

## Job Report

Ronnee L. Schultz  
Marine Biologist

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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  
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### Population Studies of the Sports and Commercial Fin-Fish and Forage Species of the Aransas Bay System

**Abstract:** Rough estimates of the numbers of juvenile redfish, Sciaenops ocellata and trout, Cynoscion nebulosus, in the Aransas Bay system were 2,000,000 and 4,000,000, respectively. Juvenile drum, Pogonias cromis, flounder, Paralichthys lethostigma and sheepshead, Archosargus probatocephalus, were not taken in numbers great enough to allow population estimates.

The weight per unit of effort for forage fish dropped 60.88 per cent in 20-foot trawl samples in 1962 as compared to 1961. Croaker, Micropogon undulatus, brown shrimp, Penaeus aztecus and white shrimp, Penaeus setiferus; items which made up the largest portion by weight of 1961 and 1962 catches decreased considerably in 20-foot trawl catches in 1962. The decrease in these species caused a drop in total catch in 1962. Where shrimp, by weight, composed 29.26 per cent of the 1961 catch, they accounted for only 8.86 per cent of the total catch in 1962. Ten-foot trawl samples showed a difference in percentage weight of shrimp between primary and secondary bays. In Aransas Bay, a primary bay, 14.6 per cent of the total catch was shrimp, while in Copano Bay, a secondary bay, shrimp comprised 26.51 per cent of the total catch.

Seine samples averaged 11.17 pounds of forage fish per acre in tertiary Mission Bay.

In the adult game fish program 3.8 per cent of all trout tagged were recovered. Drag seine samples indicated a population of 0.60 pounds of trout per acre. Because of the nature of trout and their habit of schooling in deep water and around reefs, it was felt that the sampling methods now employed are not adequate for trout.

Redfish had a 15 per cent tag return in 1962. This was the only fish which had sufficient tag return data to allow reliable population estimates. It was calculated that the redfish population of the Aransas Bay area was 918,000 fish weighing 1,735,000 pounds, while the limits, using Peterson's formula, were 892,000 to 1,442,000 fish weighing between 865,000 and 1,837,000 pounds. Drum, flounder and sheepshead tag returns were too meager to allow estimates at this time. However, the data indicated that game fish populations other than redfish were underfished. In 1962 there were 3.4 per cent tag returns for drum, 8.3 per cent for flounder and 0.5 per cent for sheepshead.

Objectives: To determine the abundance or relative abundance of the food and game fish and forage species of the Aransas Bay system.

Procedure: Collections were made with trammel net, drag seine, minnow seine and otter trawls. These collections were made at fixed stations (Figure 1) in widely scattered areas of the bay system so that most types of habitat were sampled during the course of the study.

Four collections were made each month with the trammel net or drag seine. The trammel net was 1200 feet long and 40 inches deep. The inner mesh was 3 inches stretched and the outer mesh or brails were 12 inches stretched. The net was pulled by hand and the area sampled was calculated. The drag seine was 600 feet long and 6 feet deep. The mesh was three inches stretched. It was worked in the same manner as the trammel net. Four collections were made each month with a minnow seine 60 feet long and 6 feet deep. The mesh was three-fourths of an inch stretched. The seine was pulled by hand and the area sampled was calculated. All game fish collected were measured and counted. At Seine Station 1 all forage species caught were measured, counted and weighed.

An estimate of the total number of juvenile and adult food and game fish in the bay system was calculated by averaging the catch from all stations sampled, determining the area covered, converting to numbers or pounds per acre and multiplying by the number of acres of similar habitat in the bay system which was 347,775 acres.

Twelve collections were made each month with an otter trawl. Four times each month a 20-foot trawl was used. The mesh was 1 1/2-inch stretch. Eight times each month, a 10-foot trawl was used. The mesh was 1 1/4-inch stretch with a one-half of an inch stretch meshed inner liner. All trawl stations (Figure 1) were sampled for 15-minute time intervals. All forage species caught were counted, measured and weighed. One unit of effort was one 15-minute trawl.

Special collections were made with gear such as traps, other nets and hook and line. Such collections were made primarily for tagging purposes. Hydrographic and meteorological information was gathered at the time of each sampling. The water salinity was determined with the use of specific gravity hydrometers and Knudsen's Hydrographic Tables. The water temperature at the bottom was measured with a centigrade thermometer and the turbidity of the water with a U. S. Geological Survey Turbidity Scale.

## Findings and

### Discussion: Juvenile Food and Game Fish

On an average catch per acre basis (Figure 2) juvenile trout, Cynoscion nebulosus and redbfish, Sciaenops ocellata, were the most frequently encountered and abundant species of game fish caught in the 60-foot seine.

Juvenile redbfish (Table 1) were most abundant from February through June 1962; these fish then became too large to be caught with the seine and were no longer taken. Later, in November 1962, young-of-the-year began to appear as a new crop.

Observations made at the time of the freeze in 1962 indicated that the juvenile redbfish population had not been damaged. As can be seen in Table 7, the commercial catch of redbfish during September and October 1962 showed an increase over the previous year. This increase came at a time when the young reds, which would have been hurt by the freeze in January, were just reaching commercial size.

Figure 3 illustrates the size range of juvenile redfish taken in this study. With the size seine used, it is doubtful that redfish smaller than 20 millimeters could be caught. As it was, the fish below 50 millimeters were taken only when they became entangled in debris gathered up by the net.

Table 1 contains a comparison of abundance by station for redfish in the Aransas Bay area. Station 1 (Figure 1) represents a tertiary bay as does Station 2. Station 3 is a secondary bay station and Station 4 is a primary bay station. Samples at Station 3 and 4 produced more juvenile redfish than Stations 1 and 2. Widgeon grass, Ruppia maritima and shoal grass, Diplanthera wrightii, were the most common plants found at Station 1. During the study widgeon grass was replaced by shoal grass which is tolerant of the higher salinity. Station 3 was similar in characteristics to Station 1. Station 2 and 4, on the other hand, had scattered shoal grass and several kinds of algae present during the study. At Stations 1 and 3 the turbidity was generally high, while Stations 2 and 4 had low turbidities.

The trout, Cynoscion nebulosus, was the most abundant juvenile game fish taken in seine samples from April to December 1962 (Figure 2). A peak of abundance was noted in June 1962 (Figure 2). In 1961 the peak came in October and November. A second peak was observed in the fall of 1962, but it did not reach the proportions it had the previous year.

Table 1 depicts the difference in station catches for trout. In 1962 Station 1 (Figure 1) had a heavy concentration of juvenile trout with a peak of 81 fish per acre in October. In 1962 the highest concentration of trout at any time at this station was 19.2 fish per acre. In 1962 a habitat change occurred at Station 1 in which widgeon grass, which had been abundant in 1961, was replaced by a few scattered tufts of shoal grass. This reduction of cover is believed to have been an important factor in the decline of trout at Station 1.

It is obvious that in the month of June, when a peak abundance of trout was noted, the catch was made up of very small trout (Figure 3). In later months, the size range had a large spread indicating an extended spawning period.

Drum, Pogonias cromis, flounder, Paralichthys lethostigma and sheepshead, Archosargus probatocephalus, were not taken in numbers large enough to allow abundance determinations. In March and April, flounder (Figure 3) 20 to 40 millimeters were taken. It is believed, however, that many flounder are missed by the sampling methods now employed. Drum taken in this study were quite large, 75 to 130 millimeters (Figure 3), indicating small drum were missed during the study period. Ripe sheepshead are found near the jetties at Port Aransas in February and March. Spawning may extend through June as young sheepshead, 14 to 18 millimeters (Figure 3), were taken in seine samples in June and July in 1962.

By taking the average number of redfish and trout per acre caught during the year's seine sampling and multiplying by the acres of water of similar habitat, it is possible to obtain a rough estimate of the standing crop of juvenile redfish and trout. For juvenile redfish this figure was calculated to be approximately 2,000,000 fish and for trout approximately 4,000,000 fish. These figures of course would be subject to seasonal change. As sampling continues and more data is accumulated, more accurate figures can be obtained.

When the forage fish program for the Texas coast was initiated, it was decided that there were 11 food items which appeared most often in the stomachs of predator fishes. They are the pinfish, Lagodon rhomboides;

croaker, Micropogon undulatus; anchovy, Anchoa mitchelli; menhaden, Brevoortia gunteri; sardine, Harengula pensacolatae; silversides, Menidia beryllina; mullet, Mugil cephalus; the crab, Callinectes sapidus, in the juvenile state (0 to 100 mm. carapace width) and the commercial peneid shrimps, Penaeus aztecus, Penaeus setiferus and Penaeus duorarum. These were considered major forage species in this study.

In Table 2 a comparison of the 20-foot trawl catch per unit of effort for 1961 and 1962 is presented. Figure 4 is a comparison of pounds per unit of effort for 1961 and 1962. A comparison of percentage, rise and fall of catch per unit of effort for each species, is found in Figure 5. A 60.88 per cent drop in the total catch was experienced in 1962 in comparison to the catch in 1961. Figure 4 shows a peak of abundance for forage fish in August 1961, which did not appear in 1962.

Three species of fish increased in abundance considerably in 1962. One of these, the pinfish (Figure 5), increased 14.3 per cent. Other species that increased were the anchovy and the silversides. Since silversides were not taken in large numbers in 1961, a slight increase in number and weight raised the catch percentage but did not increase the total catch greatly.

There was a decrease in the percentage catch of the remaining forage items. Croaker dropped 61.8 per cent, menhaden, 32.0 per cent and penaeid shrimp 88.16 per cent. The two most abundant forage items, croaker and shrimp, decreased the most. This accounts for the large total percentage drop in catch as the croaker and shrimp comprised 83 per cent of the 1961 catch. Species composition for 1961 and 1962 in the 20-foot trawl was as follows:

<u>Species</u>	<u>1961</u>	<u>1962</u>
Pinfish	3.38%	10.07%
Croaker	54.61%	53.38%
Anchovy	6.56%	19.97%
Menhaden	3.23%	5.61%
Sardine	0.94%	0.49%
Silversides	0.01%	0.11%
Mullet	1.35%	0.38%
Pigfish	0.06%	1.10%
Shrimp	29.26%	8.86%

Forage species caught in the 10-foot trawl and their weights in unit of effort are found in Table 4. In Table 5 the difference between Aransas and Copano Bay 10-foot trawl catch is shown. As there are two 10-foot trawl stations in Aransas Bay and two in Copano Bay, a comparison between secondary and primary bay catches can be made. Species composition was as follows:

<u>Species</u>	<u>Aransas Bay 10-ft.</u>	<u>Copano Bay 10-ft.</u>	<u>Aransas Bay 20-ft.</u>
Pinfish	21.68%	0.98%	10.07%
Croaker	35.40%	24.55%	53.38%
Anchovy	20.80%	24.71%	19.97%
Menhaden	2.65%	1.64%	5.61%
Sardine	-	-	0.49%

<u>Species</u>	<u>Aransas Bay 10-ft.</u>	<u>Copano Bay 10-ft.</u>	<u>Aransas Bay 20-ft.</u>
Silversides	*	0.33%	0.11%
Mullet	-	21.28%	0.38%
Pigfish	4.87%	-	1.10%
Shrimp	14.60%	26.51%	8.86%

\* almost negligible

The difference between the catch of pinfish and croaker in Aransas and Copano Bays in the 10-foot trawl is quite large. Shrimp and mullet are the only other species that showed a difference between the two bays large enough to consider significant.

Table 3 shows catch in pounds per acre for forage species in tertiary Mission Bay seine samples. When the total average of 11.00 pounds per acre is used, a projected estimate of 3,800,000 pounds of forage fish in waters less than four feet can be calculated. In 1963 the number of stations will be increased to four, which will increase the accuracy of this type of estimate.

The species composition of the seine samples by weight was quite different from trawl samples. In seine hauls the mullet was the most abundant forage fish with the croaker second, while in trawls the croaker and the shrimp made up the largest weight of forage items.

#### Adult Game Fish

Five fish are of primary interest to the sports and commercial fishery in the Aransas Bay area. They are the trout, redbfish, drum, flounder and sheepshead. The results of monthly sampling for these species in 1961 and 1962 are found in Figures 6 and 7. As noted in Figure 6 sampling was interrupted in May, June and July in 1962 when the sampling gear was lost in a sudden storm. All figures, therefore, are taken from data excluding those months.

Trout (Figure 6) had different peaks of abundance in 1961 and 1962. In 1961 a peak was apparent in July followed by a drop in September. In 1962 the peak occurred in August, followed by a drop in September. In 1962 a winter peak did not occur as it did in December of 1961. Sheepshead and trout have an inverse relationship of abundance, the significance of which is not understood at this time.

The pounds per acre average for trout taken in biological samples with the drag seine came to 0.60 pounds in 1962 (Table 6). If this figure is multiplied by 347,775, the acreage of waters less than four feet deep in the Aransas Bay area, the resultant, 208,665 pounds, does not approach the commercial harvest for 1962 (Table 6). This discrepancy in study data can be attributed to the schooling nature of trout and their habit of frequenting deep water and reefs, areas which were not sampled during this study. The obvious conclusion reached is that the area sampling with the drag seine is not of value in determining trout populations.

A total of 157 trout was tagged in 1962. Six of these tagged trout were returned for a 3.8 per cent recovery. This low return suggests a large trout population. With the small number of fish tagged and the small return, it is difficult to arrive at a valid population estimate for trout at this time. It is believed that the tagging program provides the method that will eventually lead to estimates of trout populations if enough fish can be tagged and good returns are obtained. From the available data it is concluded that trout are underfished.

Redfish (Figure 6) showed peaks of abundance in different months between 1961 and 1962. In 1962 a slight peak was noted in August and another in November. In 1961 a peak came in August, but in November there was a drop in pounds per acre.

In January 1962 a freeze occurred. Fortunately, tides were low at the time and juvenile and adult redfish had moved to deeper water. This was one factor which may have prevented a heavy redfish mortality. That such a mortality did not occur is indicated by the fact that in the months of September through December, when young-of-the-year enter the commercial fishery, commercial landings for redfish increased in the Aransas area some 16,000 pounds over the same period in 1961.

Unlike trout, redfish had a high percentage of tag returns (Table 8). From 120 tagged redfish, 18 were recovered for a 15 per cent return. Of these recoveries, 7 were taken by commercial fishermen and 11 by sportsfishermen. This gives the commercial interests 38.88 per cent of the recoveries and sportsfishermen 61.2 per cent.

With the drag seine sampling method, redfish averaged 1.23 pounds per acre in 1962 (Table 6). With the use of this information it was found that the population came to an estimated 427,000 pounds as an average for the Aransas Bay area. The peak abundance for redfish occurred in August (Figure 6) reaching 3.6 pounds per acre or an estimated 904,000 pounds.

Another estimate of the redfish population was calculated from tagging data. First, an average weight of redfish caught commercially and by sportsfishermen was needed. To obtain this figure, the average weight (2.54 pounds) of 250 commercially caught redfish was used and from a recent creel census the average weight of redfish (1.2 pounds) caught by sportsfishermen was used. Then by using the number of redfish tagged in 1962 (120) and the number recaptured by commercial means, the total number of redfish taken by sports and commercial fishermen can be derived. The estimate is 918,000 redfish weighing 1,735,000 pounds.

On testing this estimate with Peterson's formula for population limits, the following values are obtained:

$$\text{Limits of } N = \frac{n X}{x \pm \sqrt{x(1 - \frac{x}{n})}}$$

N = Limits of the population

n = Commercial catch in pounds or number

X = Total number of tagged fish at large

x = Number of commercially recovered tags

It is thus calculated that there were between 892,000 and 1,442,000 redfish weighing between 865,000 and 1,837,000 pounds in the Aransas area in 1962.

Since the limits are rather narrow, it can be said that the original population estimate of 918,000 redfish is fairly accurate. Therefore, the tagging program in determining redfish populations is invaluable and the catch per area is also valuable except that it apparently misses the largest fish.

With 15 per cent of the redfish population being harvested every year it is imperative that a continued watch be made upon this species. With natural mortality taking an unknown percentage, the spawning stock could become endangered if total harvest is increased to 25 or 30 per cent as it has in other areas. To control the harvest of redfish somewhat, especially of the smaller redfish, a minimum size of 14 inches could be placed on redfish caught

by sportsfishermen. This would increase the average weight of the redfish retained by sportsfishermen and also increase the standing crop of Year Class I redfish. It could also allow greater number of redfish to reach the adult or mature state and insure an adequate spawning stock.

The drum catch during 1961 and 1962 varied slightly in average pounds per acre (Figure 6). Table 6 indicates that the numbers of drum increased, but the overall weight to number ratio decreased indicating smaller drum were taken in 1962 compared to 1961. The sample average in 1961 showed an increase in drum and redfish up to a point. Then the redfish declined while drum continued to increase. In 1962 this was not true, however, as the catch of redfish declined, so did the drum.

In calculating the drum population with the results obtained by drag seine sampling it is found that the average weight of the drum population in the Aransas Bay area was 448,000 pounds, a little less than four times the commercial catch for 1962 (Table 7). This would indicate that the tag returns for drum would be fairly high if the area sampling results represent a true portion of the total population. However, the drum had a low tag return percentage (Table 8). A total of 347 drum were tagged in 1962 with only 13 or 3.4 per cent recovered. The commercial tag return accounted for 2 or 0.5 per cent indicating a very large drum population much larger than the estimated 448,000 pounds and, therefore, an underfished population.

To obtain an idea of the population limits (N) the results of tagging drum were used and the limits of 18 million to 106 million resulted. The difference between these limits was so large that any estimate of the drum population may be unreliable at this time. It is felt that the tagging program will lead to estimates of the drum population, providing enough drum can be tagged and a good return can be recorded.

The average catch per acre for flounder in the 1962 study (Table 6) was very near to the 1961 average. By present sampling methods, far too few flounder were taken to allow a reasonable population estimate. The tagging program also left something to be desired. Until some method of sampling is devised which will enable catching and tagging more flounder, the estimation of the population of flounder is impossible and only relative abundance may be ascertained. From the small commercial landings for flounder and their difficult capture, it is felt that flounder could stand greater fishing pressure.

In 1961 and 1962 when the sheepshead catch was greatest (Figure 6) the catch of other species was low.

Commercially, the sheepshead (Table 7) catch increased over the same period in 1962 as did the sample average (Table 6) over 1961. During this past year's study sheepshead increased 269 per cent in drag seine samples. This increase in commercial and study catch indicates an increasing population of fish and a therefore underfished population.

When sampling data is used to calculate the sheepshead population in the Aransas area, the figure 2,300,000 pounds is obtained. The commercial catch (Table 7) of sheepshead, some 40,000 pounds, represents only 1.0 per cent of the estimated population, while commercially recovered tags showed 0.5 per cent harvest. In addition when sheepshead population limits are calculated from tag returns, the population estimate by the area sampling method is far below calculated limits of 6,000,000 to 12,000,000 pounds. With the data thus far gathered, it is difficult to obtain reliable population estimates for sheepshead.

Through this study it was found that the only fish which the area or drag seine method is sampling fairly well is the redfish and sheepshead. There is still much to be desired, however, in estimating populations from data gathered by these methods. In order to obtain population estimates on species other than redfish, many more fish must be tagged during the study period.

From this study it is obvious that game and food fish species, with the possible exception of redfish, are actually underfished. It is known that sportsfishermen alone cannot harvest enough fish to keep fish populations at a healthy level and as long as a majority of these bays are closed, thousands of pounds of fish will be wasted each year.

Prepared by: Ronnee L. Schultz  
Marine Biologist

James R. Stevens  
Project Leader

Ernest G. Simmons  
Regional Supervisor

Approved by Terrance R. Leary  
Coordinator



Table 1  
A Comparison of Juvenile Game Fish Catch in Number Per Acre by Station in 1962

<u>Station</u>	<u>Redfish</u>											
	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>
1	*	0.0	0.0	19.2	9.6	9.6	0.0	0.0	0.0	0.0	*	0.0
2	*	*	19.2	9.6	0.0	*	0.0	0.0	0.0	0.0	*	0.0
3	*	19.2	19.2	0.0	9.6	0.0	*	0.0	0.0	0.0	9.6	*
4	*	*	86.4	0.0	19.2	0.0	0.0	*	0.0	0.0	0.0	*
Total		19.2	124.8	28.8	38.4	9.6	0.0	0.0	0.0	0.0	0.0	0.0
Average		9.6	31.2	7.2	9.6	3.2	0.0	0.0	0.0	0.0	4.8	0.0

<u>Station</u>	<u>Trout</u>											
	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>
1	*	0.0	0.0	0.0	0.0	0.0	0.0	19.2	0.0	0.0	*	0.0
2	*	0.0	0.0	0.0	19.2	*	0.0	0.0	57.6	57.6	*	0.0
3	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.8	19.2	57.6	*
4	*	0.0	0.0	0.0	0.0	165.6	0.0	*	*	0.0	0.0	*
Total		0.0	0.0	0.0	19.2	165.6	0.0	19.2	86.4	76.8	57.6	0.0
Average		0.0	0.0	0.0	4.8	55.2	0.0	6.4	21.6	19.2	28.8	0.0

\* No sample taken

Table 2-Forage Fish  
A Monthly Comparison Between Catch and Pounds Per Unit of Effort for the 20-ft. Trawl in 1961 and 1962  
One Unit of Effort Equals One 15-Minute Trawl

\* no measurement

Species	Jan.			Feb.			Mar.			Apr.		
	1961	1962	1961	1962	1961	1962	1961	1962	1961	1962	1961	1962
	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e
Pinfish	No Data	0.00	Q.00	0.00	0.00	0.00	No Data	0.01	0.50	0.01	*	0.45
Croaker	"	25.00	0.09	1.50	0.01	0.01	"	0.45	45.00	0.45	58.50	1.40
Anchovy	"	119.00	0.25	185.75	0.31	0.31	"	0.73	235.70	0.73	427.50	0.65
Menhaden	"	1.00	0.03	0.00	0.00	0.00	"	0.15	3.00	0.15	0.00	0.55
Sardine	"	0.00	0.00	0.50	0.02	0.02	"	0.01	0.25	0.01	0.00	0.00
Silversides	"	3.00	0.01	1.75	0.01	0.01	"	0.00	0.00	0.00	0.00	0.00
Mullet	"	0.00	0.00	0.00	0.00	0.00	"	0.01	1.25	0.01	0.00	0.40
Sub-Adult												
Crabs	"	13.00	*	6.00	*	*	"	*	22.25	*	1.50	*
Shrimp	"	3.50	0.02	1.75	0.01	0.01	"	0.01	2.75	0.01	0.00	0.00
Pigfish	"	0.00	0.00	0.00	0.00	0.00	"	0.00	0.00	0.00	0.00	0.00
Average Catch												
Effort in Pounds		0.48		0.36				1.37			3.45	0.63

Species	May			June			July			Aug.		
	1961	1962	1961	1962	1961	1962	1961	1962	1961	1962	1961	1962
	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e
Pinfish	0.00	0.06	4.22	0.15	0.00	0.09	0.00	0.00	11.25	0.37	7.75	0.11
Croaker	94.00	2.28	73.00	1.71	350.50	6.13	6.50	58.25	1.66	221.00	8.23	23.50
Anchovy	378.00	0.56	50.00	0.46	141.00	0.19	0.04	136.50	0.13	91.70	0.19	0.00
Menhaden	0.00	0.00	41.75	0.60	0.00	0.03	0.00	0.00	0.00	0.00	2.25	0.16
Sardine	0.00	0.00	0.75	0.03	0.00	0.00	0.00	0.00	0.00	0.00	10.75	0.23
Silver-sides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	0.01
Mullet	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.11
Sub-Adult												
Crabs	0.00	0.00	4.50	*	1.07	0.75	8.50	0.56	1.50	*	1.00	0.06
Shrimp	454.00	3.79	94.50	0.78	138.20	0.96	139.00	0.94	10.00	0.10	132.40	1.23
Pigfish	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.03	0.50	0.01	0.75	0.09
Average Catch												
Effort in Pounds	6.69	3.73		8.15	0.83		8.07	2.27		10.42		3.14

Table 2--Continued

Species	Sept.			Oct.			Nov.			Dec.			
	1961	1962		1961	1962		1961	1962		1961	1962		
	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	
Pinfish	5.50	0.27	2.75	0.16	2.00	0.15	4.25	0.29	No Data	4.75	0.15	5.32	0.21
Croaker	58.70	1.19	2.75	0.23	8.00	0.52	1.75	0.13	"	0.00	0.00	8.00	0.45
Anchovy	90.20	0.24	90.25	0.17	75.70	0.27	290.00	0.48	"	560.25	0.98	84.75	0.30
Menhaden	2.50	0.05	1.50	0.11	14.25	0.42	0.75	0.05	"	0.00	0.00	0.00	0.00
Sardine	0.25	0.02	1.50	0.03	1.75	0.11	0.25	0.01	"	0.00	0.00	0.00	0.00
Silver-													
sides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	"	0.00	0.00	0.00	0.00
Mullet	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	"	0.25	0.02	0.00	0.00
Sub-Adult													
Crabs	0.25	*	0.25	*	1.50	*	0.75	*	"	0.50	*	29.25	*
Shrimp	38.00	1.00	0.50	0.01	150.70	0.50	19.00	0.32	"	18.00	0.44	79.70	2.46
Pigfish	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.07	"	0.75	0.02	1.25	0.11
Average Catch													
Effort in Pounds	2.77	0.71	1.97	1.35						1.61		3.53	
													0.50

## Species Year Average

Species	1961		1962	
	c/e	lb/e	c/e	lb/e
Pinfish	*	0.16	10.30	0.18
Croaker	144.40	2.54	28.34	0.97
Anchovy	163.36	0.31	252.69	0.36
Menhaden	*	0.15	4.10	0.10
Sardine	1.47	0.04	0.25	0.01
Silversides	0.31	0.00	0.50	0.00
Mullet	*	0.06	0.11	0.01
Sub-Adult				
Crabs	5.48	*	4.69	*
Shrimp	124.55	1.36	21.95	0.16
Pigfish	0.31	0.03	0.25	0.02
Average		4.65		1.81

Table 3  
Pounds Per Acre of Forage Species by Month Caught in 60-foot Seine

	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Total</u>	<u>Avg.</u>	<u>Per Cent of Total Annual Catch</u>
Pinfish	0.00	0.00	0.00	0.00	0.00	0.00	1.51	0.00			1.51	0.17	1.49
Croaker	2.26	1.62	0.57	0.18	0.38	0.00	0.00	0.00			5.01	0.56	4.97
Menhaden	0.00	0.61	0.08	0.00	0.00	0.30	0.00	0.00			0.99	0.11	0.97
Mullet	29.14	1.93	32.07	0.17	5.48	19.97	1.24	0.00	No Data	No Catch	89.99	10.00	89.50
Shrimp	0.00	0.00	0.48	0.36	0.06	0.11	1.83	0.23	No Data	No Catch	3.07	0.34	3.04
Total	31.40	4.16	33.20	0.71	5.92	20.38	4.58	0.23			100.57	11.18	

Table 4-Forage Fish  
A Monthly Comparison Between Catch and Pounds Per Unit of Effort for the 10-ft. Trawl in 1961 and 1962  
One Unit of Effort Equals One 15-Minute Trawl

Species	Jan.			Feb.			Mar.			Apr.		
	1961	1962	1961	1962	1961	1962	1961	1962	1961	1962	1961	1962
	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e
Pinfish	No Data	0.00	No Data	No Data	No Data	No Data	No Data	0.33	0.02	No Data	No Data	No Data
Croaker	"	3.50	"	"	"	"	"	19.30	0.21	"	"	"
Anchovy	"	78.66	"	"	"	"	"	8.00	0.01	"	"	"
Menhaden	"	7.50	"	"	"	"	"	0.00	0.00	"	"	"
Sardine	"	0.00	"	"	"	"	"	0.00	0.00	"	"	"
Silversides	"	1.83	"	"	"	"	"	0.00	0.00	"	"	"
Mullet	"	5.33	"	"	"	"	"	0.33	0.18	"	"	"
Pigfish	"	0.00	"	"	"	"	"	0.00	0.00	"	"	"
Sub-Adult Crabs	"	3.83	"	"	"	"	"	2.33	0.00	"	"	"
Shrimp	"	1.00	"	"	"	"	"	0.00	0.00	"	"	"
Average		0.75						0.00	0.42			

Species	May			June			July			Aug.		
	1961	1962	1961	1962	1961	1962	1961	1962	1961	1962	1961	1962
	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e
Pinfish	No Data	0.00	No Data	0.00	0.00	0.00	No Data	0.00	No Data	1.12	0.03	0.03
Croaker	"	0.66	"	3.85	0.07	0.07	"	1.62	"	2.00	0.08	0.08
Anchovy	"	70.00	"	45.85	0.07	0.07	"	122.75	"	241.30	0.19	0.19
Menhaden	"	48.33	"	0.28	0.00	0.00	"	0.12	"	0.12	0.00	0.00
Sardine	"	0.00	"	0.00	0.00	0.00	"	0.00	"	0.00	0.00	0.00
Silversides	"	0.00	"	0.00	0.00	0.00	"	0.00	"	0.00	0.00	0.00
Mullet	"	0.00	"	0.00	0.00	0.00	"	0.00	"	0.00	0.00	0.00
Pigfish	"	0.00	"	0.12	0.01	0.01	"	0.00	"	0.50	0.01	0.01
Sub-Adult Crabs	"	0.33	"	0.29	0.00	0.00	"	0.25	"	0.38	0.00	0.00
Shrimp	"	14.66	"	27.57	0.17	0.17	"	8.50	"	2.62	0.03	0.03
Average		0.14		0.32				0.23				

Table 4--Continued

Species	Sept.		Oct.		Nov.		Dec.	
	1961	1962	1961	1962	1961	1962	1961	1962
	c/e	lb/e	c/e	lb/e	c/e	lb/e	c/e	lb/e
Pinfish	No Data	0.12	0.00	0.13	0.00	0.01	1.87	0.05
Croaker	"	0.88	0.70	0.62	2.33	0.08	0.00	0.00
Anchovy	"	0.62	245.50	109.50	237.00	0.09	21.37	0.03
Menhaden	"	0.75	0.00	0.00	110.00	0.13	0.00	0.00
Sardine	"	0.12	0.80	0.00	0.00	0.00	0.00	0.00
Silversides	"	0.12	0.00	0.00	0.00	0.00	0.16	0.00
Mullet	"	0.12	0.02	0.00	0.00	0.00	0.00	0.00
Pigfish	"	0.00	0.00	0.00	0.00	0.00	0.12	0.02
Sub-Adult Crabs	"	0.62	0.00	0.00	0.00	0.00	0.25	0.01
Shrimp	"	7.37	35.60	13.12	9.10	0.62	1.62	0.00
Average		0.19	0.05	0.31	0.59	0.13	30.12	0.26
		0.44	0.30	0.31	0.37	0.37	0.63	0.44

Species	Average 1961		Average 1962	
	3 months	12 months	3 months	12 months
	c/e	lb/e	c/e	lb/e
Pinfish	0.94	0.04	1.06	0.03
Croaker	1.51	0.09	3.74	0.06
Anchovy	188.16	0.23	69.84	0.09
Menhaden	36.67	0.04	5.72	0.01
Sardine	0.32	0.01	0.01	0.00
Silversides	0.00	0.00	0.21	0.00
Mullet	0.44	0.04	0.69	0.10
Pigfish	0.00	0.00	0.15	0.01
Sub-Adult Crabs	1.16	0.00	0.14	0.00
Shrimp	1.61	0.07	11.55	0.09
Total		0.52		0.39

Table 5--Forage Fish  
A Comparison of 10-foot Trawl Catches in Aransas and Copano Bays  
One Unit of Effort Equals One 15-Minute Trawl

	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.	
	No.	lb.	No.	lb.	No.	lb.	No.	lb.	No.	lb.	No.	lb.	No.	lb.	No.	lb.
Aransas Bay	0.50	0.03	No Data	0.00	0.00	0.00	No Data	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.06
Pinfish	0.00	0.00	"	51.00	0.40	1.00	"	0.01	0.01	0.04	2.00	0.04	0.75	0.04	3.75	0.14
Croaker	75.50	0.06	"	6.00	0.01	20.00	"	0.04	0.04	0.08	21.00	0.08	0.75	0.00	13.25	0.02
Anchovy	2.00	0.03	"	0.00	0.00	0.00	"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Menhaden	0.00	0.00	"	0.00	0.00	0.00	"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sardine	0.00	0.00	"	0.00	0.00	0.00	"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silversides	0.00	0.00	"	0.00	0.00	0.00	"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Mullet	0.00	0.00	"	0.00	0.00	0.00	"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-Adult Crabs	0.00	0.00	"	0.00	0.00	0.00	"	0.00	0.00	0.00	0.50	0.00	0.25	0.00	0.50	0.00
Shrimp	1.00	0.00	"	0.00	0.00	1.00	"	0.01	0.01	0.02	2.25	0.02	3.50	0.02	2.00	0.02
Pigfish	0.00	0.00	"	0.00	0.00	0.00	"	0.00	0.00	0.02	0.25	0.02	0.00	0.00	1.00	0.02
Totals	0.12	0.41						0.06	0.06	0.16	0.25	0.02	0.00	0.06	0.26	0.26

	Sept.		Oct.		Nov.		Dec.		Average No. 1962 12 months		Average lb. 1962 12 months	
	No.	lb.	No.	lb.	No.	lb.	No.	lb.				
Aransas Bay												
Pinfish	0.25	0.01	0.25	0.01	2.50	0.06	13.75	0.31	1.92		0.05	
Croaker	1.75	0.09	0.00	0.00	0.00	0.00	3.25	0.00	6.35		0.08	
Anchovy	15.75	0.01	26.25	0.21	4.00	0.01	23.75	0.04	20.62		0.05	
Menhaden	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.04	0.30		0.01	
Sardine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	
Silversides	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.20		0.00	
Mullet	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	
Sub-Adult Crabs	1.25	0.00	1.00	0.00	1.00	0.00	3.25	0.00	0.78		0.00	
Shrimp	2.50	0.08	5.50	0.04	8.00	0.10	14.00	0.04	3.98		0.03	
Pigfish	0.00	0.00	0.00	0.00	0.50	0.03	1.25	0.05	0.30		0.01	
Totals		0.19		0.26		0.20		0.48			0.23	

Table 5--Continued

	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.	
	No.	lb.	No.	lb.	No.	lb.	No.	lb.	No.	lb.	No.	lb.	No.	lb.	No.	lb.
Copano Bay																
Pinfish	0.00	0.00	No Data	0.00	0.00	0.00	No Data	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.01
Croaker	5.25	0.04	"	3.50	0.07	0.01	"	0.50	0.01	0.08	4.75	0.80	2.50	0.80	0.25	0.01
Anchovy	80.50	0.09	"	12.50	0.02	0.10	"	95.00	0.10	65.25	0.09	244.75	0.28	469.50	0.37	0.37
Menhaden	10.75	0.06	"	0.00	0.00	0.03	"	72.50	0.03	0.50	0.00	0.25	0.00	0.25	0.00	0.00
Sardine	0.00	0.00	"	0.00	0.00	0.00	"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silversides	2.75	0.02	"	0.00	0.00	0.00	"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullet	8.00	0.89	"	0.50	0.05	0.00	"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pigfish	0.00	0.00	"	0.00	0.00	0.00	"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-Adult Crabs	5.25	0.00	"	3.50	0.00	1.00	"	1.00	0.00	0.00	0.00	0.25	0.00	0.25	0.00	0.00
Shrimp	1.00	0.00	"	0.00	0.00	21.50	"	21.50	0.04	46.25	0.28	13.50	0.10	3.25	0.03	0.42
Totals		1.10			0.14				0.18		0.45		1.18			

	Sept.		Oct.		Nov.		Dec.		Average No. 1962		Average lb. 1962	
	No.	lb.	No.	lb.	No.	lb.	No.	lb.	12 months	12 months	12 months	12 months
Copano Bay												
Pinfish	0.00	0.00	0.00	0.00	1.25	0.04	0.25	0.01	0.18	0.01	0.01	0.01
Croaker	0.00	0.00	2.50	0.21	0.00	0.00	6.75	0.00	2.60	0.15	0.15	0.15
Anchovy	433.50	0.32	198.00	0.15	38.75	0.05	50.00	0.04	168.78	0.15	0.15	0.15
Menhaden	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.38	0.01	0.01	0.01
Sardine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silversides	0.25	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.32	0.00	0.00	0.00
Mullet	0.00	0.00	0.00	0.00	0.25	0.03	2.00	0.33	1.08	0.13	0.13	0.13
Pigfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-Adult Crabs	0.00	0.00	0.00	0.00	2.50	0.00	5.00	0.01	1.78	0.00	0.00	0.00
Shrimp	12.25	0.29	38.50	0.43	52.25	0.40	7.00	0.04	19.55	0.16	0.16	0.16
Totals		0.61		0.79		0.52		0.43			0.61	0.61



Table 6

## A Comparison Between 1961 and 1962 Average Pounds Per Acre-Catch

	Trout	Redfish	Drum	Flounder	Sheepshead
1961	Number/acre lbs. /acre	2.05 1.92	1.44 1.07	0.24 0.18	1.84 1.84
1962	Number/acre lbs. /acre	1.73 1.23	2.89 1.29	0.09 0.07	7.23 6.80

Table 7

## Commercial Catch 1961-1962 (Bay Data Completed for only 4 Months in 1961)

	Drum	Redfish	Trout	Flounder	Sheepshead
1961					
September	7,329	4,087	11,857	2,454	20
October	5,871	8,516	17,087	3,390	25
November	8,922	14,205	34,041	9,282	66
December	9,475	11,942	38,619	6,509	75
Total	31,597	38,750	101,604	21,635	186
1962					
January	36,004	24,630	87,121	965	70
February	18,781	4,231	30,412	607	4
March	19,272	6,120	36,714	565	18,825
April	9,137	4,163	32,667	331	878
May	11,232	2,389	16,130	762	260
June	11,781	5,302	13,983	5,270	1,502
July	10,668	6,829	12,719	6,208	2,917
August	6,595	9,135	13,576	4,258	3,889
September	9,667	11,384	14,913	4,267	4,941
October	11,612	11,864	20,453	3,702	2,879
November	15,980	18,486	31,756	32,788	2,723
December	20,899	13,106	33,439	5,583	1,050
Total	181,628	117,539	343,913	65,306	39,956

Table 8  
Returns of Fish Tagged in the Aransas-Copano Bay System in 1962

<u>Species</u>	<u>No. Tagged</u>	<u>Returned</u>	<u>Per Cent Return</u>	<u>Per Cent Hook Line</u>	<u>Per Cent Commercial</u>	<u>Longest Dist. Moved</u>	<u>Shortest Dist. Moved</u>	<u>Longest Time Laps</u>	<u>Shortest Time Laps</u>
Trout	157	6	3.8	3.1	0.6	10 miles	0 miles	217 days	9 days
Redfish	120	19	15.8	9.2	6.6	40 miles	0 miles	365 days	9 days
Drum	374	13	3.4	2.9	0.5	10 miles	0 miles	235 days	3 days
Flounder	12	1	8.3	8.3	0.0	1 mile	1 mile	222 days	222 days
Sheepshead	181	1	0.5	0.0	0.5	15 miles	15 miles	27 days	27 days

Table 9  
Accumulative Percentage Tag Returns from Month of Release for 1962

<u>Species</u>	<u>Month</u>								
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
Trout	1.27	1.91	1.91	3.18	3.18	3.80	3.80	3.80	3.80
Redfish	3.33	4.16	5.00	9.16	10.83	12.50	14.16	14.16	15.00
Drum	1.06	1.33	1.33	1.60	2.13	2.60	2.94	3.47	3.47
Flounder	0.00	0.00	0.00	0.00	0.00	8.30	8.30	8.30	8.30
Sheepshead	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Figure 1  
Aransas Bay Fin-Fish Stations

- 10-foot trawl
- 20-foot trawl
- △ 60-foot seine
- trammel net or drag seine

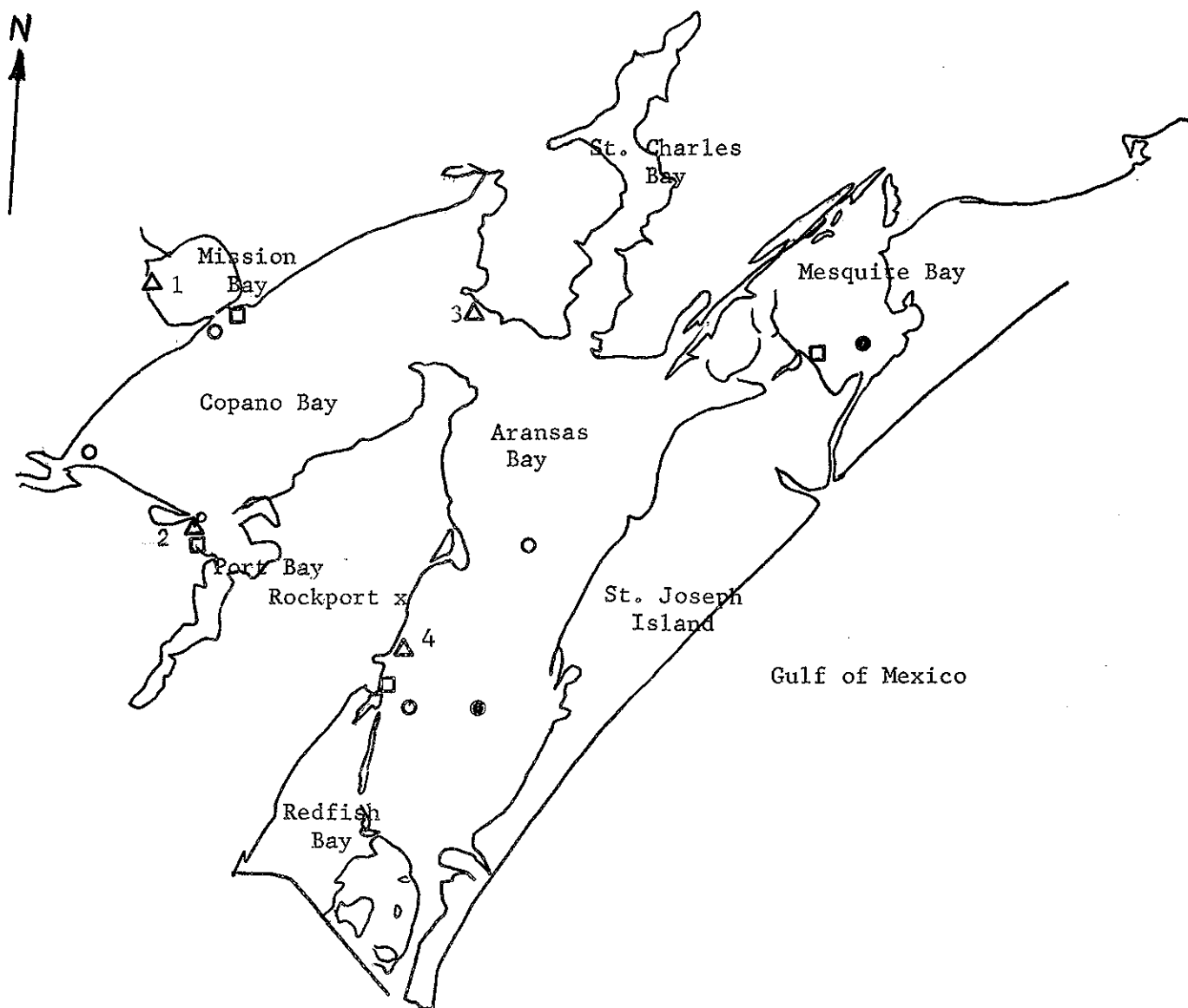


Figure 2  
Monthly Catch Per Acre  
for Juvenile Redfish, Trout, Drum, Sheepshead and Flounder-1962

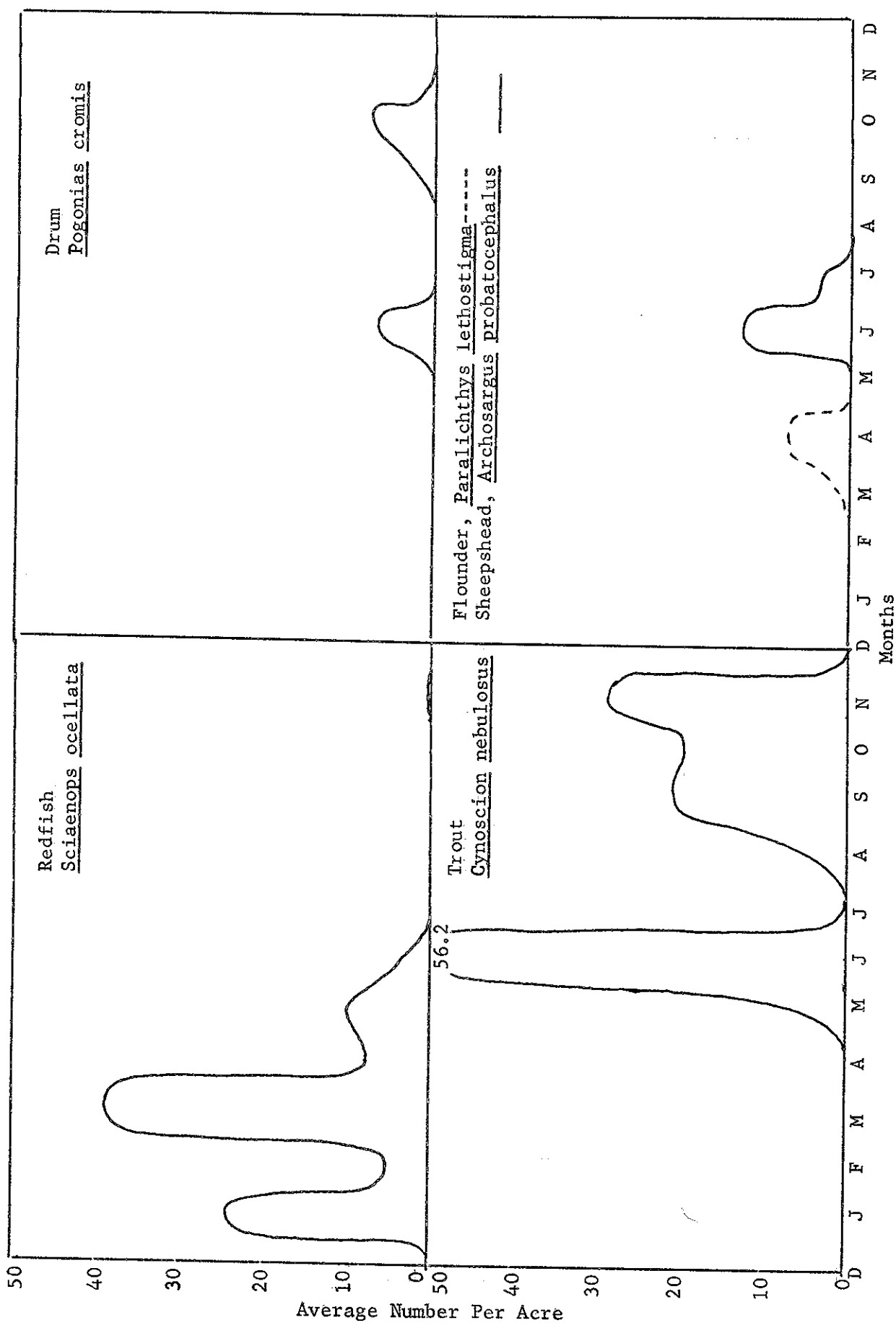


Figure 3

Monthly Size Range of Juvenile

Redfish, Trout, Drum, Sheephead and Flounder in 1962 . one specimen

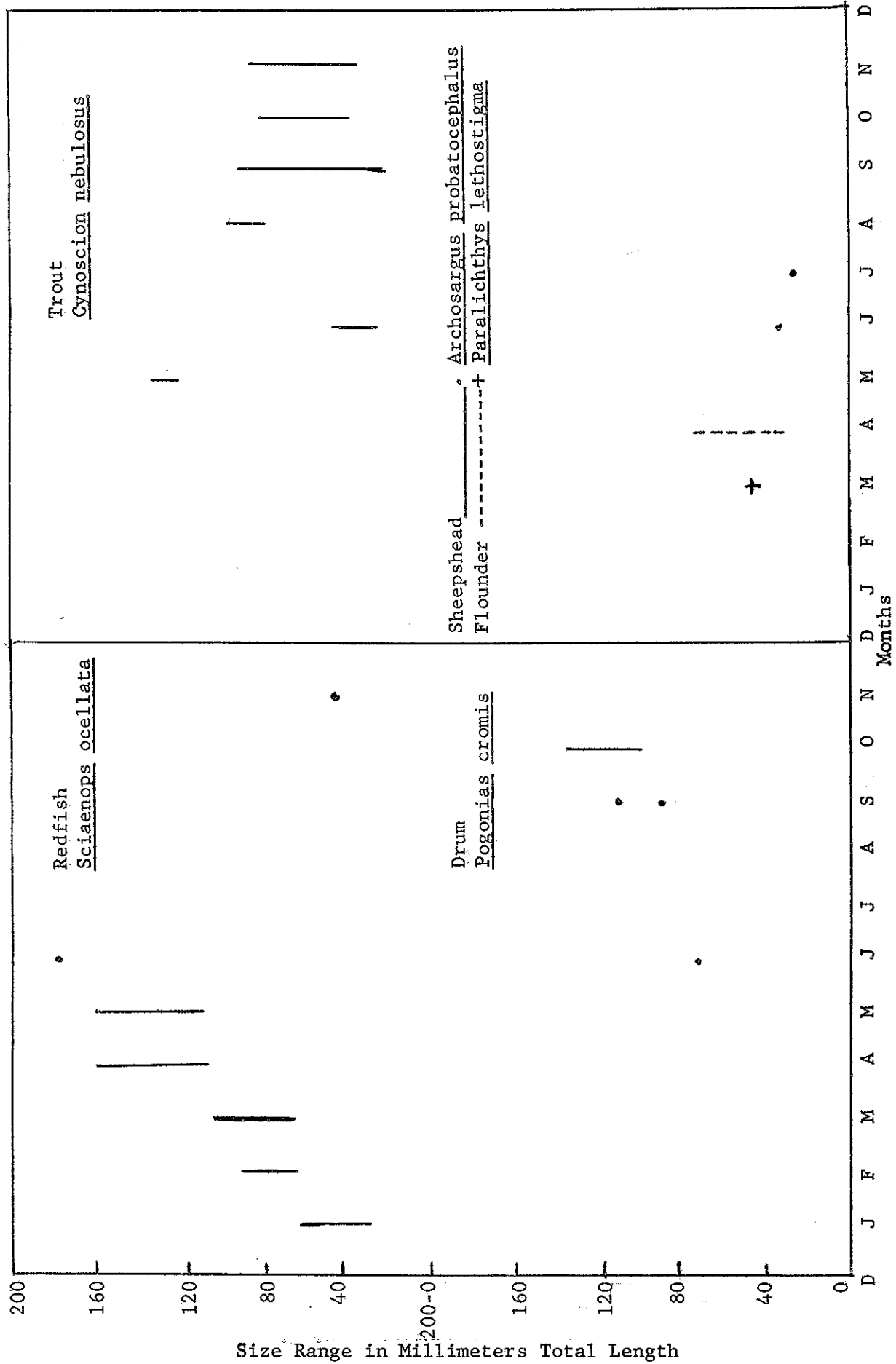


Figure 4  
 Forage Fish Catch Per Unit of Effort in 10- and 20-foot Trawls for 1961 and 1962  
 One Unit of Effort = 1-15 Minute Trawl

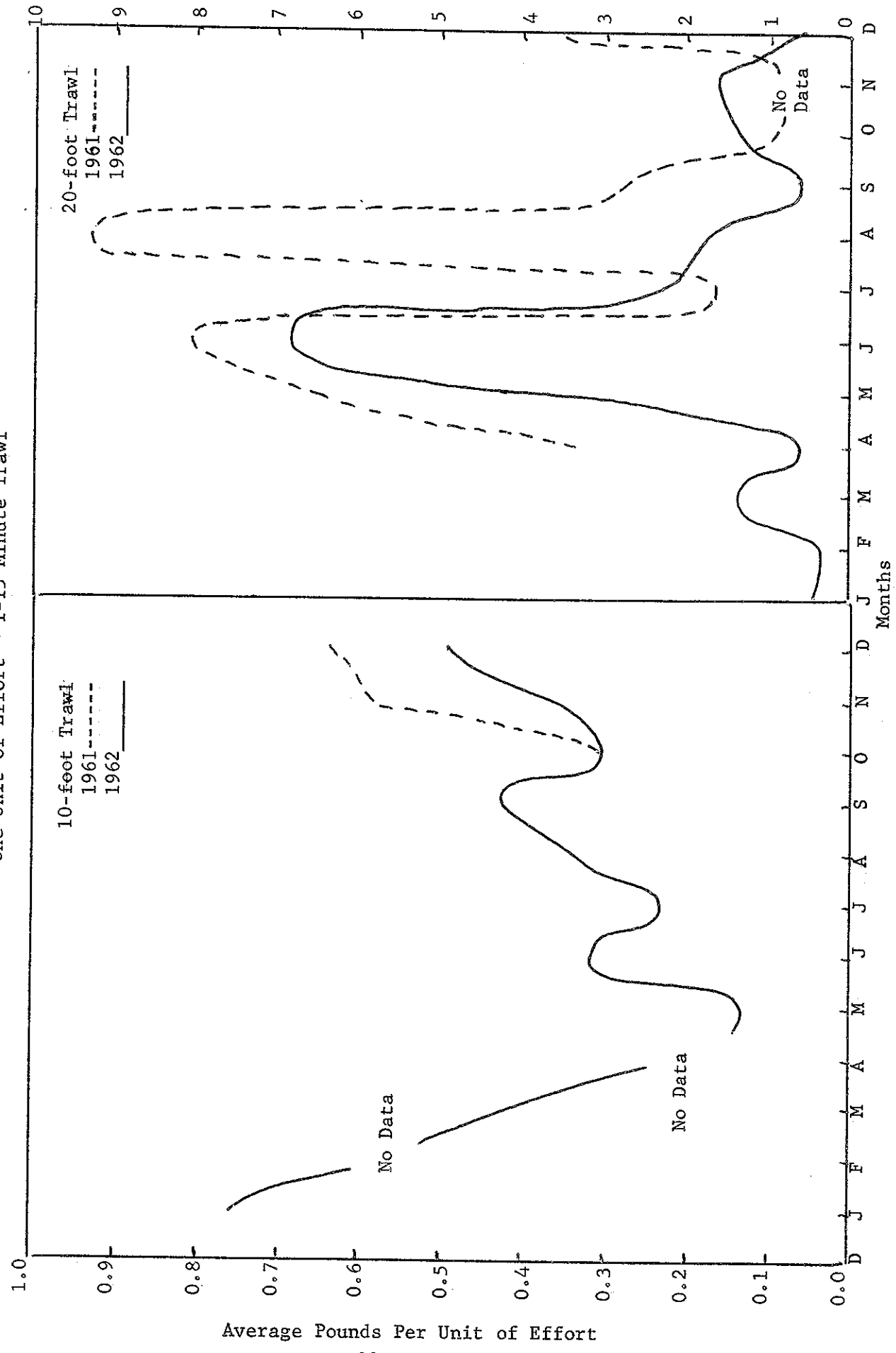


Figure 5  
A Comparison of Catch for a 20-foot Trawl for 1961 and 1962

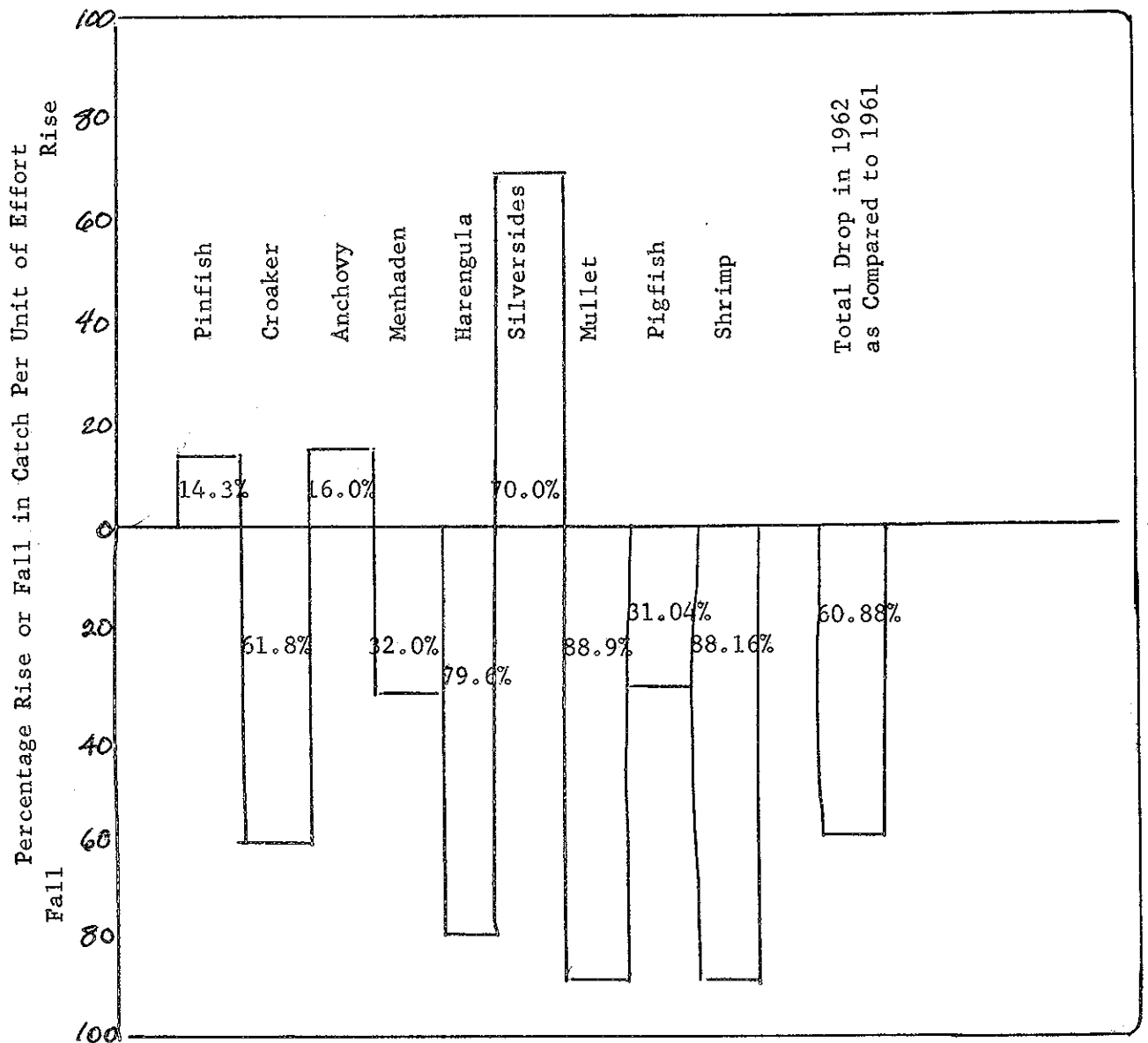


Figure 6  
 Monthly Catch in Pounds Per Acre of Adult Game Fish in 1961 and 1962  
 Trout----- Redfish~~~~~ Flounder-.-.-.-. Drum \_\_\_\_\_ Sheephead =====

