

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. 2

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

Abstract: Seasonal occurrences, size ranges, and distribution of forage fish, juvenile game fish, and adult game fish in various habitats of Galveston Bay were studied.

Forage species were most abundant in spring and least abundant in winter. Most species occurred during summer and fall.

Juvenile spotted sea trout, Cynoscion nebulosus, black drum, Pogonias cromis, and redbfish, Sciaenops ocellata, were more abundant at nursery areas sampled in 1963 than in 1962.

Atlantic croaker, Micropogon undulatus, and sheepshead, Archosargus probatocephalus, were the most abundant adult game fish collected.

Game fish tags were returned at a slower rate in 1963 than in the previous year.

Procedures: Forage samples were collected monthly with: (1) a 10-foot otter trawl of 1½-inch stretched mesh and a cod end of one-half of an inch stretched mesh (2) a 60-foot nylon bag seine, 6 feet deep of three-fourth of an inch stretched mesh. The trawl was pulled by boat for 15-minute durations and covered approximately one acre. Seine hauls were made in shallow water and the total area of bay bottom covered was calculated. Small samples of each species were measured for rough average size determinations. Standard length in millimeters, weights by species, and total sample weight were recorded.

Juvenile fish populations were sampled monthly at four regular stations with a 60-foot nylon seine, 6 feet deep of three-fourth of an inch stretched mesh. Sampling procedure followed that described for forage species.

Four adult game stations were sampled monthly with a 1,200-foot drag seine, 4 feet deep and 2½-inch stretched mesh. The bag section was of 2-inch stretched mesh and was 6 feet deep. The net was pulled by hand and the total area sampled calculated. Lengths and weights of all game fish caught were recorded.

Special collections were made with trammel nets, gill nets and hook and line.

Tags were applied to game fish that appeared to be in good condition after capture.

Hydrographic and meteorological data were obtained at each station. Temperatures were read in degrees centigrade and salinities were determined by the Mohr Titration Method.

References used to identify species were Breder (1948), Hildebrand and Cable (1934), Welsh and Breder (1923), and Hoese (1958).

Findings and

Discussion:

Forage Species

Forage data collected during this survey are presented in Table 1. A total of 319,804 specimens were captured and examined. This included 55,614 caught with a 60-foot seine and 264,190 caught by a 10-foot trawl. Sampling distribution, temperatures, and salinities by seasons are presented in Table 2. The largest sample sizes were collected during spring and summer months; lowest during fall and winter.

Fifty species* of forage fish and three invertebrate types were taken. The bay anchovy, Anchoa mitchilli, was the most abundant species caught in trawls (Figure 2), but composed only 20 per cent of the total forage weight (Figure 3).

Seine samples were numerically dominated by commercial shrimp, Penaeus sp., and striped mullet, Mugil cephalus, (Figure 2). Mullet composed 39 per cent of the total weight as compared to 3 per cent for shrimp (Figure 3).

The large numbers of juvenile croakers (20-40 mm) in December, February, and March trawl catches tend to distort winter and early spring data making numbers present high and weights low.

Summer samples yielded the largest number of species (40). ~~Trawls caught~~

1. Anchovy	26. Mullet
2. Croaker	27. Pigfish
3. Anchovy	28. Crab
4. Mullet	29. Shrimp
5. Sand lance	30. Others

Cynoscion arenarius - The value of the sand sea trout as a forage item is not understood. It was the fourth most abundant species collected by trawling. Juveniles (20-45 mm) were present during every month except December. This indicates a long spawning season. Renfro (1959) found spring and summer to be peak spawning months.

Brevoortia patronus - The largescale menhaden, like the mullet, is less vulnerable to small trawls. Sixty-three per cent of the total sample was caught in one sample in August. Renfro (1959) states that Galveston Bay serves as a nursery area for thousands of small menhaden which mass in large schools during summer months. The fish swim near the surface and are hard to catch in trawl samples but are often found in the stomachs of the more important game fish.

Leiostomus xanthurus - The spot ranked 8th in trawl catches and 7th in seine hauls (Figure 2). The young-of-the-year first appeared in late December.

Stellifer lanceolatus - Star drum were present during summer and fall. They appear to have left the bay during winter and spring months. Renfro (1959) found post-larvae entering the bay in June.

Fundulus similis, F. grandis, and Cyprinodon variegatus are the more important cyprinodonts in this area. They predominated winter seine samples, but did not appear in trawl samples.

Lagodon rhomboides - Pinfish were abundant at times at the shallow grassy seine stations in West Bay. Several juveniles (35 mm) appeared in the April trawl samples. The species was more abundant in salinities over 25 ppt.

Spheroides nephelus - The southern puffer was fairly abundant in the summer and fall, especially on shallow muddy bottoms. Its importance as a food item is questionable. It apparently spawns in the spring.

During the summer, 1 trawl and 3 seine stations were added in locations previously not sampled (Figure 1). Catches at these stations did not appear to differ significantly from other catches; therefore, it might be assumed that samples at regular stations gave a fairly good picture of the quality and quantity of species present in the bay.*

Species collected by gear other than trawl and seine or during supplemental sampling were also recorded. These are presented separately in Table 3.

Bad weather and personnel shortage cut the winter sampling short; therefore, attempts to stratify sampling by time within a season or between seasons were unsuccessful.

Juvenile Game Fish

Relative year-class strength of several juvenile game species, based on a method proposed by Marr (1952), is estimated in Table 4. Monthly deviations of the 1963 calculations for number of juvenile game fish per acre from the 1962 findings are shown. The catch per acre calculations were projected from areas covered by the routine 60-foot bag seine hauls.

Survival of 1963 year-class black drum, redfish, and spotted sea trout appears to be higher this year than in 1962. Sheepshead and flounder data were too weak to allow comment; however, the lack of these species in the samples would suggest a poor year class.

* No test was set up for other seasons; therefore, these limited data may apply only to summer.

West Bay (Mud Cut) was the only station to produce all five major game fish. Surf Oaks was an important nursery area for spotted sea trout, redfish, and black drum.

Bolivar and Lone Oak did not appear to be important nursery areas during this survey.

There was no apparent correlation between salinity and juvenile game fish distribution.

Table 6 shows monthly size ranges of juvenile game fish collected during 1962 and 1963.

Although the spawning season of redfish is lengthy, September, October, and November appear to be peak months (Table 6). Zero year-class spotted sea trout (20-40 mm) appeared first in July catches (1962 and 1963), but spawning activity probably continued through September (Table 6) since trout as small as 31 mm were collected in October.

Spotted Sea trout - Forty-eight juvenile trout were collected this year. The size range was 28 mm to 138 mm. Salinities at stations producing trout varied between 13 and 37 ppt. The first 1963 year-class spotted sea trout were taken in July at Mud Cut. The largest single collection (15) was taken at Surf Oaks in November (size range 57-106 mm). Small juveniles (20-40 mm) were found in all months from July through October. A small peak of abundance occurred in July, followed by a larger one in November.

Redfish - The first 1963 year-class redfish appeared in November at Surf Oaks. Low tides in December hampered adequate sampling; however, 5 specimens between 21-59 mm were taken at Mud Cut and Moses Lake (Figure 1). Salinities in nursery areas varied between 21.7 and 31.9 ppt. Small redfish (58-90 mm) taken in February, March, and April were assumed to be of the 1962 spawn (Table 6).

Southern Flounder - Stevens (1962) found large concentrations of flounder in Mud and Taylor Lakes (Figure 1) in February, March, and April of 1962 (Table 6). Few juvenile flounder were taken during this survey.

Sheepshead - West Bay serves as a nursery area for sheepshead and even though only three specimens were recorded during this survey, small sheepshead were observed in the Ruppia (widgeon grass) beds on several occasions.

Black Drum - Surf Oaks served as an important nursery area for black drum in 1963. Figure 4 shows a growth curve of young drum taken on various dates between May 28 and November 21, 1963. Size ranges and mean sizes are also given. Salinities are recorded in Table 5. During the 175 days the drum remained at Surf Oaks, they grew at the rate of about 0.5 mm/day.* By fitting a regression line to monthly mean sizes of drum (Figure 5), a growth rate of 0.6 mm/day was estimated. These drum probably resulted from a winter spawn and show a slower growth rate than that found by Frisbie (1961) in Delaware Bay. The spawning period would probably be January through March, which agrees with findings of Pearson (1929) and Simmons and Breuer (1962).

Game Fish

Findings

and Discussion: Croaker and sheepshead were the dominant game fish in drag seine samples. Table 7 shows monthly catches of game fish at the four regular stations sampled (Figure 1). Salinities and temperatures taken during sampling are also shown in Table 7.

* Growth rate based on mean size/time computations.

Mud Cut was the only station to consistently produce game fish. Stevens (1961) described the area and states that stable hydrology, vegetation, and an adjacent pass to the Gulf makes this a suitable fish habitat.

The croaker has become an increasingly important game fish in this area. This species is sought by large numbers of sportsmen during summer and fall months and the croaker "runs" at Rollover Pass are becoming as popular as the large redfish "runs" in the Gulf surf during the fall.

An unusually large redfish "run" occurred in the Gulf surf at Galveston during September, October, and November 1963, after hurricane "Cindy". Local anglers said this was the largest run since 1900.

Although samples indicate black drum and sheepshead are relatively abundant in this area, little sport or commercial pressure is exerted on these species.*

Commercial Landings

Figure 7 shows the commercial landings for Galveston Bay during 1963. Spotted sea trout composed 67 per cent of the total catch; while redfish landings represent only 2 per cent of the total.

An index of commercial catches by months is presented in Figure 6. Peak months were November and March. Summer catch data reflects a change in fishing activity due, mainly, to trash fish and crabs that damage nets during the warm months.

Fish Tagging

Tagging data and returns are presented in Tables 8 and 9. Only 13 tags were returned from the 1963 tagging program (Table 8). Thirteen tags were returned from previous taggings (1961-1962). Redfish showed the highest rate of returns (4.3 per cent) (Table 9).

Tag returns from all species suggest little movement between bays. To date, 44 redfish tags out of 262 tagged since September 1961, have been returned. Thirty-six of these recoveries were from redfish released in West Bay or Chocolate Bay (Figure 1). None of the fish were recovered outside of these areas. This tends to suggest heavy exploitation of the species in this area, with little movement between bays involved.

Comments: The value of the sand sea trout and croaker as game fish has been underestimated. A future study of the status of the fishery and biology of these species would be justified.

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* See commercial landings (1963) for commercial catch; sports pressure taken from unpublished data of creel census now in progress.

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Table 1
Seasonality of Forage Species in Galveston Bay (1963)

	<u>Dec.-Feb.</u>		<u>Mar.-May</u>		<u>June-Aug.</u>		<u>Sept.-Nov.</u>	
	<u>Trawl</u>	<u>Seine</u>	<u>Trawl</u>	<u>Seine</u>	<u>Trawl</u>	<u>Seine</u>	<u>Trawl</u>	<u>Seine</u>
1. <i>Micropogon undulatus</i>	1511		3998	263	472	295	85	33
2. <i>Anchoa mitchilli</i>	708	1	4581	4	7045	2	3087	13
3. <i>Cynoscion arenarius</i>	5		19		157	8	54	15
4. <i>Stellifer lanceolatus</i>					4		50	10
5. <i>Sphaeroides nephelus</i>	4		3	8	23	228	39	182
6. <i>Leiostomus xanthurus</i>	3		19	128	31	131	7	31
7. <i>Citharichthys spilopterus</i>	2	1	10	1	22	24	7	4
8. <i>Harengula pensacolae</i>					1			6
9. <i>Brevoortia patronus</i>	21		10	3	38	173	12	4
10. <i>Dorosoma cepedianus</i>	9							
11. <i>Polydactylus octonemus</i>			5	9	9	2	3	1
12. <i>Caranx hippos</i>						4	1	
13. <i>Chloroscombrus chrysurus</i>					3	1	5	
14. <i>Peprilus paru</i>					2			
15. <i>Poronotus triacanthus</i>				3				
16. <i>Mugil cephalus</i>	8	17		172		512		286
17. <i>Bairdiella chrysura</i>			1		2	60	5	5
18. <i>Lagodon rhomboides</i>			9	3		196		13

Table 1--Continued

	<u>Dec.-Feb.</u>		<u>Mar.-May</u>		<u>June-Aug.</u>		<u>Sept.-Nov.</u>	
	<u>Trawl</u>	<u>Seine</u>	<u>Trawl</u>	<u>Seine</u>	<u>Trawl</u>	<u>Seine</u>	<u>Trawl</u>	<u>Seine</u>
19. Chaetodipterus faber				2			1	2
20. Trichiurus lepturus					1			
21. Menticirrhus americanus	1			5		12		14
22. Trinectes maculatus							1	1
23. Achirus lineatus					1		2	
24. Porichthys porosissimus					21		5	
25. Dasyatis sabina			1		6			
26. Bagre marina					22	7	1	1
27. Symphurus plagiusa	1		1		18	3	24	3
28. Prionotus tribulus	2			4				
29. Syngnathus scovelli						1	1	
30. Myrophis punctatus			1					
31. Synodus foetens	1				2		4	
32. Astrocropus y-graecum	2							1
33. Gobiesox strumosus	1							
34. Elops saurus						2		
35. Fundulus grandis		19		113		70		

Table 1--Continued

	<u>Dec.-Feb.</u>		<u>Mar.-May</u>		<u>June-Aug.</u>		<u>Sept.-Nov.</u>	
	<u>Trawl</u>	<u>Seine</u>	<u>Trawl</u>	<u>Seine</u>	<u>Trawl</u>	<u>Seine</u>	<u>Trawl</u>	<u>Seine</u>
36. <i>Fundulus similis</i>		19		328		64		
37. <i>Cyprinodon variegatus</i>		58		269		16		
38. <i>Menidia beryllina</i>				1		4		4
39. <i>Trachinotus carolinus</i>								1
40. <i>Oligoplites saurus</i>								5
41. <i>Eucinostomus</i> sp.						21		4
42. <i>Gobiosoma boscí</i>						1		1
43. <i>Lucania parva</i>				6				
44. <i>Hypsoblennius lonthas</i>						1		
45. <i>Orthopristis chrysopterus</i>		3				106		8
46. <i>Seriola</i> sp.					1			
47. <i>Opsanus beta</i>					1			
48. <i>Ancylopsetta quadrocellata</i>							1	
49. Squid (<i>Lolliguncula brevis</i>)	1		40		22		38	1
50. Shrimp	482	14	867	54	1443	481	1164	736
51. Crabs (<i>Callinectes</i> sp.)	25	15	21	45	22	116	85	83

Table 2
Sample Distribution, Temperature, and Salinity Range by Seasons (1963)

	<u>Winter</u>	<u>Spring</u>	<u>Summer</u>	<u>Fall</u>
Salinity Range (ppt)	2.1 - 31.9	11.0 - 32.3	5.2 - 37.9	15.9 - 33.6
Temperature Range ($^{\circ}\text{C}$)	8.4 - 17.7	15.3 - 30.8	27.4 - 35.0	17.0 - 34.5
No. of Samples:				
Seine (60')	5	8	14	13
Trawl (10')	10	26	26	22

Table 3
Species of Special Note (1963)

<u>Species</u>	<u>Location</u>	<u>Date</u>	<u>No. and Size Range</u>	<u>Salinity (ppt)</u>
Pristis pectinatus	West Bay	6/18/63	1 specimen (830 mm)	34.3
Serranus atrobranchus	Redfish Island	7/ 2/63	1 specimen (140 mm)	29.0
Seriola sp.	Texas City Dike	7/15/63	1 specimen (29 mm)	28.7
Opisthonema oglinum	San Luis Sand Flats	7/24/63	15 specimens (120-160 mm)	36.7
Scorpaena russula	Hanna's Platform	9/20/63	1 specimen (40 mm)	23.5
Lagocephalus laevigatus	Redfish Island	10/ 8/63	1 specimen (320 mm)	-
Lutianus apodus	Hanna's Platform	12/ 5/63	1 specimen (76 mm)	21.5

Table 4
Juvenile Game Fish Collections (1962 & 1963)
Calculated Number of Individuals Per Acre*

	Speckled Trout			Redfish			Drum			Sheepshead			Flounder		
	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.
<u>February</u>															
Mud Cut	0	0	0	1.8	0	-1.8	0	0	0	1.7	0	-1.7	0	0	0
Surf Oaks	0	0	0	18.2	5.8	-12.4	0	0	0	0	0	0	0	0	0
Lone Oak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivar Penn.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<u>March</u>															
Mud Cut	0	0	0	7.1	0	-7.1	0	0	0	7.1	0	-7.1	0	0	0
Surf Oaks	14.3	0	-14.3	14.3	10.8	-3.5	0	0	0	0	0	0	57.1	0	-57.1
Lone Oak	0	0	0	0	0	0	0	10.8	+10.8	0	0	0	0	0	0
Bolivar Penn.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<u>April</u>															
Mud Cut	NS	0	-	NS	0	-	NS	8.1	-	NS	0	-	NS	8.1	-
Surf Oaks	NS	0	-	NS	64.8	-	NS	0	-	NS	0	-	NS	0	-
Lone Oak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivar Penn.	NS	0	-	NS	0	-	NS	0	-	NS	0	-	NS	0	-
<u>May</u>															
Mud Cut	0	NS	-	7.1	NS	-	7.1	NS	-	0	NS	-	7.1	NS	-
Surf Oaks	NS	0	-	NS	0	-	NS	5486.4	-	NS	0	-	NS	0	-
Lone Oak	0	0	0	7.1	0	-7.1	7.1	0	7.1	7.1	0	-7.1	0	0	0
Bolivar Penn.	NS	0	-	NS	0	-	NS	0	-	NS	0	-	NS	0	-
<u>June</u>															
Mud Cut	0	0	0	5.6	0	-5.6	38.9	11.6	-27.3	0	11.6	11.6	0	11.6	11.6
Surf Oaks	NS	0	-	NS	0	-	NS	1965.6	-	NS	0	-	NS	0	-
Lone Oak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivar Penn.	NS	0	-	NS	0	-	NS	8	-	NS	0	-	NS	0	-

Table 4--Continued

	Speckled Trout			Redfish			Drum			Sheepshead			Flounder		
	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.
<u>July</u>															
Mud Cut	22.2	109.0	86.8	0	0	0	61.1	54.6	-6.5	5.6	9.1	3.5	0	0	0
Surf Oaks	0	0	0	0	0	0	11.1	583.2	572.1	0	0	0	0	0	0
Lone Oak	0	0	0	0	0	0	0	0	0	0	0	0	5.6	0	-5.6
Bolivar Penn.	0	0	0	0	0	0	22.2	0	-22.2	0	0	0	0	0	0
<u>August</u>															
Mud Cut	21.4	46.0	24.6	0	0	0	14.3	0	-14.3	14.3	0	-14.3	0	0	0
Surf Oaks	0	0	0	0	0	0	33.3	295.7	262.4	0	0	0	0	0	0
Lone Oak	NS	6.4	-	NS	0	-	NS	0	-	NS	0	-	NS	0	-
Bolivar Penn.	100.0	0	-100.0	0	0	0	0	0	0	0	0	0	100.0	0	-100.0
<u>September</u>															
Mud Cut	7.7	0	-7.7	0	0	0	53.8	33.9	-19.9	7.7	0	-7.7	7.7	0	-7.7
Surf Oaks	0	6.5	6.5	0	0	0	16.7	32.5	15.8	0	0	0	0	0	0
Lone Oak	NS	29.0	-	NS	0	-	NS	0	-	NS	0	-	NS	0	0
Bolivar Penn.	NS	0	-	NS	0	-	NS	0	-	NS	0	-	NS	0	-
<u>October</u>															
Mud Cut	77.8	36.4	-41.4	0	0	0	44.4	0	-44.4	0	0	0	0	0	0
Surf Oaks	NS	174.0	-	NS	0	-	NS	87	-	NS	0	-	NS	0	-
Lone Oak	11.1	11.3	+2	0	0	0	0	0	-	0	0	0	0	0	0
Bolivar Penn.	0	0	0	0	0	0	0	0	-	0	0	0	5.6	0	-5.6
<u>November</u>															
Mud Cut	NS	NS	-	NS	NS	-	NS	NS	-	NS	NS	-	NS	NS	-
Surf Oaks	0	805.5	805.5	0	170.1	170.1	0	113.4	113.4	0	0	0	0	0	0
Lone Oak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bolivar Penn.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4--Continued

	Speckled Trout			Redfish			Drum			Sheepshead			Flounder		
	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.	1962	1963	Mon. Dev.
<u>December</u>															
Mud Cut	0	108.8	108.8	0	108.8	108.8	0	0	0	0	0	0	0	0	0
Surf Oaks	NS	0	-	NS	0	-	NS	0	-	NS	0	-	NS	0	-
Lone Oak	NS	0	-	NS	0	-	NS	0	-	NS	0	-	NS	0	-
Bolivar Penn.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-

Total															
Monthly Deviation			869.0			241.4			832.8			-22.8			-164.4

* Assumes equal distribution over a one-acre nursery area

-14- NS - No samples taken

NOTE: Only those months in which samples were taken both years (1962-1963) were compared.

Table 5
Temperature and Salinity Ranges at Juvenile Stations (1963)

	<u>Surk Oaks</u>		<u>Lone Oak</u>		<u>Mud Cut</u>		<u>Bolivar</u>	
	Temp. (°C)	Sal. (ppt)	Temp. (°C)	Sal. (ppt)	Temp. (°C)	Sal. (ppt)	Temp. (°C)	Sal. (ppt)
February	15.0	13.4	13.8	11.9	12.8	23.0	11.8	21.4
March	24.3	15.1	22.8	15.0	17.0	23.6	20.9	23.7
April	25.5	14.5	27.5	11.0	26.7	21.9	27.8	27.5
May	27.0	17.8	26.0	12.5	-	-	30.8	22.0
June	30.3	19.4	28.5	10.1	31.4	34.3	31.0	31.6
July	31.4	15.9	-	17.0	-	33.5	-	30.2
August	32.5	19.7	-	13.0	35.0	37.9	-	33.9
September	27.5	15.9	31.5	17.4	26.0	28.9	31.5	32.1
October	22.9	24.7	26.2	18.6	25.2	32.5	26.3	32.4
November	24.2	24.5	17.0	21.5	-	-	25.0	30.4
December	17.5	2.1	13.7	18.0	17.7	31.9	14.8	27.1

Table 6
Monthly Size Distribution of Juvenile Game Fish (1962-1963)
Redfish

Size	<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>	
	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>
21-30 mm																						1
31-40 mm																						
41-50 mm	2																		1		4	
51-60 mm		1	1																2			
61-70 mm	1		1		2	1																
71-80 mm				1	3	2																
81-90 mm					4	3																
91-100 mm					7		1															
101-110 mm					4																	
110-120 mm																						
121-130 mm																						
131-140 mm																						
141-150 mm																						
151-160 mm									1													
Total	3	1	2	1	20	6	1	0	1	0	0	0	0	0	0	0	0	0	0	3	0	5

Table 6--Continued

Size	Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	62	63	62	63	62	63	62	63	62	63	62	63	62	63	62	63	62	63	62	63	62	63
21-30 mm													1									
31-40 mm											2		2	1			1					
41-50 mm											1	2		1				1				
51-60 mm												3								1		
61-70 mm												2		1				2				
71-80 mm												4	1			1		2		4		
81-90 mm												1		2			2			6		
91-100 mm	1													1		1		3		3		
101-110 mm																	1			1		
111-120 mm																		1				
121-130 mm	1			1														1				
131-140 mm				1															2			
141-150 mm																		3				
151-175 mm																1						
Total	2	0	2	0	0	0	0	0	0	0	3	12	3	7	1	2	7	12	0	15	0	0

Table 6--Continued

(298)

-18-

Size	<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>	
	62	63	62	63	62	63	62	63	62	63	62	63	62	63	62	63	62	63	62	63	62	63
21-30 mm																						
31-40 mm							47			1												
41-50 mm							343			31		5										
51-60 mm							106		1	113		23		2								
61-70 mm							11			28		18		10								
71-80 mm									3		7	8		17								
81-90 mm											5	4	1	1								
91-100 mm										1		1		3		4						
101-110 mm											1		2	2	1	3						
111-120 mm													1	12	1	2		1		2		
121-130 mm											1		2	3			4			1		
131-140 mm														1			1			1		
141-150 mm									2							1	3					
151-160 mm															2							
161-170 mm				1																		
171-180 mm						1	1															
181-200 mm							1		1													
201-220 mm											1											
Total	0	0	0	1	0	1	2	507	7	175	14	59	4	49	8	10	4	5	0	4	0	0

Table 6--Continued

	Sheepshead																					
	<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>	
<u>Size</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>
21-30 mm										2		1										
31-40 mm																						
41-50 mm														1								
51-60 mm	1																					
61-70 mm																						
71-80 mm																						
81-90 mm																						
91-100 mm																						
101-150 mm								1					1		1							
Total	1	0	0	0	0	0	1	0	0	2	1	1	2	0	0	0	0	0	0	0	0	0

Table 6--Continued

Flounder																						
Size	<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>	
	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>	<u>62</u>	<u>63</u>
11-20 mm	141		5																			
21-30 mm	19		89		5																	
31-40 mm	1		54		35																	
41-50 mm			11		45																	
51-60 mm					12																	
61-70 mm					2		1															
71-80 mm																						
81-90 mm					1						1											
91-100 mm																						
101-150 mm									2				1									
Totals	161	0	159	0	100	0	1	0	0	2	1	0	1	0	0	0	0	0	0	0	0	0
Not Measured			285																			

Table 7 - Summary of Game Fish Caught at Drag Seine Stations (1963) (expressed as no/acre)

HUMBLE CAMP

SPECIES	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Spt. Sea Trout			1.15	0.17		0.49	0.24			0.34	0.45	
Redfish												
Black Drum		3.90					0.24	0.31	0.28	0.45	0.15	
Flounder									0.14			
Sheepshead										0.11	1.20	
Sand Trout	not sampled				not sampled				0.32	0.67		
Croaker				4.41		3.90	18.54	4.06	0.42	0.67		
Acres/Sampled		3.10	2.60	5.90		4.10	4.10	3.20	7.10	8.90	6.60	5.90
W. Temp. (°C)		13.50	18.60	26.00		33.10		29.90	29.00	26.10	23.00	8.10
Salinity (ppt)		17.30	15.40	21.20		18.70	16.90	25.50	26.00	24.50	24.40	27.00

ELM GROVE

SPECIES	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Spt. Sea Trout						0.24						
Redfish												
Black Drum		0.24						0.16				
Flounder						0.49		0.16				
Sheepshead				0.51	not sampled	0.73	0.28	0.32			0.16	not sampled
Sand Trout	not sampled									0.10		
Croaker			10.98	0.17		27.80	14.72	11.80		1.01		
Acres sampled		4.10	4.10	5.90		4.10	3.60	6.10		9.90	6.40	
W. Temp. (°C)		15.00	24.00	27.20		32.00		35.00		25.50	23.00	
Salinity (ppt)		17.80	20.50	27.40		21.10	23.70	26.40		21.80	23.60	

Table 7 (Cont.) - Summary of Game Fish Caught at Drag Seine Stations (1963) (expressed as no/acre)

LONE OAK BAYOU

SPECIES	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Spt. Sea Trout		0.24				2.20					0.85	
Redfish			0.24			0.49	0.49	0.57	0.59	0.25	0.43	
Black Drum		1.46	2.44	0.17	0.49	13.41	0.24	0.86	8.24	1.52		
Flounder					0.49	0.49	0.49	2.86				
Sheepshead			0.73	0.68	6.10	5.37	13.90	2.29	11.80	1.65	8.30	
Sand Trout									0.29	0.25		
Croaker			10.49	0.51		7.07	6.82	13.43	16.43	0.13		
Acres Sampled		4.10	4.10	5.90	4.10	4.10	4.10	3.50	3.40	7.90	4.70	
W. Temp. (°C)		12.40	22.80	26.00	28.80	32.00		34.20	25.50	26.00	22.40	
Salinity (ppt)		27.30	10.40	11.90	12.20	12.10	17.00	12.50	19.50	18.60	23.60	

NOT SAMPLED

NOT SAMPLED

MUD CUT (WEST BAY)

SPECIES	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Spt. Sea Trout			1.02	1.53		0.49	0.98	0.26	0.81	1.08		
Redfish	0.73	0.51	0.85	0.68			0.24	5.00	0.24	0.27		2.20
Black Drum	0.24		0.34	1.02				1.05	0.24	0.82		0.74
Flounder			0.68	0.17				0.26				
Sheepshead	0.49	0.34	0.51	23.73		0.49	0.24	5.53	0.24	14.32		6.58
Sand Trout									0.35			
Croaker							1.95	1.58	1.28	1.35		
Acres/sampled	4.10	5.90	5.90	5.90		4.10	4.10	3.80	8.60	3.70		4.10
W. Temp. (°C)	13.80	12.80	17.00	28.30		31.40	32.00	33.50	26.00	25.20		17.70
Salinity (ppt)	23.50	23.00	23.60	21.90		34.30	33.50	37.90	28.90	32.50		31.90

NOT SAMPLED

NOT SAMPLED

Table 8
Tag Returns (1963)

<u>Species</u>	<u>Place Tagged/Date</u>	<u>No. Days Free</u>	<u>Distance from Release Point (nautical miles)</u>	<u>Place Recovered</u>	<u>Direction</u>
Drum	Gulf Surf 7/ 2/62	35	8	Gulf Surf (61st.)	N
Drum	Bolivar Pt. 6/ 6/63	34	5	Bolivar Yacht Basin	E
Sheepshead	Elm Grove Pt. 4/27/63	47	0	Elm Grove Point	-
Sheepshead	Lone Oak Bayou 9/25/63	1/2	0	Lone Oak Bayou	-
Sheepshead	Chocolate Bay 9/27/63	8	3	Oyster Lake-Intracoastal	S
Sheepshead	Mud Cut 10/22/63	49	0	Mud Cut	-
Redfish	Mud Cut 4/27/63	123	0	Mud Cut	-
Redfish	Mud Cut 4/27/63	122	1/4	S. Mud Cut	-
Spotted Sea Trout	Mud Cut 4/29/63	51	-	West Bay	-
Spotted Sea Trout	Mud Cut 10/22/63	15	1/2	Bird Island (West Bay)	S
Sheepshead	Lone Oak Bayou 7/17/63	50	3	Jack's Pocket (Trinity Bay)	N
Drum	Lone Oak Bayou 2/ 6/63	211	3	Jack's Pocket	N

Tag Returns from Previous Years Tagging

Drum	N. Chocolate Bay 11/19/62	137	-	N. Chocolate Bay	-
Drum	N. Chocolate Bay 4/20/62	393	-	Chocolate Bay	-
Drum	Mud Cut 12/ 6/62	325	1/2	N. Bird Island	S
Redfish	Mud Cut 12/ 7/62	143	0	Mud Cut	-
Redfish	Mud Cut 12/ 7/62	143	0	Mud Cut	-
Redfish	Mud Cut 12/ 7/62	144	1	Oyster Creek	SW
Redfish	Mud Cut 12/ 7/62	242	4	Christmas Bay	S
Redfish	Mud Cut 12/ 7/62	288	4½	Snake I. West Bay	E
Redfish	Mud Cut 12/17/62	286	11	Hoecker's Pt. (West Bay)	E
Redfish	Mud Cut 10/18/62	315	1/2	Guyton's Cut (West Bay)	S
Redfish	Mud Cut 12/28/61	487	-	West Bay	-
Redfish	Double Bayou 11/21/61	574	20	South Jetty-Galveston	S
Speckled Trout	Mud Cut 12/ 7/62	166	3½	Sea Isle (West Bay)	E

Table 9
Tagging Data (1963)

<u>Species</u>	<u>No. Tagged</u>	<u>No. Returned</u>	<u>% Returned</u>	<u>Max. No. Days Free</u>
Spotted Sea Trout	103	2	1.9	51
Croaker	73	0	0.0	-
Redfish	47	2	4.3	123
Sand Sea Trout	48	0	0.0	-
Black Drum	241	4	1.6	211
Sheepshead	298	5	1.7	50
Flounder	<u>16</u>	0	0.0	-
Total	826			

FIGURE 1. Fish Sampling Stations

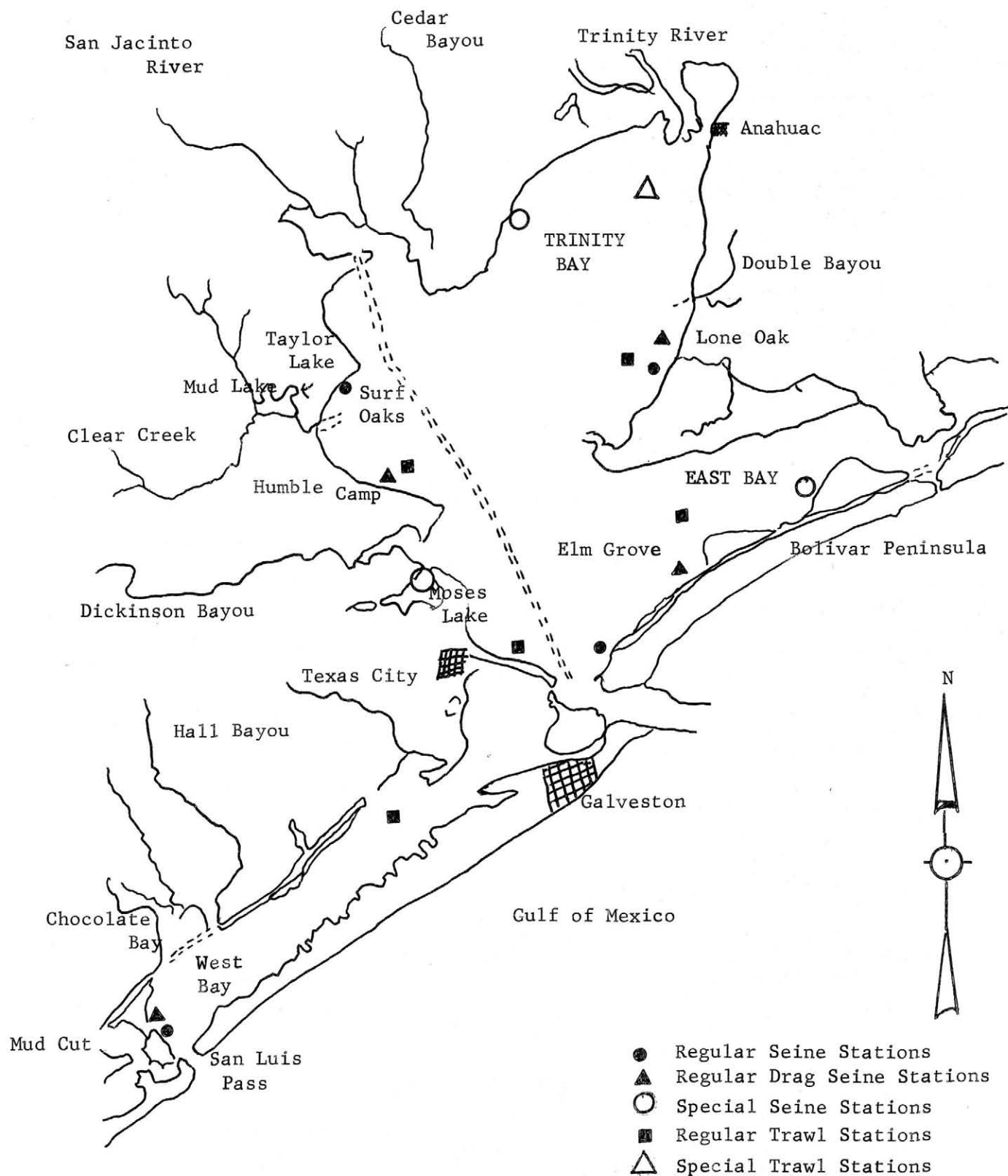


FIGURE 2 - Species composition of seine & trawl data by number (1963)

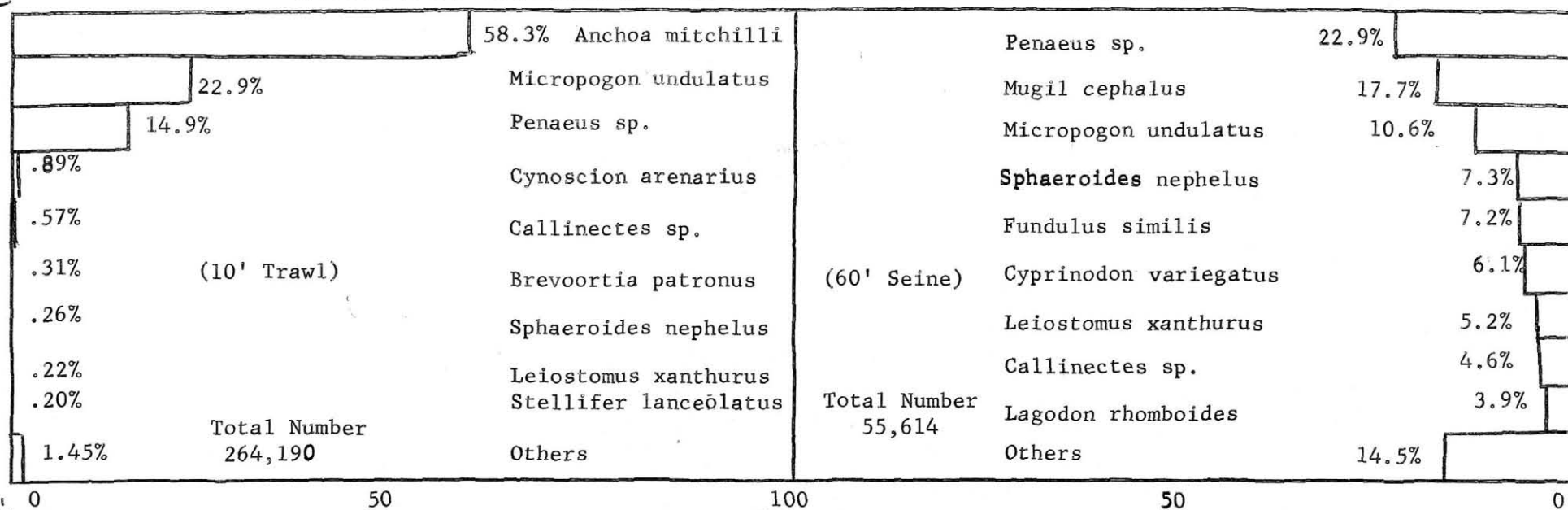
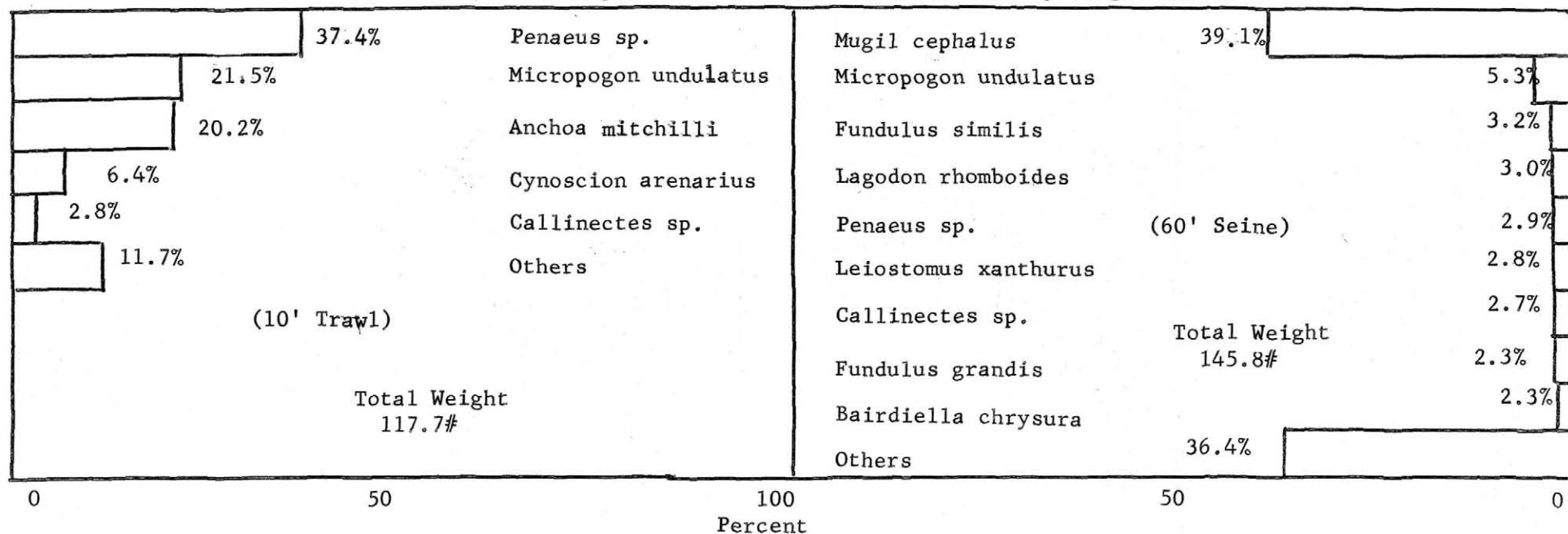
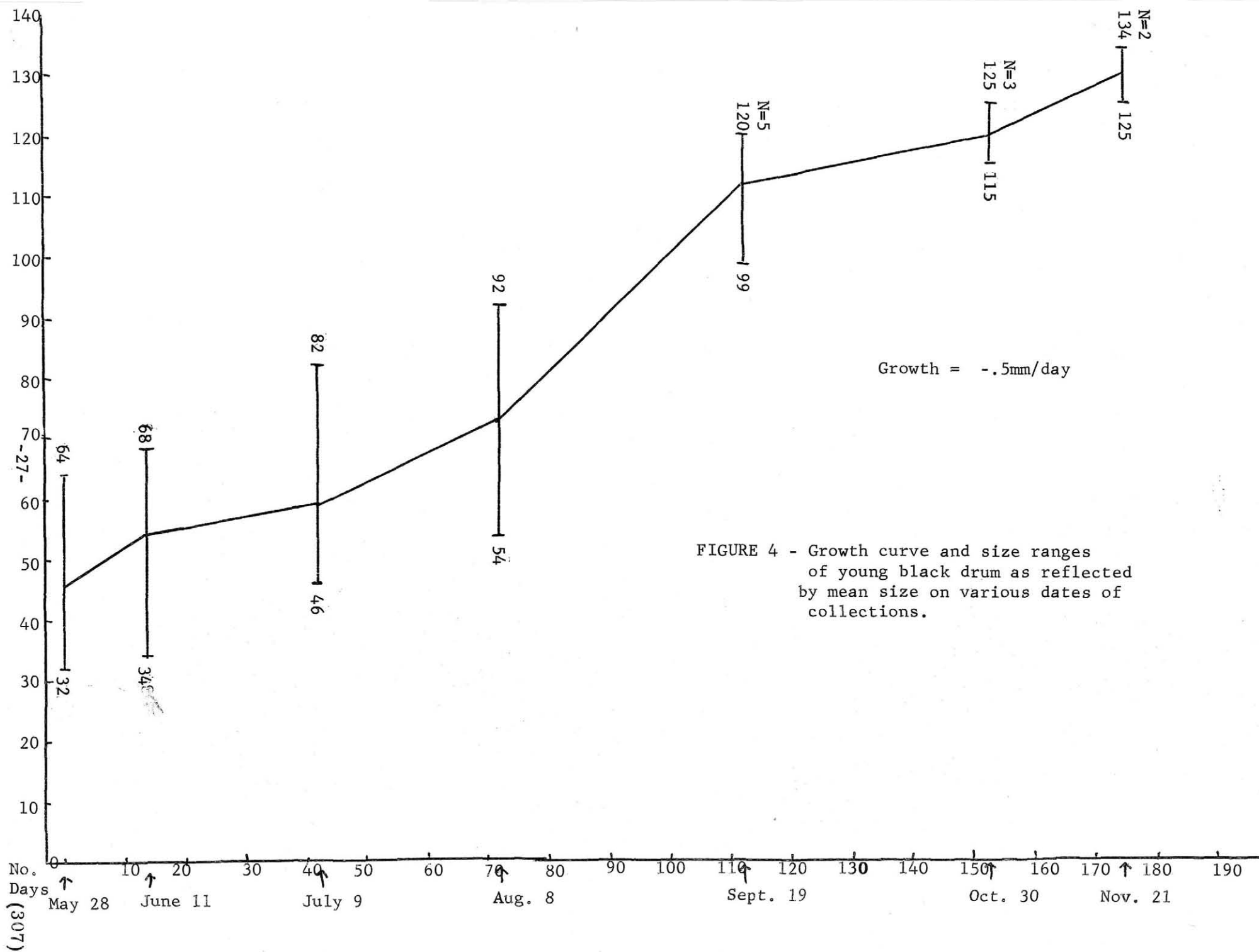


FIGURE 3 - Species composition of seine and trawl data by weight (1963)





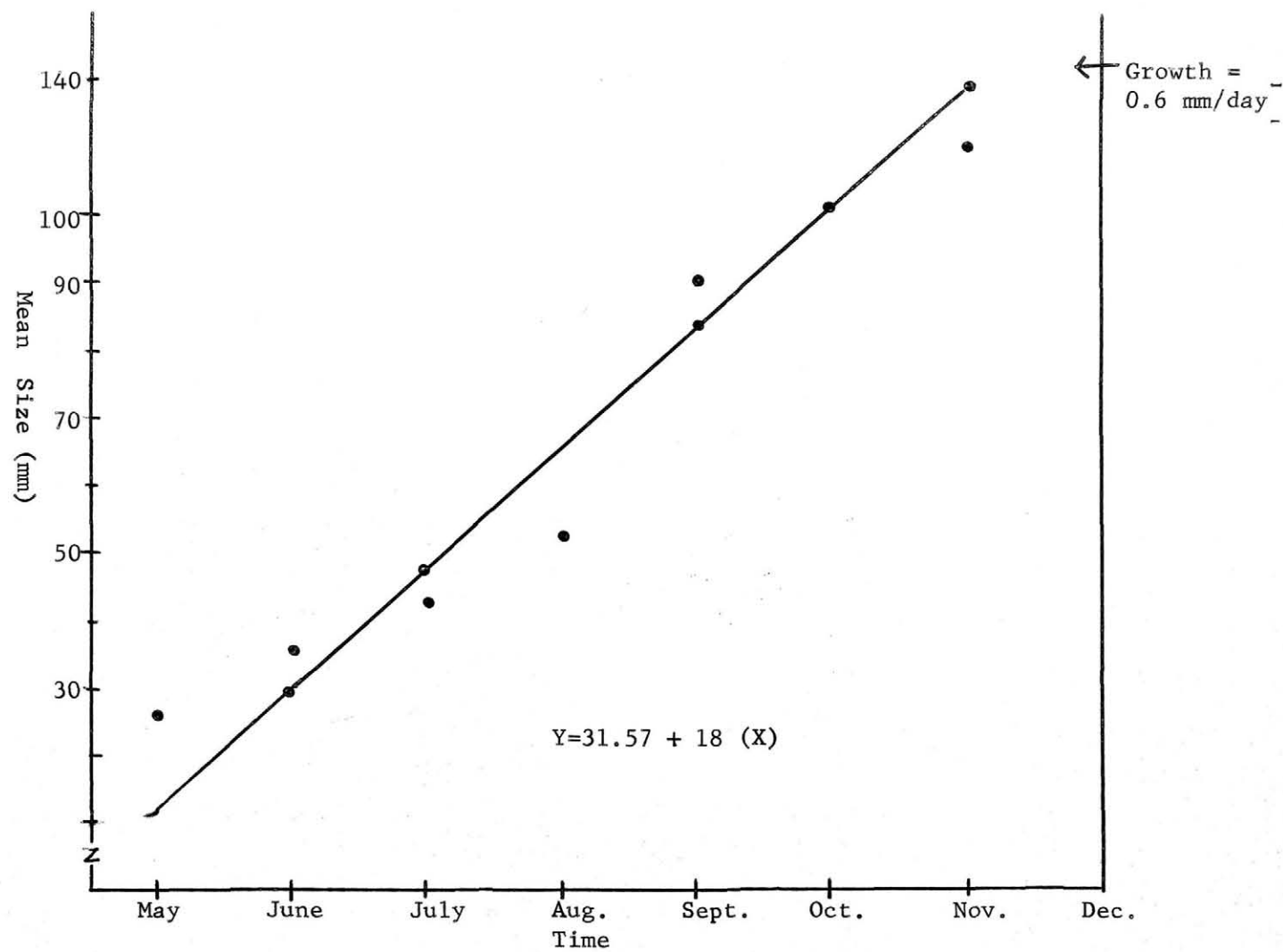
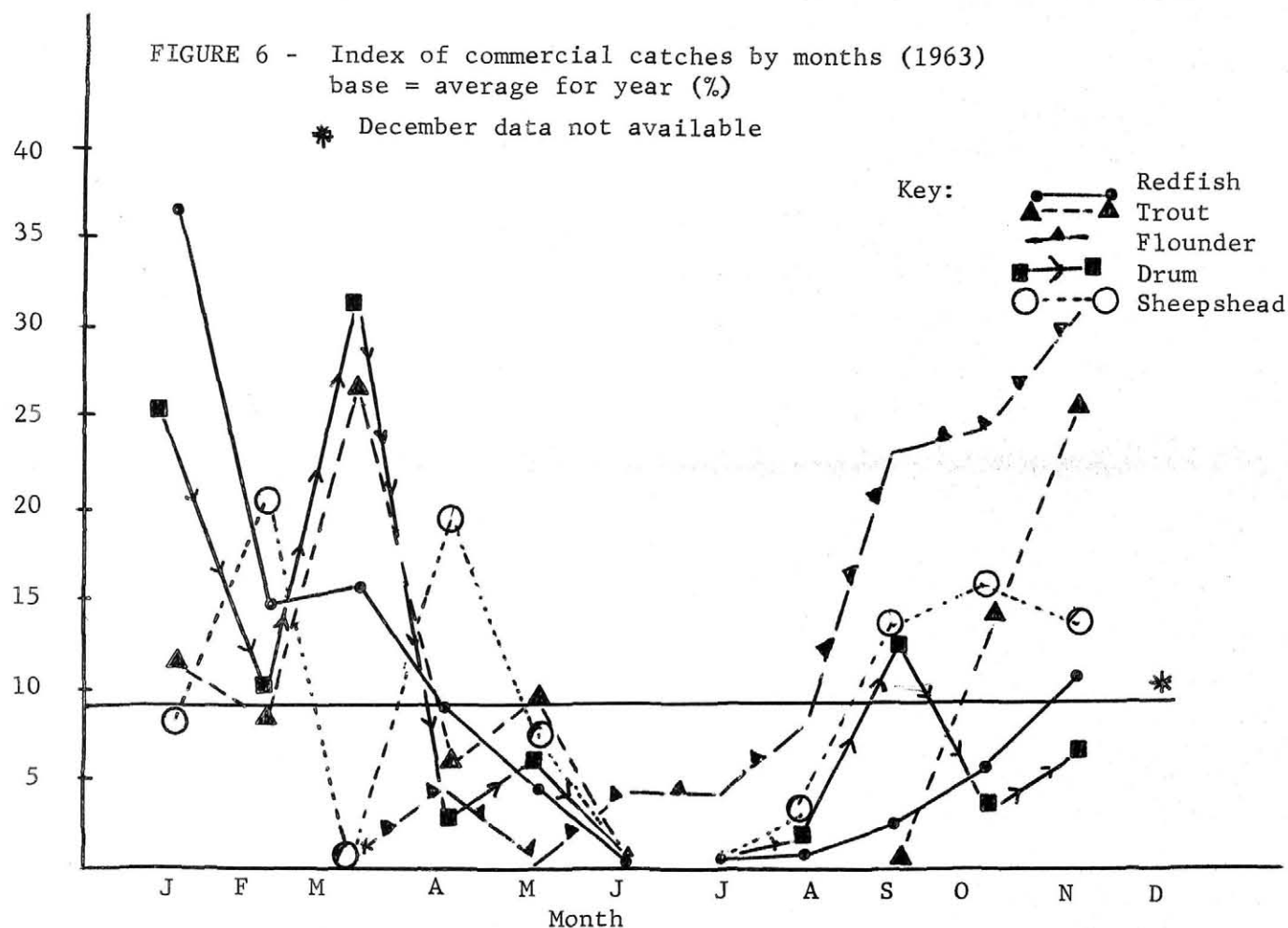


FIGURE 5 - Growth rate of black drum, as calculated by the regression equation



	Total					
	4575	146842	27090	19603	20622	218,732
Jan.	1737	16296	96	5049	1653	24,831
Feb.	664	11808	50	1884	4190	18,596
Mar.	720	39636	41	6130	0	46,527
Apr.	387	8119	1108	524	3983	14,121
May	200	14448	175	1132	1545	17,500
June	0	0	1072	0	0	1,072
July	0	0	1124	0	30	1,154
Aug.	20	16	2163	386	585	1,170
Sept.	101	2	6325	2516	2710	11,654
Oct.	250	18638	6676	634	3190	29,388
Nov.	496	37879	8360	1348	2736	50,818
Dec.	Not Available					
	Redfish	Trout	Flounder	Drum	Sheepshead	

FIGURE 7 - Commercial landings (in pounds) - Galveston Bay (1963)

Source: Parks & Wildlife Marine Products Report
(Galveston - Sabine Area)