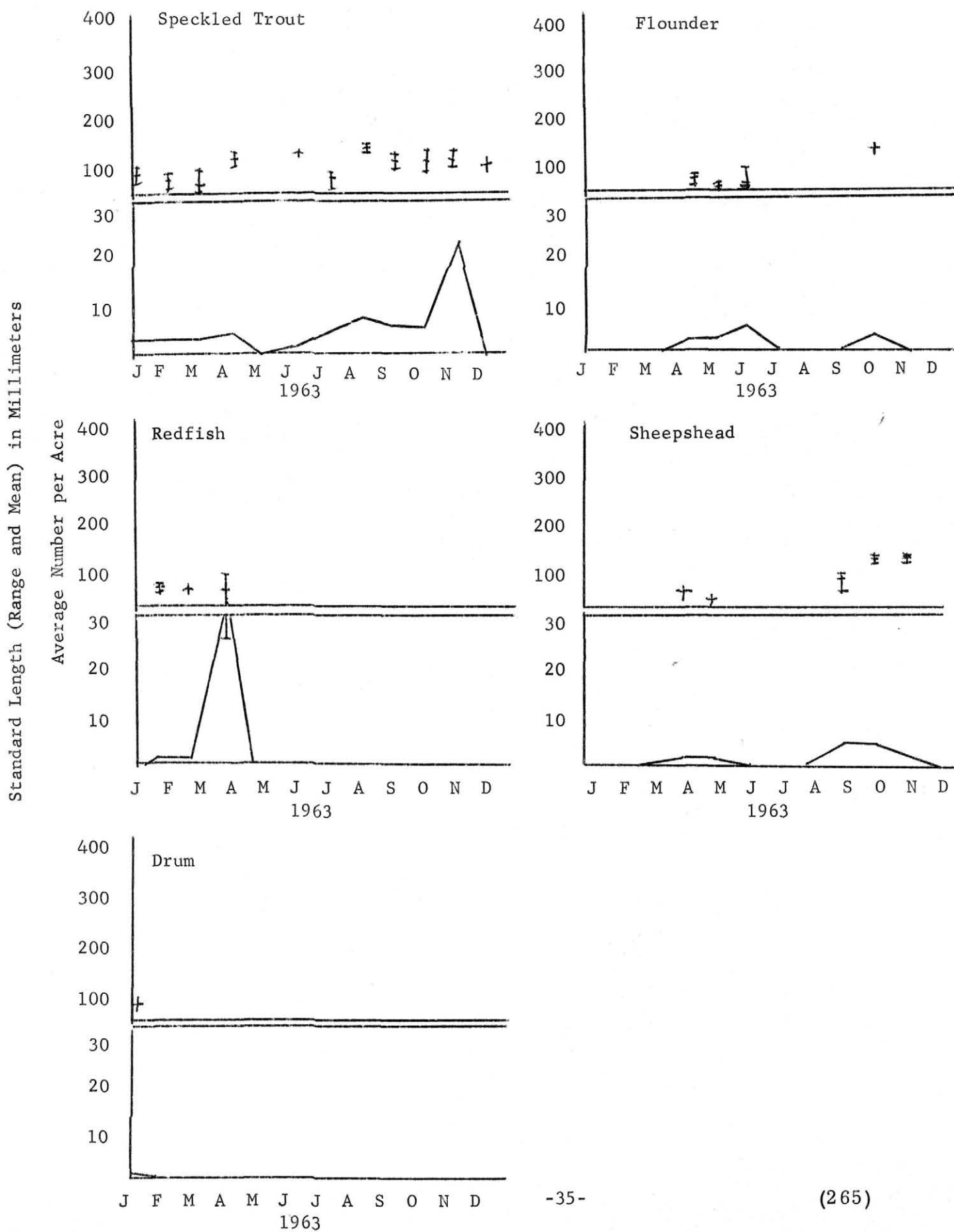


Figure 13  
Juvenile Game Fish - Upper Laguna Madre

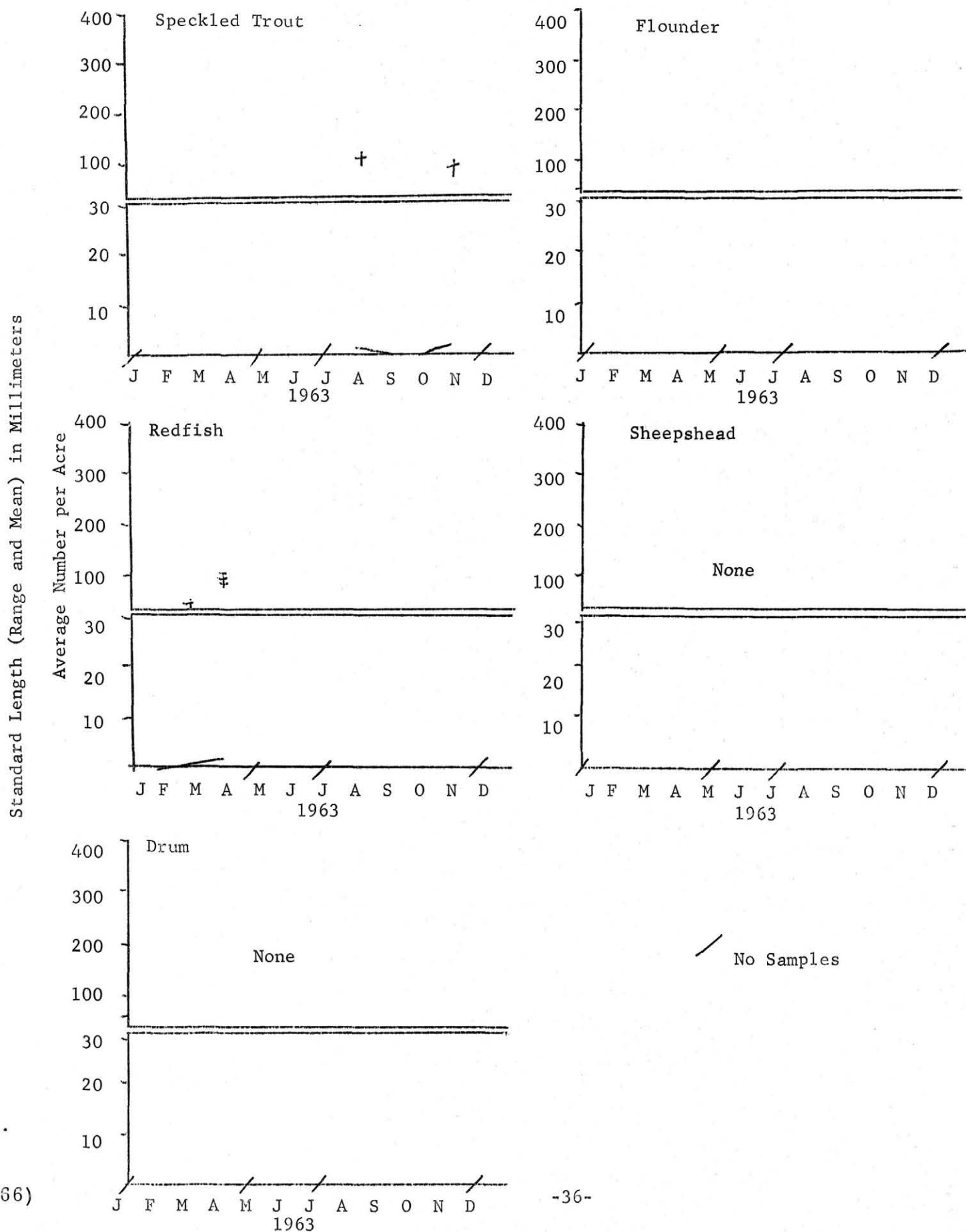


Figure 14  
Juvenile Game Fish - Lower Laguna Madre

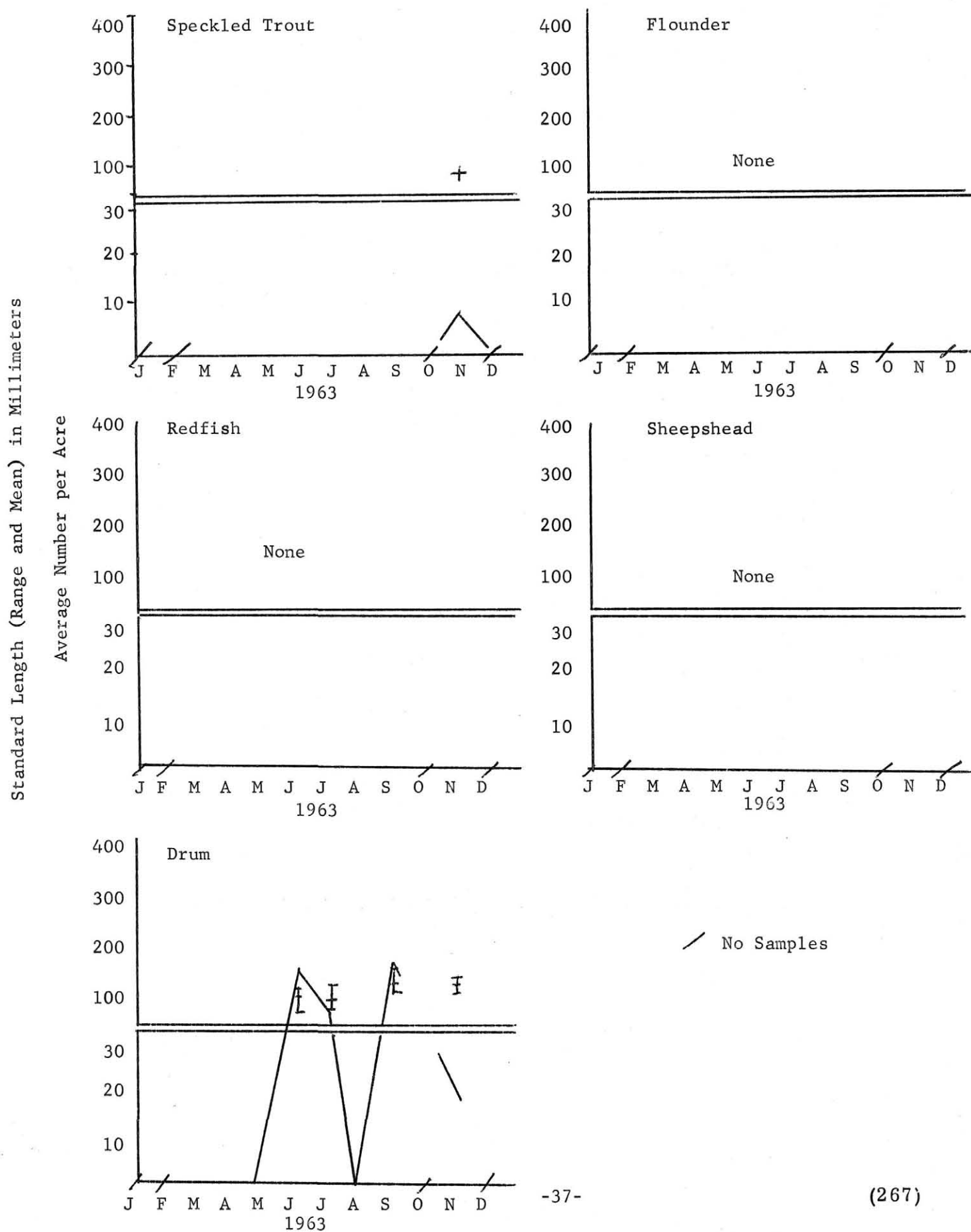
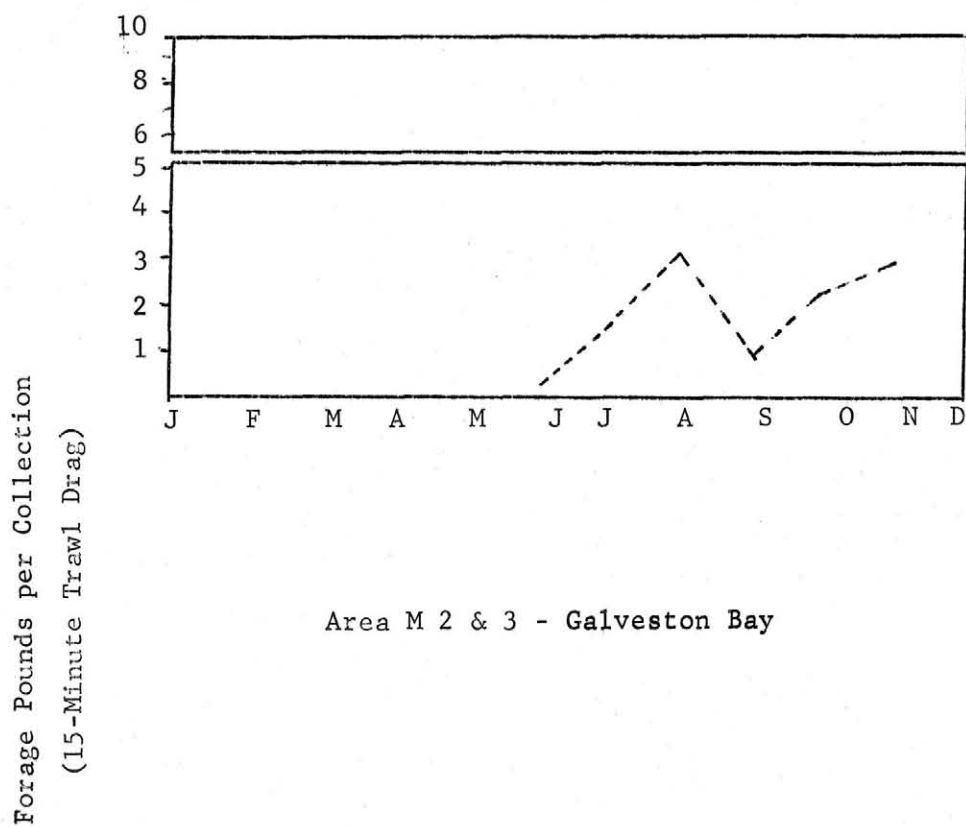


Figure 15  
Average Monthly Catch of Forage Species

Area M 1 - Sabine Lake

—— 1962  
- - - 1963



Area M 2 & 3 - Galveston Bay

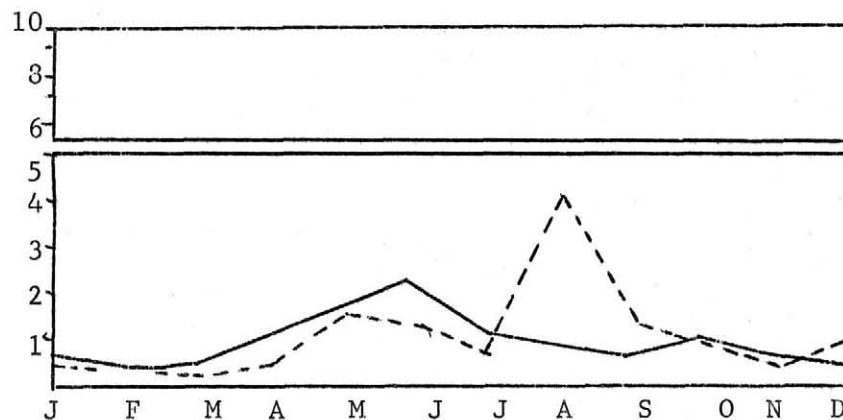
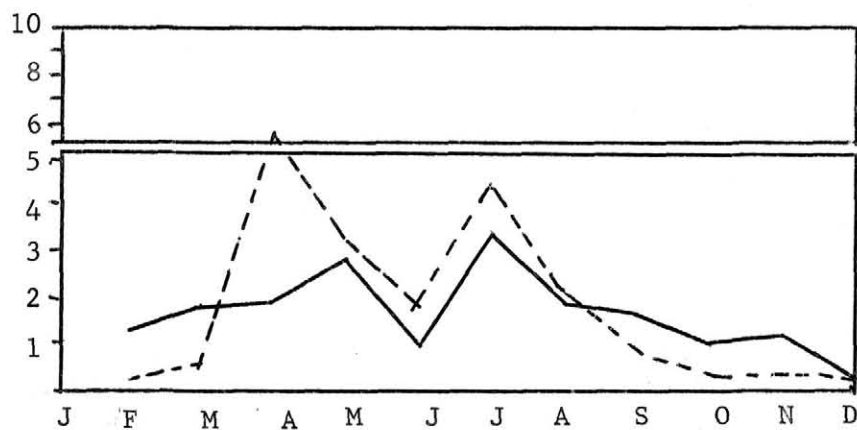


Figure 16  
Average Monthly Catch of Forage Species

Area 4 - Matagorda Bay

— 1962  
- - - 1963

Forage Pounds per Collection  
(15-Minute Trawl Drag)



Area 5 - San Antonio Bay

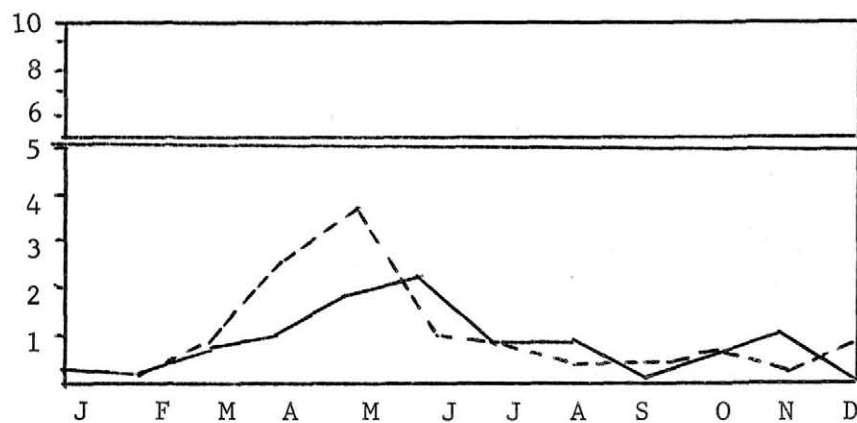
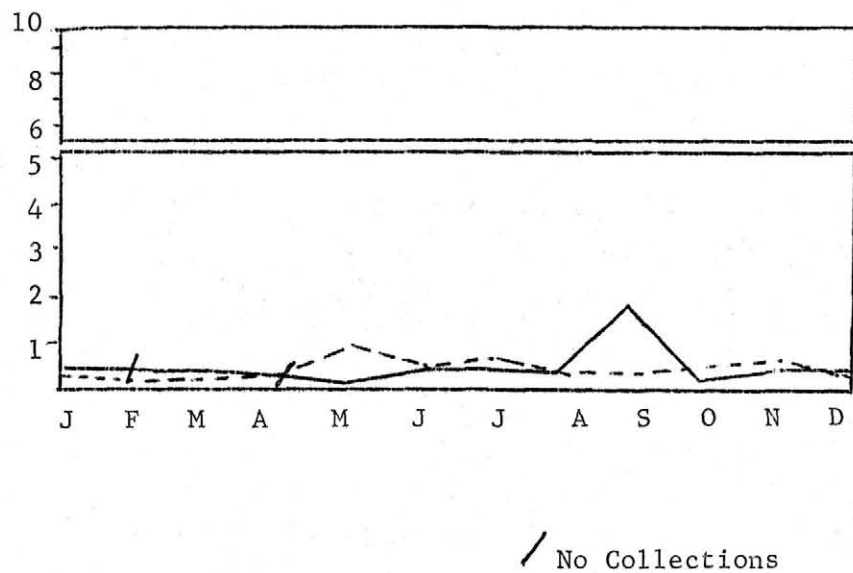


Figure 17  
Average Monthly Catch of Forage Species

Area 6 - Aransas Bay

— 1962  
- - - 1963

Forage Pounds per Collection  
(15-Minute Trawl Drag)



Area 7 - Corpus Christi Bay

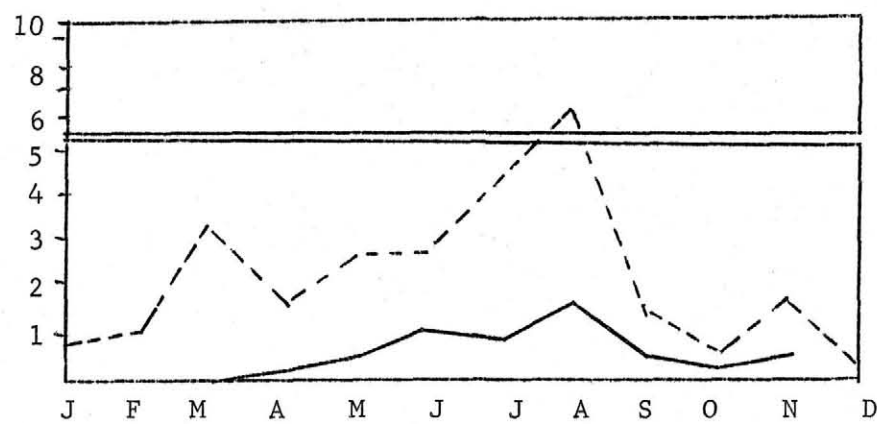
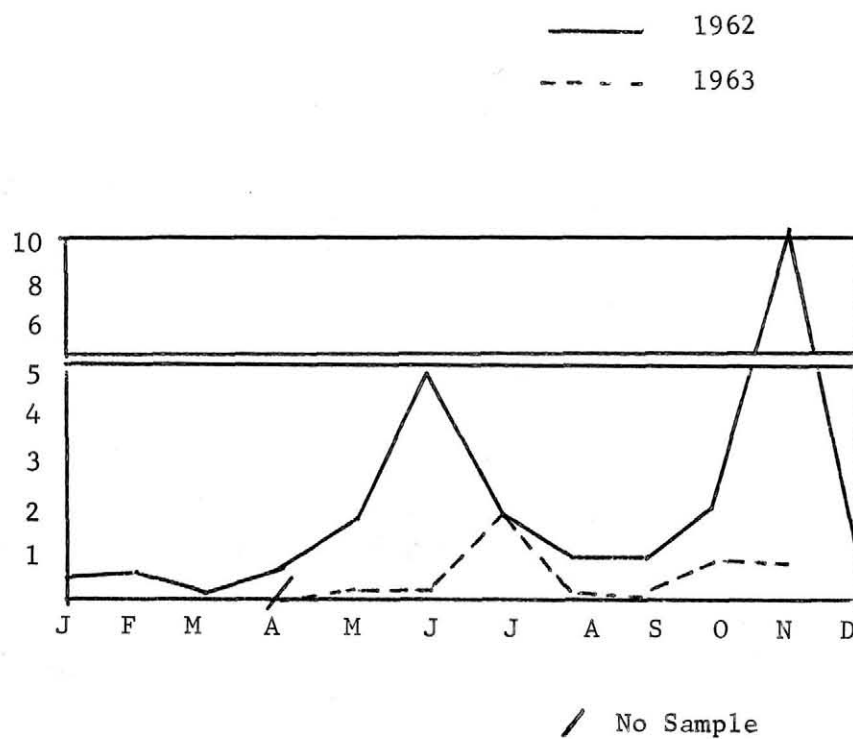




Figure 18  
Average Monthly Catch of Forage Species

Area 8 - Upper Laguna Madre

Forage Pounds per Collection  
(15-Minute Trawl Drag)



Area 9 - Lower Laguna Madre

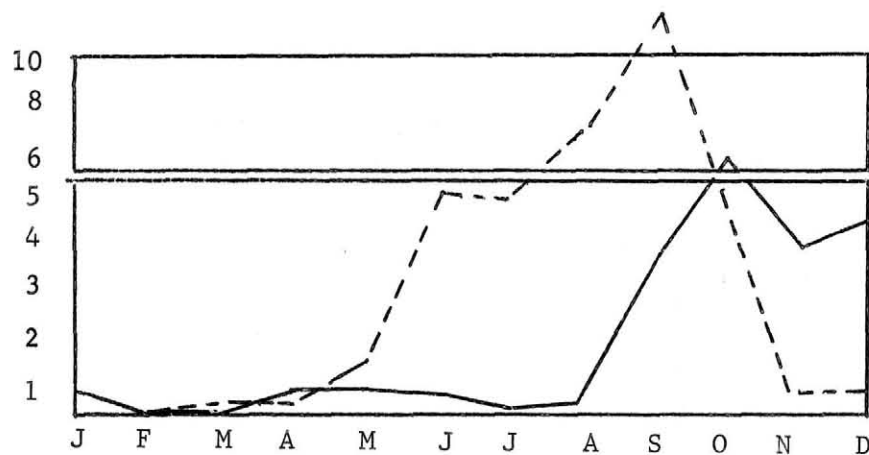
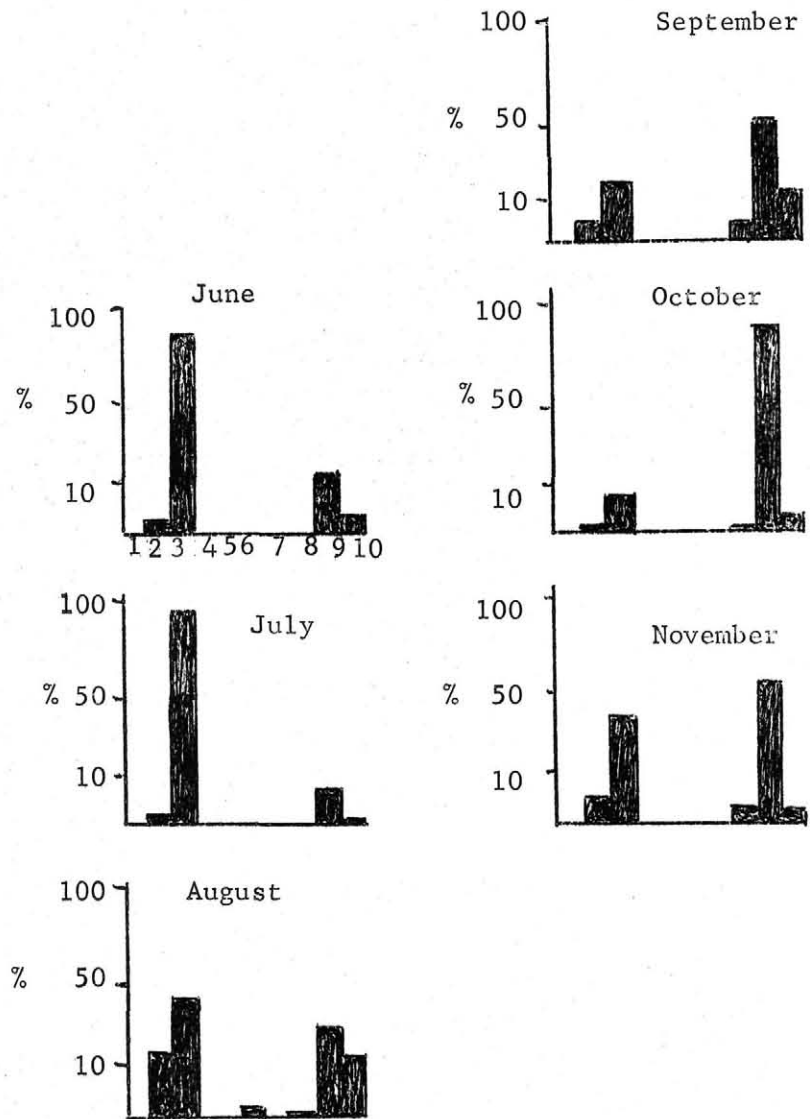


Figure 19  
Species Composition of Forage Catch

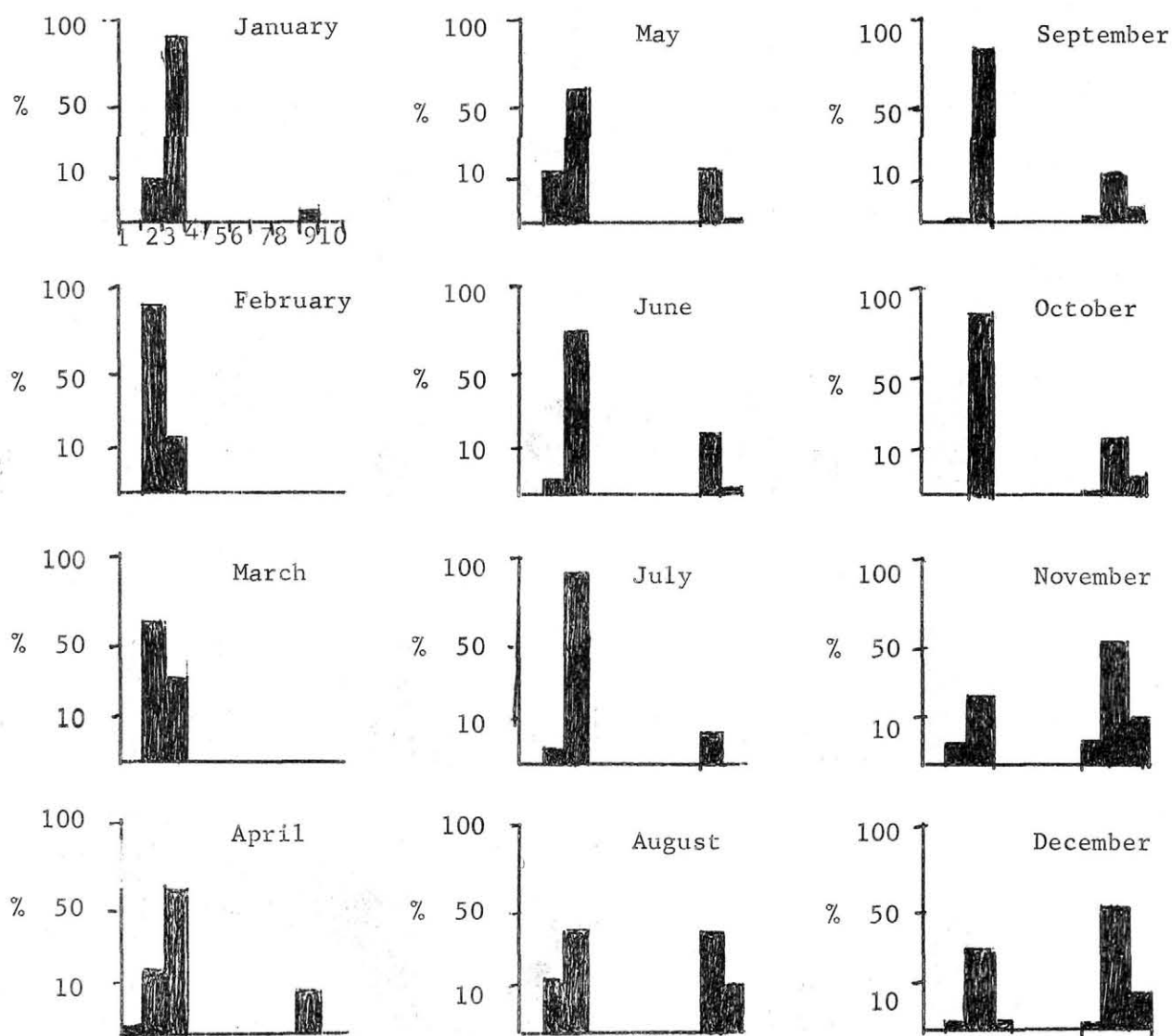
Area M-1  
Sabine Lake



- |                |            |
|----------------|------------|
| 1. Pinfish     | 6. Mullet  |
| 2. Croaker     | 7. Pigfish |
| 3. Anchovies   | 8. Crabs   |
| 4. Menhaden    | 9. Shrimp  |
| 5. Silversides | 10. Others |

Figure 20  
Species Composition of Forage Catch

Areas M-2 and 3  
Galveston Bay Area

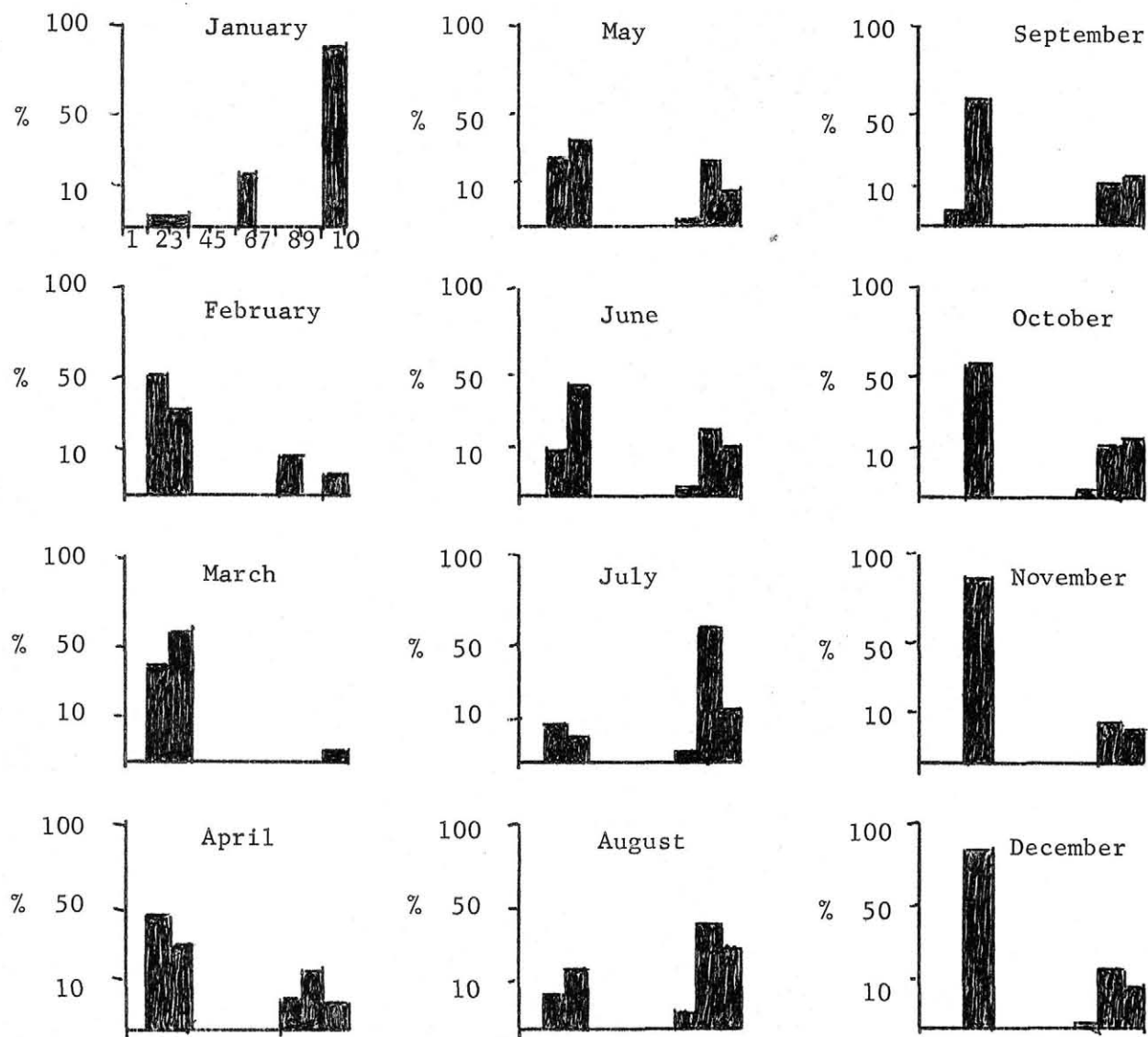


- |                |            |
|----------------|------------|
| 1. Pinfish     | 6. Mullet  |
| 2. Croaker     | 7. Pigfish |
| 3. Anchovies   | 8. Crabs   |
| 4. Menhaden    | 9. Shrimp  |
| 5. Silversides | 10. Others |

Figure 21  
Species Composition of Forage Catch

Area M-4

Matagorda Bay Area

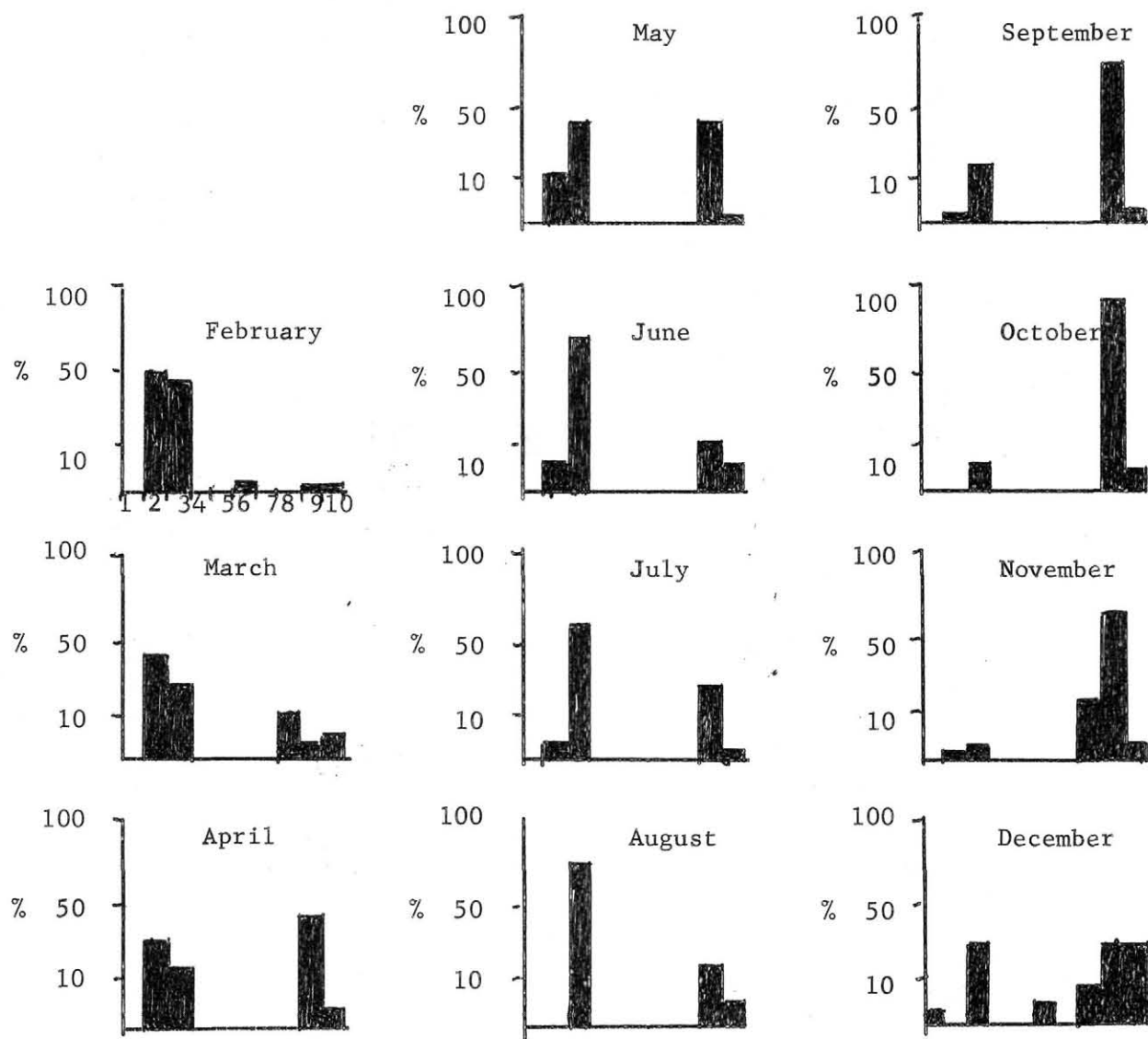


- |                |            |
|----------------|------------|
| 1. Pinfish     | 6. Mullet  |
| 2. Croaker     | 7. Pigfish |
| 3. Anchovies   | 8. Crabs   |
| 4. Menhaden    | 9. Shrimp  |
| 5. Silversides | 10. Others |

Figure 22  
Species Composition of Forage Catch

Area M-5

San Antonio Bay Area



- |                |            |
|----------------|------------|
| 1. Pinfish     | 6. Mullet  |
| 2. Croaker     | 7. Pigfish |
| 3. Anchovies   | 8. Crabs   |
| 4. Menhaden    | 9. Shrimp  |
| 5. Silversides | 10. Others |

Figure 23  
Species Composition of Forage Catch

Area M-6

Aransas Bay Area

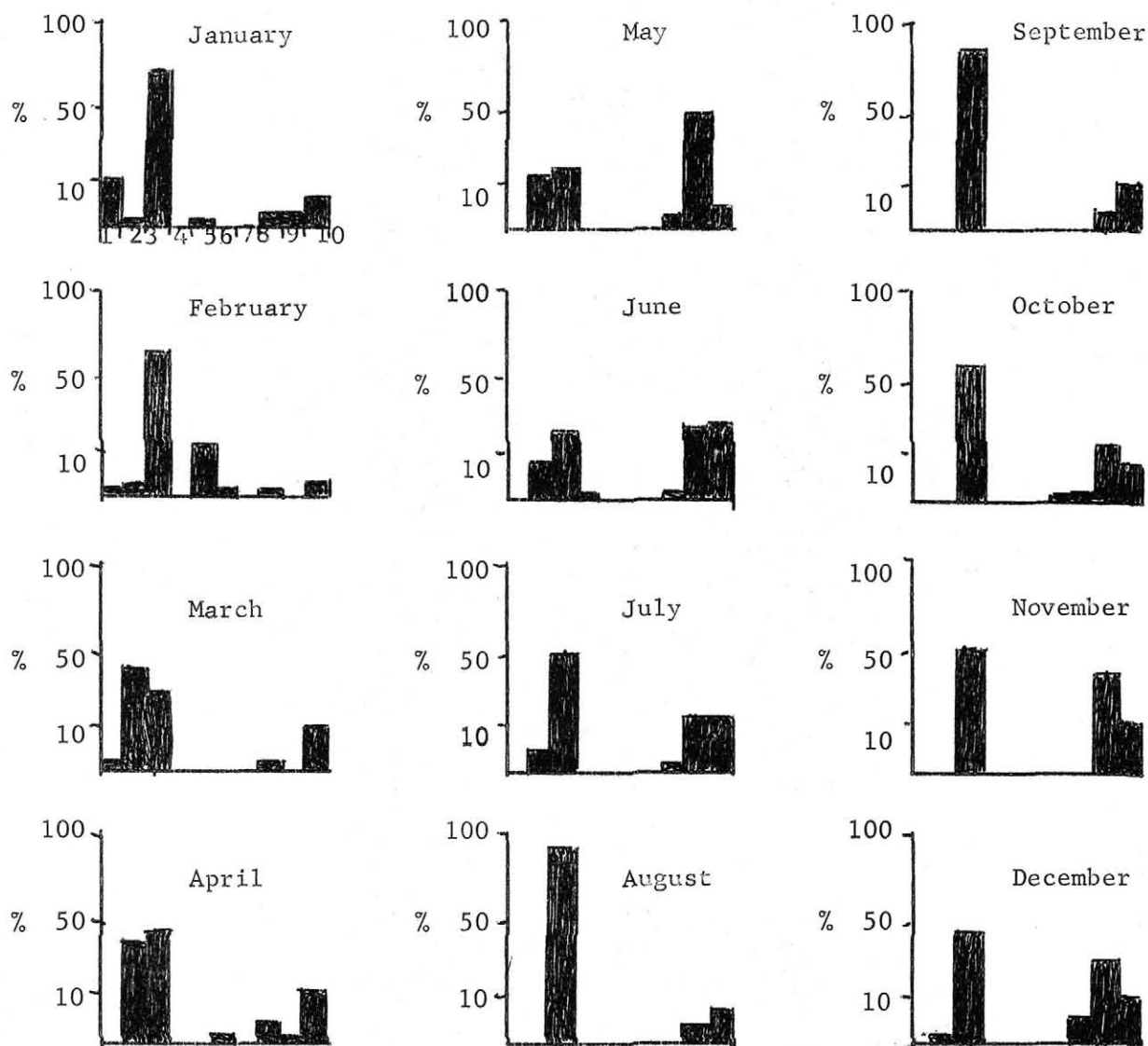
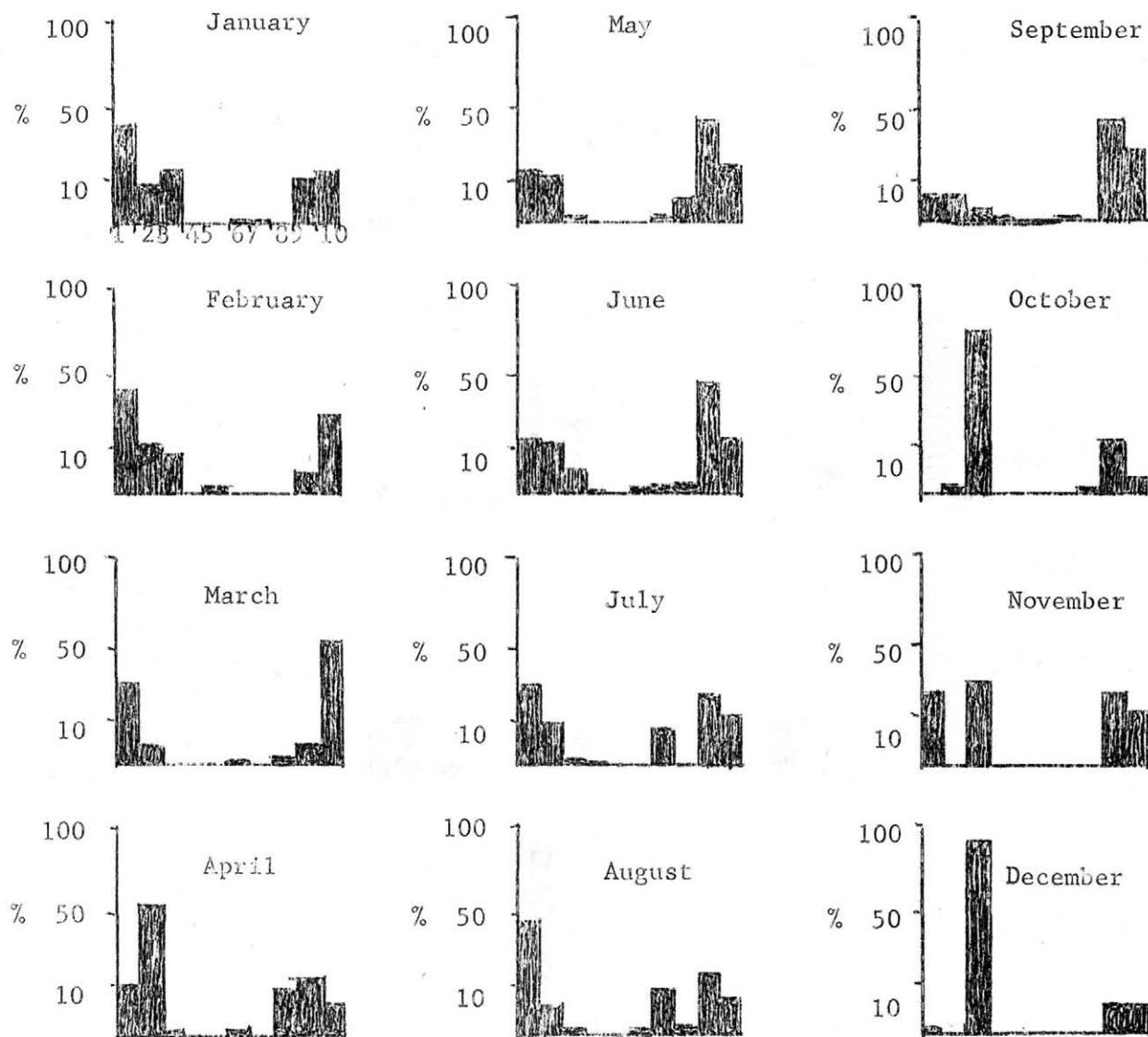


Figure 24  
Species Composition of Forage Catch

Area M-7

Corpus Christi Bay Area

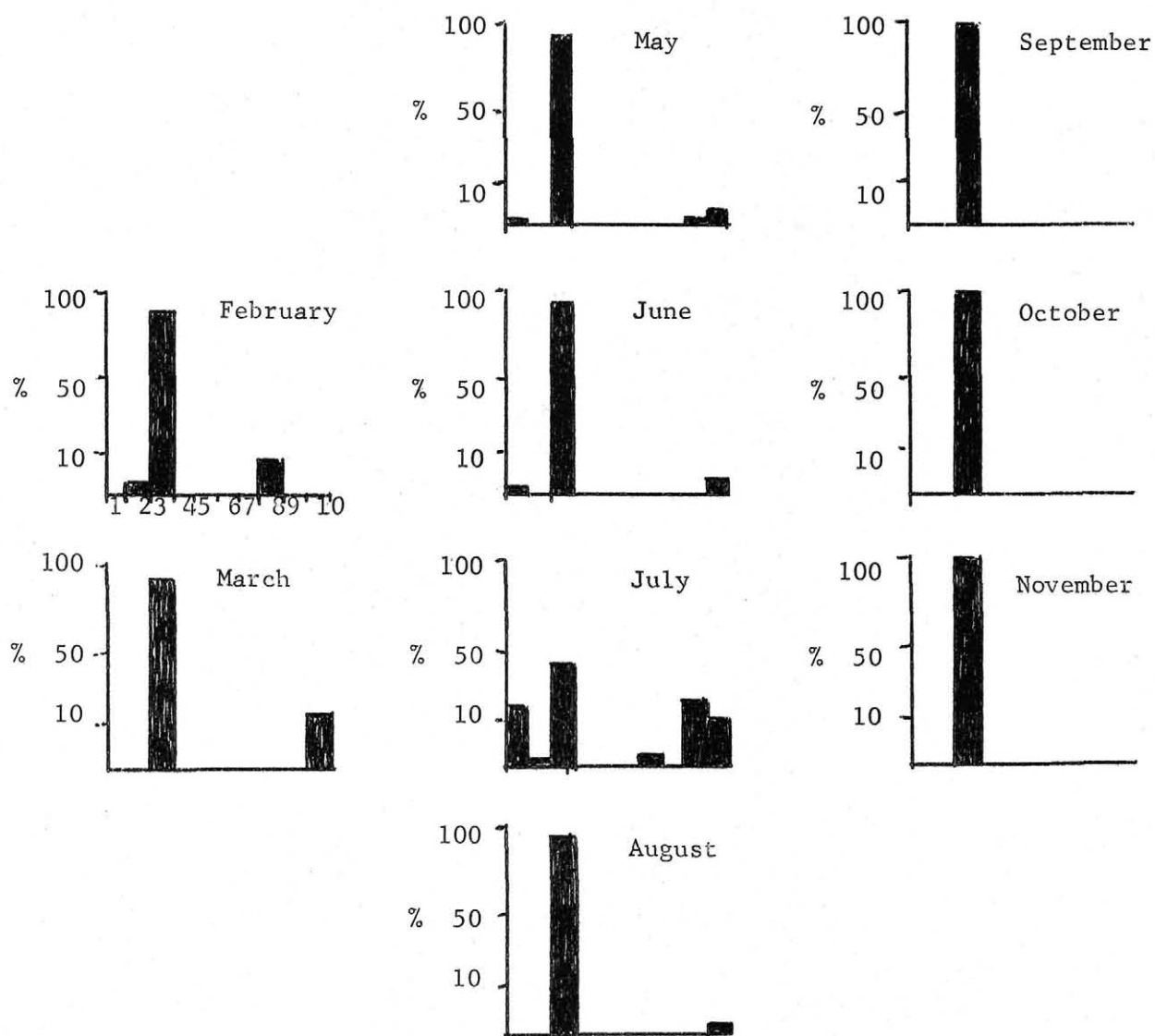


- |                |            |
|----------------|------------|
| 1. Pinfish     | 6. Mullet  |
| 2. Croaker     | 7. Pigfish |
| 3. Anchovies   | 8. Crabs   |
| 4. Menhaden    | 9. Shrimp  |
| 5. Silversides | 10. Others |

Figure 25  
Species Composition of Forage Catch

Area M-8

Upper Laguna Madre



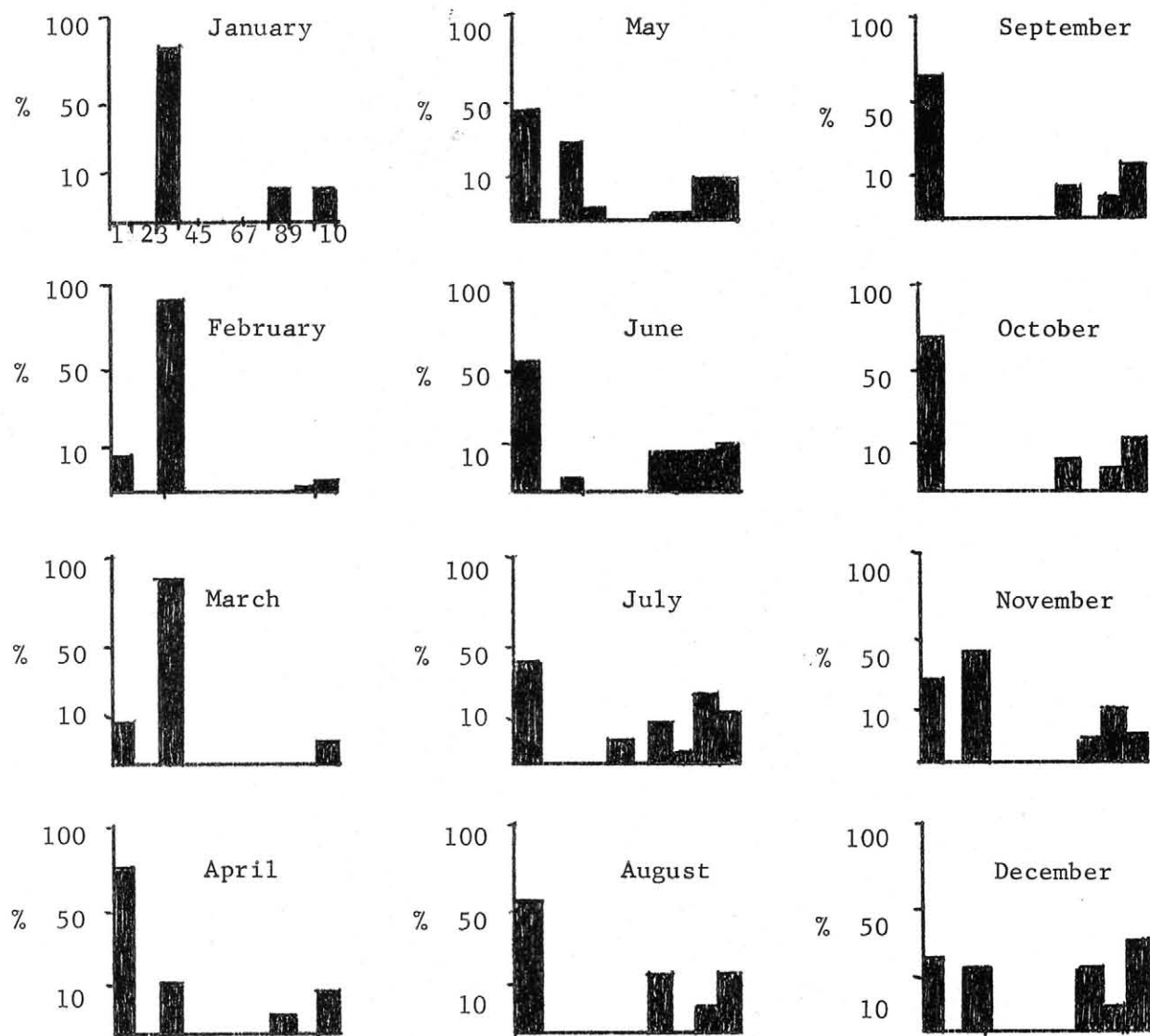
- |                |            |
|----------------|------------|
| 1. Pinfish     | 6. Mullet  |
| 2. Croaker     | 7. Pigfish |
| 3. Anchovies   | 8. Crabs   |
| 4. Menhaden    | 9. Shrimp  |
| 5. Silversides | 10. Others |



Figure 26  
Species Composition of Forage Catch

Area M-9

Lower Laguna Madre



- |                |            |
|----------------|------------|
| 1. Pinfish     | 6. Mullet  |
| 2. Croaker     | 7. Pigfish |
| 3. Anchovies   | 8. Crabs   |
| 4. Menhaden    | 9. Shrimp  |
| 5. Silversides | 10. Others |