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. 5

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

Abstract: Juvenile trout, *Cynoscion nebulosus*, catch in 1963 was similar to that in 1962. A peak juvenile trout population of 9.7 million fish was calculated for September-November 1963, as compared to 8.8 million in 1962. Limited tag returns for adult trout indicated an annual fishing mortality of 5.9 per cent and "other losses" of 93.6 per cent. Adult trout population estimates were calculated from tag returns and by a catch per unit effort method. The results varied considerably.

Juvenile redfish, *Sciaenops ocellata*, catch decreased 96 per cent compared to 1962. A freeze in 1963 was thought to be one reason for this decrease. Tag return data for adult redfish show 26 per cent return per year for three years. The adult redfish population, as computed by the area density method, was estimated to be 480,000 fish compared to the 1962 estimate of 918,000 fish. Per cent tag returns indicated a population of about 900,000 fish. The annual fishing mortality for redfish was estimated to be 25.8 per cent.

The estimated drum, *Pogonias cromis*, population was 1 million pounds for 1963. An annual fishing mortality of 6.8 per cent was calculated for drum while other losses were estimated to be 45.7 per cent.

The sheepshead population was estimated to be about 1 million pounds.

There was a 75 per cent decrease in catch per unit effort for forage fish species in 1963 compared to 1961. Salinities increased 80 per cent. Croaker and menhaden catches reflected this increase in bay salinities by a decrease in abundance.

Objectives: To determine the populations of food and game fish and forage species of the Aransas Bay System and to evaluate different methods of estimating populations.

Procedures: Collections were made with trammel net, drag seine, minnow seine, and otter trawl. These collections were made at fixed stations (Figure 1) in widely scattered areas of the bay so that all habitat types present were sampled.

Four collections were made each month with the drag seine, except, beginning in September 1963, only 2 stations a month were made. The drag seines used were 600 and 2,400 feet, each of 3-inch mesh, except the 2,400-foot net which had 2-inch mesh in the battle wings. Both nets were 6 feet deep. The nets were pulled and the area covered was calculated. The trammel net was 4 feet deep with 3-inch inside mesh and 12 inches outside mesh. The trammel net was used in connection with tagging only. All game fish collected were measured and counted. Other species present were noted.

Populations of trout, redfish, and drum were calculated by multiplying the catch per acre by the number of acres of similar habitat. Estimates were also derived from the percentage of tagged fish returned by commercial fishermen in conjunction with commercial landings.

Four collections were made each month with a minnow seine. This net was 60 feet long and 6 feet deep. The mesh was three-fourth of an inch stretched. The net was pulled and the area sampled was calculated. All game fish collected were measured and counted. Forage fish species were measured and counted also.

Twelve collections were made each month with otter trawls. Four times each month a 20-foot trawl was used. The mesh was 1½-inch stretch. Eight times each month a 10-foot trawl was used. The mesh was 1¼-inch stretched and had a liner in the cod end of the trawl of one-half of an inch stretched. Collections made with each trawl were of 15-minute duration or fraction thereof. All forage fish were counted and weighed. The rough average size of each species was determined and recorded.

Special collections were made for the purpose of tagging or experiment or to determine habitat changes.

Information gathered from all collections were recorded on an appropriate form. Hydrographic and meteorological information was collected with each study sample and the results entered on each sample form. All forms were duplicated and a copy sent to the project leader.

Findings and Discussion:

Juvenile Food and Game Fish

Trout - In 1962 sampling (Figure 2, Table 1) two distinct peaks of abundance were recorded for trout, *Cynoscion nebulosus*, one in June and the other extending over a period from September through November.

This was not the case in 1963, as only one peak in September, October, and November occurred. The 1963 peak was followed by a subsequent decrease in abundance and by November no juvenile trout were taken in seine samples (Table 1).

In comparing trout abundance in 1962 and 1963, discounting a peak caused by one large sample in June of 1962 (Table 1), both studies show similar population patterns (Figure 2). Isolated groups of trout were taken throughout the year, and major peaks of abundance occurred from September through November in both years.

Using the fall peak of abundance (Table 1), the average juvenile trout population, on the nursery grounds for the three months in 1962 and 1963, was calculated to be 8.8 million and 9.7 million, respectively. Many writers agree (Paulik 1963) (Parker and Black 1959) (Black 1958) that mortalities of large magnitude are not uncommon in nature and high mortality for juvenile trout could be expected.

Redfish - Samples were almost void of juvenile redfish, *Sciaenops ocellata*, in 1963 (Table 1 and Figure 2) and seine samples indicate that, in 1963, there was a 96 per cent decrease in Year Class 0 redfish abundance.

There are several possible reasons for a drastic decline. It is possible that the abnormally high salinities in 1963 may have had an influence on juvenile redfish survival. A factor, which could account for the decrease, was the occurrence of freezes during the 1962-1963 spawning season. If juvenile redfish were caught, at the time of freezes, in the shallow flats, it was possible that a high mortality might have occurred. Biologists working in the Corpus Christi Bay area reported taking 10-15 small dead redfish per 15-minute drag with a shrimp trawl during the freeze.

Again, as in 1961 and 1962, few juvenile drum, flounder, and sheepshead were taken. Two drum were taken in April 1963, one flounder in May, and one sheepshead in September.

Forage Fish

In this report, "forage fish" shall include pinfish, Lagodon rhomboides; croaker, Micropogon undulatus; anchovy, Anchoa mitchilli; menhaden, Brevoortia sp.; sardine, Harengula pensacolae; silversides, Menidia beryllina; mullet, Mugil cephalus; the crab, Callinectes sapidus (10-100 mm), and commercial shrimp, Penaeus aztecus, P. setiferus, and P. duorarum.

In Table 2, a comparison of the catch per unit of effort for the 20-foot trawl in 1961-62-63 is presented.

In Table 3 is found a comparison of the 10-foot trawl unit of effort and in Figure 3 the 60-foot seine catch per acre. One unit of effort with the 10- and 20-foot trawl is one 15-minute drag. One unit of effort with the 60-foot seine is one 30- by 150-foot drag.

The catch per unit of effort for forage fish in the trawl, as well as the seine samples, decreased in 1963.

In 1962, the 20-foot trawl catch was 61 per cent less than in 1961 and in 1963 it was 75 per cent less. The average salinity of the bays in 1961, 1962, and 1963 was 18.0, 29.0, and 34.0 ppt, respectively. This indicates a 61 per cent increase in salinity in 1962 and an additional 18 per cent increase in 1963. This correlates inversely with the 61 per cent decrease catch per unit of effort in 1962 and the additional 14 per cent decrease in 1963. This appears to be a true relationship, but more study is needed.

In 60-foot seine samples (Figure 3) the pounds per acre catch in 1963 decreased about 90 per cent. This is accounted for by a 90 per cent drop in mullet catch. The differences in catch per acre between other species was very small. It was noted, however, that the croaker and menhaden catch, as in the 20-foot trawl, decreased considerably. This decrease, correlated with the salinity increase, further indicates that high salinity waters seem unsuitable for the propogation of certain species.

Adult Game Fish

Trout, redfish, drum, flounder, and sheepshead were important as food and game fish in the Aransas area in 1963. These fish were sought by both commercial and sport fishermen during the year.

In 1961, a program designed to sample these species was initiated. The results of this sampling in 1963 are found in Figures 4 and 5 and Tables 4, 5, 6, and 7.

In 1963, the average sample catch of trout in pounds per acre was 2.0 pounds (Table 4), and the maximum catch for any month was 7.7 pounds in December.

These values (Table 4) indicate an average increase in density of 128 per cent over 1962, while commercial landings (Table 5) increased 28 per cent. Peak catches per acre occurred in December 1961, in July 1962, and in July, August, and December 1963 (Figure 4). Some periods were missed due to loss of gear.

The apparent increased abundance is probably due to increased populations. Some are probably due to changes in sampling technique. In 1961, a trammel net was used in sampling populations. This was replaced in 1962 by a 600-foot drag seine of the same mesh as the trammel net and late in 1963 a 2,400-foot drag seine was used. This last seine sampled a much larger and deeper area and its use coincided with increased catches of trout. More study is needed on differences in catch ratio with various gear.

Three methods of determining populations were used in this study. One method was the area density where the catch per acre was multiplied by the area of similar waters 1 to 4 feet deep in the Aransas Bay System (347,000 acres). The second method involved using commercial landings and the percentage of commercially returned tags in a simple ratio. The third method was by calculating the fishing mortality from tagging data and using commercial landings.

In the first method, averages of 2.0 pounds of trout per acre, multiplied by the acres of shallow water in the area, gave an average trout population of about 700,000 pounds.

Tagging results, on the other hand, indicate much larger populations. Of 565 trout tagged in 1963 (Table 7) 17, or 3 per cent, were reported recovered. For a three-year period 1961-1963 (Table 6) the average annual recovery rate was 3.2 per cent. Fifty per cent of these returned, or 1.6 per cent of those tagged, were caught by commercial fishermen who landed an average of 340,000 pounds per year. If this were only 1.6 per cent of the available supply then there would be an average population of 21 million pounds of trout in the Aransas Bay area.

When mortalities were determined from monthly tag returns by formulae given by Rounsefell and Everhard (1953) the following results were obtained:

$$S = \text{Survival} = \frac{5+4+3+2+1}{9+5+4+3+2} = \frac{15}{23} = .652 \text{ per interval of 120 days}$$

$$R = 1 - S \quad = 1 - .65 = .35 \text{ total loss}$$

$$F = \text{Fishing mortality} = 15/.65 \times 571\ (1 + .65 + .65^2 + .65^3\ ) = .02$$

$$L = \text{Natural mortality and other losses} = R - F = .35 - .02 = .33$$

Using these figures, the annual mortalities were obtained by calculation. The calculated annual fishing mortality was 5.9 per cent while "other losses" equalled 93.6 per cent. By using this fishing mortality, plus commercial landings, the trout population was computed to be 11 million pounds.

Several factors should be considered. Recoveries were very few and scattered over a long period of time; therefore, mortality values gained from these data are weak. However, population structure studies by Simmons (1962) have indicated that an average annual mortality of 50-60 per cent is common and it appears that fishing mortality is insignificant compared to other losses. It is known that some tags are not returned and studies by Paulik (1962) have demonstrated high mortalities of recently tagged fish. Both of these factors decrease fishing mortality estimations and increase population estimates but might not effect total mortality values.

It is probable that larger fish were missed in the seine samples and that the population value as determined by catch per acre is low. It is equally possible that tagging estimates are high. It seems certain in view of the high mortality rates and extended spawning periods (Miles 1951) that the population maintains a fairly constant level with almost continuous recruitment, mortality and harvest, and accumulative values, for trout at least, are reflected in the tagging results.

Redfish

Redfish, like trout, showed increases in catch per acre in 1963 (Table 4 and Figure 4). This catch was not, however, greater than in 1961 when a catch of 1.9 pounds per acre was recorded. In late 1961, and early 1962, a large crop of juvenile redfish was found in the bays. This spawn of 1961 reached the 2- to 3-pound size in early 1963. It supported the major portion of the redfish harvest in 1963 and was responsible for the increase in catch per acre as well as the increase in commercial landings.

Assuming the catch per acre of adult redfish is correct, computations then show that the average redfish population in 1963 was 468,000 pounds compared to an estimated 427,000 pounds in 1962.

In 1962, tagging data suggested that the redfish population was about 918,000 fish weighing 1.7 million pounds. Similar calculations were made with tag data in 1963 but, because of an absence of commercial tag returns for redfish, the resulting 433 million fish is unacceptable.

Tag returns for three years (Table 6) indicated that the average redfish population was about 600,000 fish weighing about 1,500,000 pounds.

The differences in results between the two methods, although of much less magnitude than those for trout, are considerable. The reasons for these differences involve several factors. First, it is known that not all tags are returned. Second, it is known that the average weight of commercially caught redfish was much greater than that of redfish caught in the study samples. Third, it is known that some commercially landed fish were captured in other bays or in the Gulf of Mexico, thus diluting the tagging estimates. Finally, it is known that recruitment occurred both in the form of immigration and in growth of fish to catchable size. In all probability the actual population lies somewhere between the density average of 468,000 pounds and the tagging estimate of 1.5 million pounds.

Mortality studies are probably of more value than population estimates. The fishing and natural mortality for redfish was calculated in the following manner from quarterly tag return data for three years.

$$S = \frac{15 + 11 + 9 + 0}{27 + 15 + 11 + 9} = \frac{35}{52} = .67/120 \text{ day period}$$

$$R = 1 - S = 1 - .67 = .33$$

$$F = 35/.67 \times 240 \; (1 + .67 + .67^2) = .103$$

$$L = R - F = .33 - .10 = .23$$

By taking these figures, and calculating the annual rate, it is found that the estimated natural mortality (also other losses) was 58.7 per cent and the annual fishing mortality was 25.8 per cent.

Even these values should be viewed with caution. Some recaptured tagged fish were not returned. This, of course, would result in a fishing mortality estimate lower than the true value. Groups of tagged redfish often disappeared from the fishing area for 6-8 months, then were recaptured near the site of tagging. This would result in a higher "other loss" evaluation. In any case, it is apparent that fishing mortality for redfish is higher than for any other considered species.

Data on black drum are limited. Samples in 1963 (Figure 5) indicate a large population in summer. The catch sampling of drum (Table 4) was 3.44 pounds per acre; about 166 per cent greater than in 1962.

Using the average catch per acre to compute the population, it was estimated that there were 1.3 million pounds of drum in the Aransas area in 1963 as compared to 448,000 pounds estimated in 1962. This increase is mainly accounted for by the large catch in summer months not sampled in previous years. It is also quite probable that the particularly abundant year class of 1961 entered the fishery in 1963 for the first time causing an increase in apparent abundance.

The 3-year average tag return for drum (Table 6) was 4.5 per cent, 22 per cent of which was by commercial fishermen. For 1963, the return rate was 3.2 per cent.

These fish were tagged in scattered groups and over considerable periods of time. No single group involved enough fish to allow use of a single census technique, and tag returns were probably too scattered to allow use of multiple census techniques. If, however, all fish tagged are considered as a single group a population estimate of 13 million pounds (limits 9.6-18.4 million) can be derived using only commercial landing and commercial tag returns.

Mortality estimates can be derived from tagging data. Tag returns were grouped by 120-day periods.

$$S = \frac{7 + 10 + 3}{7 + 7 + 10} = \frac{20}{24} = 0.83$$

$$R = 1 - S = 0.17$$

$$F = 20/.83 \times 441 \ (1 + .83 + .83^2) = 0.22$$

$$\text{Other Losses } (L) = R - F = 0.148$$

Annual F = 6.8 per cent, Annual L = 45.69 per cent

The fishing mortality of 6.8 per cent represents fish caught by both sports and commercial fishermen. Commercial fishermen caught 289,000 pounds of fish and returned 22 per cent of the recaptured tagged fish. This 22 per cent of the fishing mortality (6.8 per cent) represents 1.5 per cent of all tagged drum.

$$\text{Estimated population} = \frac{289,000}{1.5} \times 100 = 19,300,000 \text{ pounds}$$

There were thus three widely divergent estimates, the area density of 1.3 million pounds, the modified single census of 13 million pounds and the estimate from mortality values of 19.3 million pounds.

The differences between these population estimates are caused primarily by selectivity of sampling methods, particularly during the early part of the year. This would indicate that the population size is larger than that shown by the area density survey. At the same time, it is known that some tags were not returned and that some immigration and emigration occurred. These factors, taken into consideration, would lower tagging estimates. At any rate, no overharvest is indicated.

Sheepshead (Figure 5), while abundant fish, are not harvested adequately. This fish is illusive to fishermen and not particularly desired by dealers (personal communication). Few sport fishermen take the time, or have the patience, to catch this fish. It does not readily (observation) hit a net.

Samples indicate that sheepshead averaged about 3.16 pounds per acre in 1963 (Table 5) as compared to 6.80 pounds per acre in 1962. This was the only fish which showed a decrease in catch per acre in 1963. In computing the sheepshead population with the per acre average, it was estimated that there were about 1 million pounds in the Aransas area, yet commercial landings were only 52 thousand pounds in 1963. In comparing the sheepshead catch to commercial landings, it was found that commercial landings increased in 1963 over those of 1962 (Table 5).

Tag information for 168 sheepshead shows one return; insufficient for use in population calculations. Returns for 3 years study came to 6; one by a sport fisherman and 5 by commercial fishermen. It is believed that sheepshead are underfished and should receive greater fishing pressure.

Flounder, for the three study years, had the lowest catch per acre of all major species. This can be explained by the flounder's ability to avoid the net. The average catch per acre in samples, 0.13 pounds, was not believed to be indicative of the actual population. For three years, tagging efforts on flounder have yielded poor results (Table 6). With only 57 tagged, and only 2 returned, little could be derived from the data.

Comments: Drum, sheepshead, and trout all appear to have very large populations. Trout have a high annual natural mortality and could stand a higher fishing mortality to make use of the portion of the population that is lost. Drum and sheepshead could also support a larger fishery.

Redfish have a large annual mortality and a high fishing mortality. When non-returned tags and natural disasters, such as freezes, are considered, it appears the redfish population could become dangerously low.

In order to allow a greater survival of young-of-the-year redfish, a 14-inch minimum size limit was enacted in Aransas County. This protects fish from about 8 to 14 inches, the time when many are caught by hook and line fishermen, and allows harvest at a more desirable size.

Because of a decline in numbers of juvenile redfish found in 1963, it appears that commercial landings, as well as pounds per acre of redfish, will decline in 1964.

In September of 1963, waters which had been closed to netting for many years were reopened. As far as can be determined, there was no great increase in commercial landings of trout attributable to this opening. The slight increase in landings (Table 5) in December may be partially from new fishing water, but also from fish taken subsequent to sudden drops in temperature in December.

There is a definite need for mortality studies on trout under controlled conditions if the ability to predict or estimate annual populations is to be attained.

Commercial landings of trout have shown an increase since 1961. The possible explanation for this is that during the years following the end of the drouth salinities were very low, especially in 1959 and 1960. If there was a good survival of juveniles at that time, then in 1963 this crop of juveniles would be reaching harvestable size (12 inches or larger).

If salinities continue to increase, or stay at present levels, it is possible that catches of forage fish will remain low or decrease still further. If salinities decrease to levels of 15-20 ppt, it is probable that catches of croaker, menhaden, and shrimp will increase to points as high, or higher, than in 1961.

In 1964, with sampling techniques worked out and larger samples being made, any rise or fall in abundance of game species may be more accurately tabulated.

A method of sampling sheepshead with a trap will be employed to try and gain more information on this little known fish.

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Table 1

A Comparison of Juvenile Game Fish Catch in Number per acre by Station in 1962 and 1963
With 60 Foot Seine

Redfish 1962

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
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	9.6	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

Redfish 1963

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*
2	0.0	0.0	0.0	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	9.6	0.0	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Trout 1962

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
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	28.6	19.2	28.8	0.0

Trout 1963

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1	0.0	0.0	9.6	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*
2	0.0	0.0	0.0	*	0.0	19.2	0.0	0.0	57.6	48.5	28.8	0.0
3	0.0	0.0	0.0	*	0.0	0.0	9.6	0.0	124.8	58.2	0.0	0.0
4	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	9.6	0.0	0.0
Total	0.0	0.0	9.6	9.6	0.0	19.2	9.6	0.0	192.0	116.3	28.8	0.0
Average	0.0	0.0	2.4	4.3	0.0	4.8	2.4	0.0	48.0	29.1	7.2	0.0

* no sample made

Table 2
A Monthly Comparison Between Pounds Per Unit of Effort for Forage Fish Caught in the 20-foot Trawl in 1961-62-63

One Unit of Effort = One 15-Minute Trawl

Species	Jan 1961	Jan 1962	Jan 1963	Feb 1961	Feb 1962	Feb 1963	Mar 1961	Mar 1962	Mar 1963
Pinfish	No Data	.00	.18	No Data	.00	.00	No Data	.01	.13
Croaker	"	.09	.04	"	.01	.01	"	.45	.00
Anchovy	"	.25	1.59	"	.31	.33	"	.73	.35
Menhaden	"	.03	.02	"	.00	.00	"	.15	.00
Sardine	"	.00	.00	"	.02	.00	"	.01	.00
Silversides	"	.01	.00	"	.01	.01	"	.00	.04
Mullet	"	.00	.01	"	.00	.00	"	.01	.00
Pigfish	"	.00	.00	"	.00	.00	"	.00	.00
Crabs	"	*	.00	"	*	.00	"	*	.00
Shrimp	"	.02	.01	"	.01	.00	"	.01	.01

Species	Apr 1961	Apr 1962	Apr 1963	May 1961	May 1962	May 1963	June 1961	June 1962	June 1963
Pinfish	.45	.00	.38	.06	.15	.03	.09	.27	.00
Croaker	.40	.20	.01	2.28	1.71	.00	6.13	.06	.33
Anchovy	.65	.30	2.36	.56	.46	.00	.19	.30	1.16
Menhaden	.55	.13	.00	.00	.60	.02	.03	.03	.04
Sardine	.00	.00	.00	.00	.03	.00	.00	.04	.00
Silversides	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mullet	.40	.00	.00	.00	.00	.00	.00	.00	.05
Pigfish	.00	.00	.00	.00	.00	.00	.00	.01	.00
Crabs	*	*	.00	.00	*	.02	.75	*	.00
Shrimp	.00	.00	.00	3.79	.78	.66	.96	.12	.00

Species	July 1961	July 1962	July 1963	Aug 1961	Aug 1962	Aug 1963	Sept 1961	Sept 1962	Sept 1963
Pinfish	.00	.37	.04	.11	.58	.11	.27	.16	.03
Croaker	6.50	1.66	.55	8.23	1.04	.47	1.19	.23	.34
Anchovy	.04	.13	.44	.19	.00	.21	.24	.17	.16
Menhaden	.00	.00	.00	.16	.00	.00	.05	.11	.03
Sardine	.00	.00	.00	.23	.00	.00	.02	.03	.05
Silversides	.00	.00	.00	.01	.00	.00	.00	.00	.00
Mullet	.00	.00	.00	.11	.00	.05	.00	.00	.05
Pigfish	.03	.01	.01	.09	1.46	.00	.00	.00	.01
Crabs	.56	*	.04	.06	.00	.01	*	*	.01
Shrimp	.94	.10	.84	1.23	.06	.58	1.00	.01	.10

Table 2--Continued

Species	Oct 1961	Oct 1962	Oct 1963	Nov 1961	Nov 1962	Nov 1963	Dec 1961	Dec 1962	Dec 1963
Pinfish	.15	.29	.00	No Data	.15	.00	.21	.14	.00
Croaker	.52	.13	.02	"	.00	.02	.45	.00	.00
Anchovy	.27	.48	.12	"	.98	.63	.30	.26	45.40
Menhaden	.42	.05	.05	"	.00	.00	.00	.00	.00
Sardine	.11	.01	.01	"	.00	.00	.00	.00	.00
Silversides	.00	.00	.00	"	.00	.00	.00	.00	.00
Mullet	.00	.00	.00	"	.02	.00	.00	.01	.00
Pigfish	.00	.07	.00	"	.02	.02	.11	.00	.00
Crabs	*	*	.01	"	*	.00	*	.00	.04
Shrimp	.50	.32	.31	"	.44	.21	2.46	.09	.74

TOTALS

Species	1961 Pounds	1961 Per Cent	1962 Pounds	1962 Per Cent	1963 Pounds	1963 Per Cent
Pinfish	.16	3.38	.18	10.07	.08	6.61
Croaker	2.54	54.61	.97	53.38	.15	12.39
Anchovy	.31	6.56	.36	19.97	.65	53.71
Menhaden	.15	3.23	.10	5.61	.01	.82
Sardine	.04	.94	.01	.49	.01	.82
Silversides	.00	.01	.00	.11	.00	.00
Mullet	.06	1.35	.01	.38	.01	.82
Pigfish	.03	.06	.02	1.10	.00	.00
Crabs	*	*	*	*	.01	.82
Shrimp	1.36	29.26	.16	8.86	.29	23.96
Total	4.65		1.81		1.21	

* weight not taken

Table 3
A Monthly Comparison Between Pounds per Unit of Effort
for the 10-foot Trawl in 1962-1963

Species	Jan		Feb		Mar	
	1962	1963	1962	1963	1962	1963
Pinfish	.00	.12	No Data	.08	.02	.06
Croaker	.02	.00	"	.00	.21	.06
Anchovy	.08	.04	"	.06	.01	.03
Menhaden	.05	.03	"	.00	.00	.00
Sardine	.00	.00	"	.00	.00	.00
Silversides	.01	.00	"	.04	.00	.00
Mullet	.59	.09	"	.08	.18	.00
Pigfish	.00	.01	"	.00	.00	.00
Crabs	.00	.01	"	.00	.00	.04
Shrimp	.00	.01	"	.00	.00	.00

Species	Apr		May		June	
	1962	1963	1962	1963	1962	1963
Pinfish	No Data	.00	.00	.03	.00	.03
Croaker	"	.15	.01	.34	.07	.19
Anchovy	"	.00	.08	.07	.07	.05
Menhaden	"	.00	.02	.00	.00	.00
Sardine	"	.00	.00	.00	.00	.00
Silversides	"	.00	.00	.00	.00	.00
Mullet	"	.16	.00	.10	.00	.00
Pigfish	"	.00	.00	.02	.01	.07
Crabs	"	.00	.00	.04	.00	.01
Shrimp	"	.00	.03	.44	.17	.19

Species	July		Aug		Sept	
	1962	1963	1962	1963	1962	1963
Pinfish	.00	.03	.03	.02	.01	.02
Croaker	.06	.12	.08	.08	.05	.03
Anchovy	.11	.09	.19	.08	.17	.06
Menhaden	.00	.00	.00	.00	.00	.00
Sardine	.00	.00	.00	.00	.00	.00
Silversides	.00	.00	.00	.00	.00	.00
Mullet	.00	.17	.00	.00	.02	.00
Pigfish	.00	.00	.01	.00	.00	.01
Crabs	.00	.12	.00	.00	.00	.01
Shrimp	.06	.13	.03	.02	.19	.03

Table 3--Continued

Species	Oct 1962	Oct 1963	Nov 1962	Nov 1963	Dec 1962	Dec 1963
Pinfish	.01	.00	.05	.00	.10	.01
Croaker	.08	.07	.00	.00	.00	.01
Anchovy	.09	.03	.03	.04	.00	.03
Menhaden	.00	.00	.00	.00	.00	.02
Sardine	.00	.00	.00	.00	.00	.00
Silversides	.00	.00	.00	.00	.00	.00
Mullet	.00	.00	.02	.00	.10	.00
Pigfish	.00	.03	.01	.00	.02	.01
Crabs	.00	.01	.00	.00	.03	.01
Shrimp	.13	.18	.26	.44	.08	.14

TOTALS

Species	1962 Pounds	1962 Per Cent	1963 Pounds	1963 Per Cent
Pinfish	.03	7.69	.03	8.10
Croaker	.06	15.38	.09	24.32
Anchovy	.09	23.07	.05	13.51
Menhaden	.01	2.56	.00	.00
Sardine	.00	.00	.00	.00
Silversides	.00	.00	.00	.00
Mullet	.10	25.64	.04	10.81
Pigfish	.01	2.56	.01	2.70
Crabs	.00	.00	.02	5.40
Shrimp	.09	23.07	.13	35.13
	.39		.37	

Table 4
A Comparison Between 1961, 1962, and 1963 Average Pounds Per Acre-Catch

		Trout	Redfish	Drum	Flounder	Sheepshead
1961	lbs./acre	0.88	1.92	1.07	0.18	1.84
1962	lbs./acre	0.60	1.23	1.29	0.07	6.80
1963	lbs./acre	2.02	1.35	3.44	0.13	3.16

* Table 5
Commercial Catch 1961, 1962, and 1963 (Bay Data Completed for only 4 Months in 1962) in Pounds

1962	Drum	Redfish	Trout	Flounder	Sheepshead
Total	181,628	117,539	343,913	65,306	39,956
1963					
January	47,845	17,558	80,586	1,643	8,124
February	34,710	11,151	33,769	845	3,002
March	34,071	5,274	26,468	391	15,677
April	24,539	4,358	32,536	1,388	2,757
May	20,867	10,574	32,681	7,459	1,195
June	16,524	6,412	17,340	6,561	2,444
July	17,458	7,371	20,926	10,144	2,739
August	14,560	10,240	24,308	5,695	2,441
September	13,654	13,587	13,233	8,757	666
October	13,964	10,922	11,084	10,108	2,041
November	28,125	20,928	36,288	37,990	5,159
December	22,801	13,652	45,294	12,304	6,028
Total	289,118	132,027	374,513	103,285	52,273

* personal communication - O. H. Farley

Table 6
Commercial and Sports Percentage Tag Returns for 1961, 1962, 1963 Combined

Species	No. Tags Total	No. Sports	Per Cent	No. Commercial	Per Cent
Redfish	84	56	66.6	28	33.3
Trout	30	15	50.0	15	50.0
Drum	43	33	76.7	10	23.2
Sheepshead	6	1	16.6	5	89.4
Flounder	2	2	100.0	0	0.0

Table 7
Tag Returns by Species for 1963

	Tagged	Returns	Per Cent
Trout	565	17	3.0
Redfish	82	16	19.0
Drum	566	18	3.2
Flounder	37	0	0.0
Sheepshead	168	1	0.5

Figure 1
Aransas Area Fin-Fish Stations

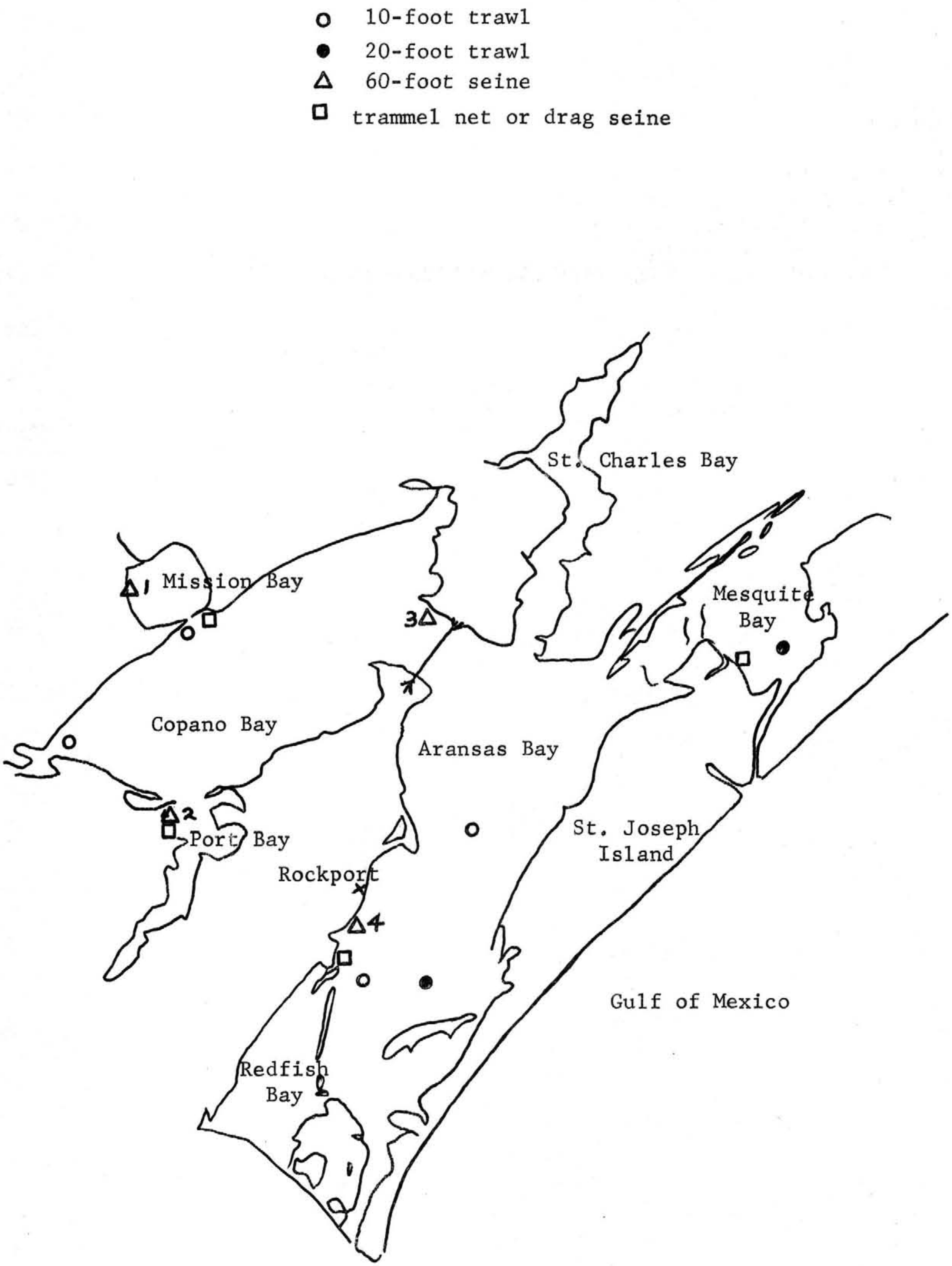

Figure 2
Juvenile Game Fish Catch Per Acre in 60-foot Seine Hauls in 1962 and 1963

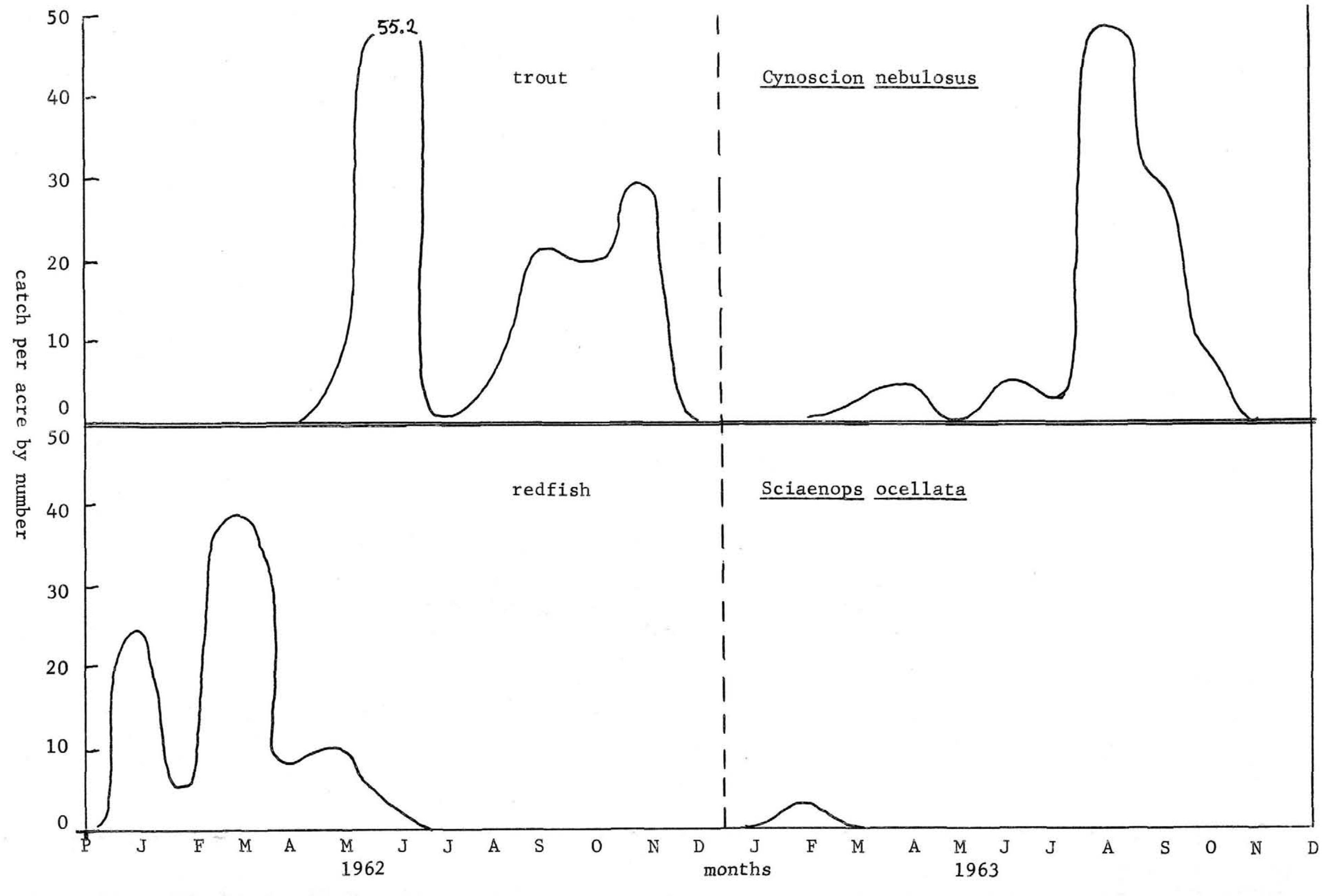

Figure 3
Pounds Per Acre Catch in 60-foot Seine Hauls in 1962 and 1963 for Forage Fish

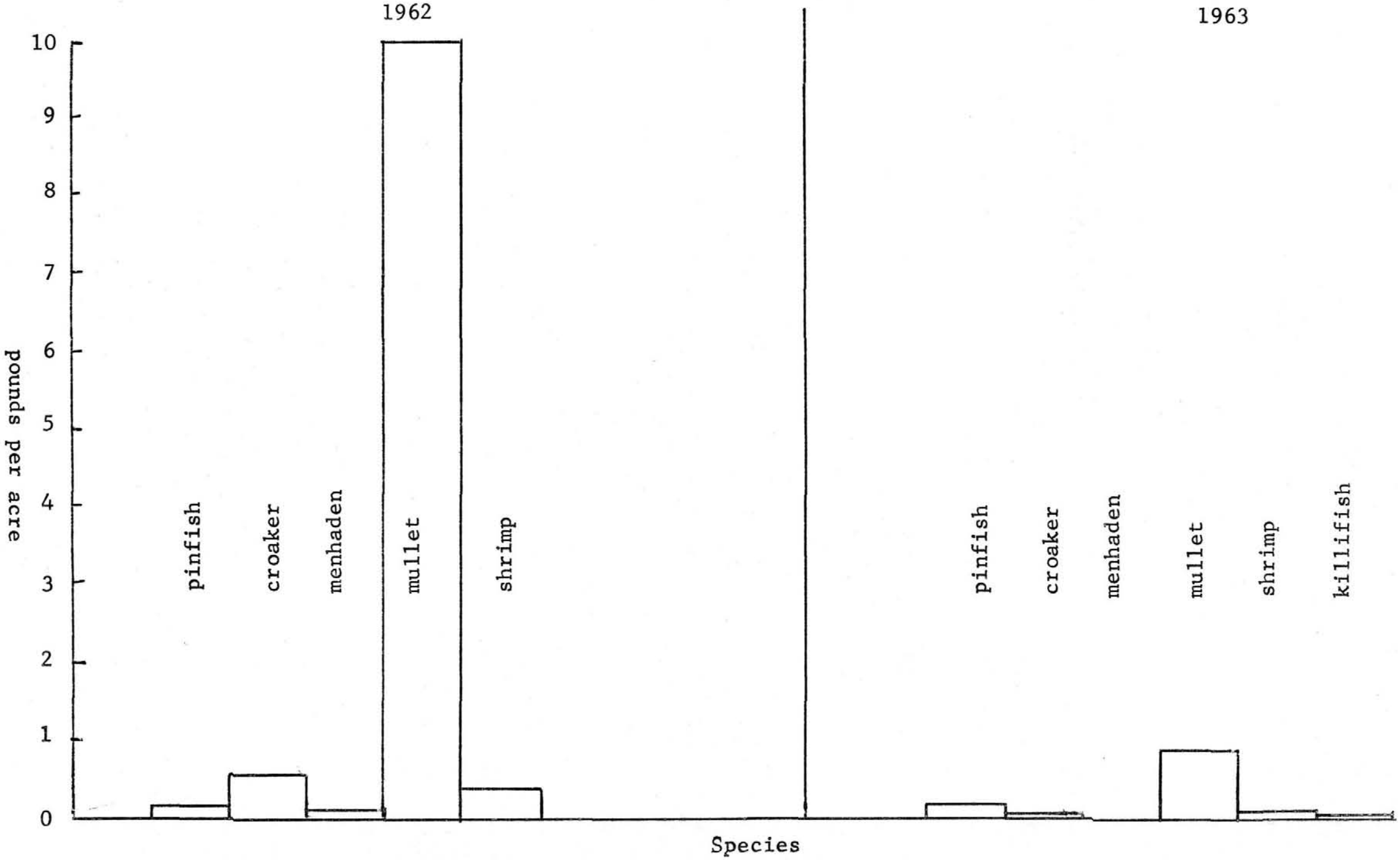

Figure 4
Adult Game Fish Catch Per Acre in 1961, 1962, and 1963

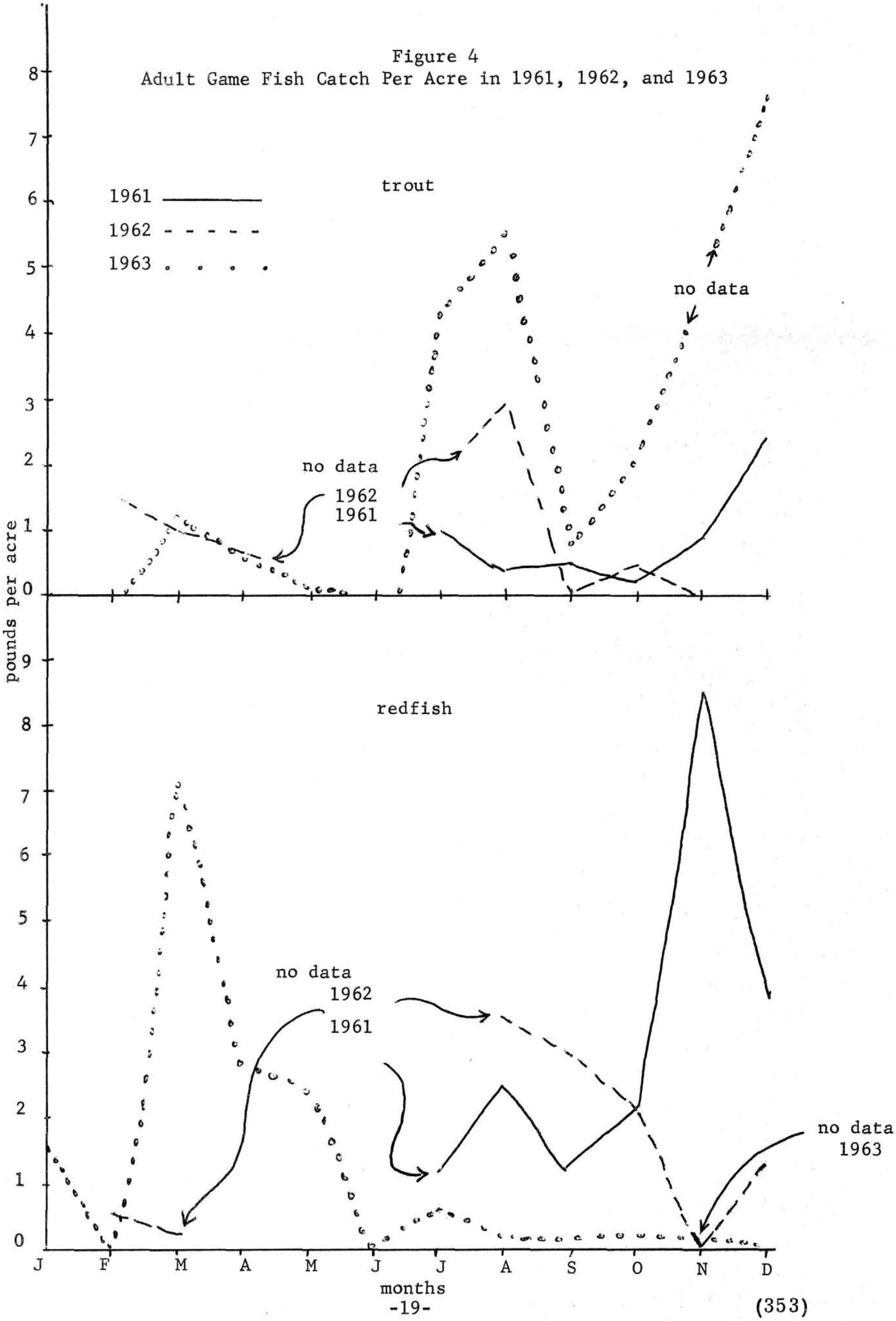

Figure 5
Adult Game Fish Catch Per Acre in 1961, 1962, and 1963