ANNUAL REPORT

for the fiscal year

September 1, 1949 to August 31, 1950

FISH TRAP INVESTIGATION

Submitted to

Game, Fish and Oyster Commission
The Marine Laboratory
Rockport, Texas

By

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INTRODUCTORY

For a number of years a clamor has been raised along the Texas coast that the lack of natural passes from the Gulf of Mexico to the bay areas is the limiting factor of the population of these bays. It has been believed by many that more passes should be cut through Mustang Island, Padre Island, St. Joseph's Island and Matagorda Island. Little heed has been given the fact that all attempts to dredge such channels have been dismal failures unless expensive jettying has accompanied the dredging operation. Silting and hurricane action inevitably nullify the effort. Nevertheless the theory still holds that the various species of marine life utilize the existing passes to repopulate the bays. It was primarily to test this theory that a fish trap was installed in Cedar Bayou. There were several other reasons for the installation of this trap, reason which may be summarized briefly.

1. To determine the time and magnitude of movement of species through the pass. For instance, is there a mass movement of sea trout (Cynoscion nebulosus) from the gulf to the bays when the spring flood tides occur? Is there a similar movement of the redfish (Sciaenops ocellatus) from the bays to the gulf in late summer and early autumn when spawning is due?

2. To establish a tagging program with the object of studying the movement and growth of the Sciaenids and the flounders (Paralichthys sp.). Where, for instance, does a sea trout go when it leaves the bayou? How long does it take this particular fish to reach its goal if a goal there is? What is the growth rate during this time of movement?

3. To aid in the study of the food habits of the various species. Is the majority of movement due to the shifting of the food supply? Will the food preference change as the seasons and the temperature change? How does size affect food habits?

4. To aid in the study of spawning activity. Do all sea trout spawn in the bays or do some spawn in the gulf? At what age do the various species spawn?

5. To determine the age of fish utilizing the pass. Will different age brackets move at different times? Will they move for different reasons?

6. To gather hydrographical and meteorological data throughout the year. What effect does change in salinity and temperature have on the movement of the various species?

All of these objectives were set up under the following summarized work plans.

WORK PLAN I

Title: A study of the effects of a natural pass on movement of fish.

WORK PLAN II

Title: Tagging operation.

WORK PLAN III

Title: Stomach analysis.

WORK PLAN IV

Title: Sex determination and study of spawning habits.

WORK PLAN V

Title: Age determination.

WORK PLAN VI

Title: The effect of hydrographical and meteorological conditions on fish populations.

WORK PLAN VII

Title: Maintenance of equipment.

AREA WORKED ON

Cedar Bayou lies approximately fifteen miles E. N. E. of Rockport, Texas and forms the eastern boundary of St. Joseph's Island and the western boundary of Matagorda Island. It serves as a waterway from the Gulf of Mexico to the inland bays terminating in Mesquite Bay. The pass itself is about two and one-half miles long, is very shallow at each end, but attains a depth of nine feet in some locations. Near the center of the pass lies Grass Island, a small bar 840 feet long by 125 feet wide. On the west side of this island is the main channel 125 feet wide; on the east is an area of shallow water 160 feet in width. Near the gulf the bottom is composed entirely of loose sand which tends to shift with the tides. At a point approximately one mile from the gulf a large mud flat begins on the east shore and extends beyond Grass Island. On the west shore lies Mud Slough, a fairly deep inlet with bottom composed of mud, sand and dead oyster shells. Beyond Grass Island toward Mesquite Bay, lie more sand and mud flats and a scattering of reefs. Large reefs and sand bars are found at the bay entrance to the bayou through which a channel

has been dredged which tends to fill in rapidly. Certain changes have occurred in the bayou during the year. The very low tides in June, supplemented by shifting sands, caused the emergence of large bars where moderately deep water was present. A large shelf of sand has emerged on the northeast side of Grass Island where the water had been three feet deep. Scouring action has deepened the main channel to a depth of some twelve or thirteen feet. The west shore of Grass Island has become muddy. A new channel, seven feet deep, has been dug between Grass Island and Matagorda Island. Through the bayou races a torrent of water during some seasons and in high winds.

Previous Investigations

As far as can be determined the fish trap as such is an entirely new project. No other investigation of its size and scope has been conducted.

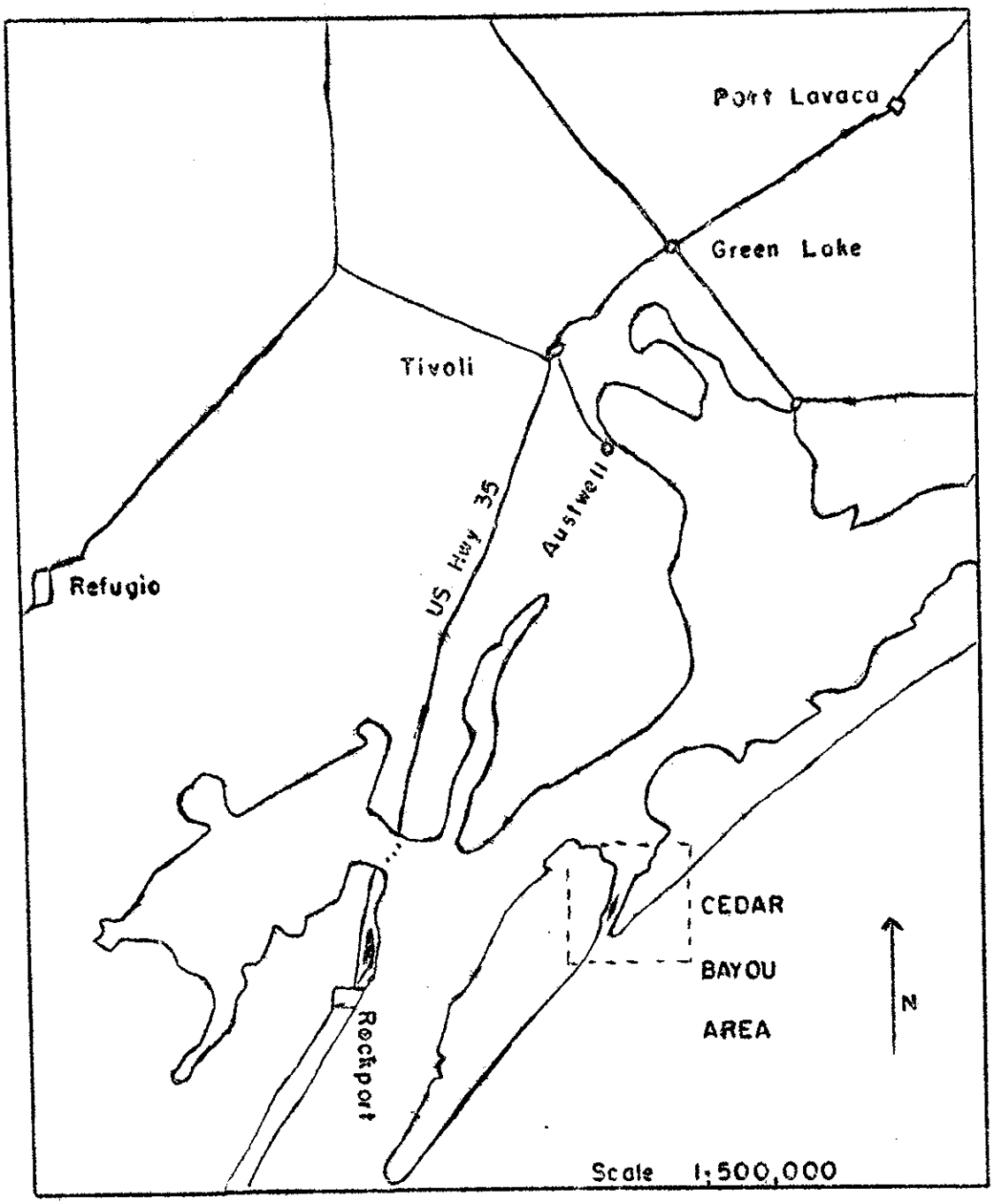
Equipment

The fish trap as originally constructed by William L. Haskell consisted of fences running S. E. from St. Joseph's Island and N. E. from St. Joseph's Island to a point near the shore of Grass Island. At this point trap boxes 30 feet by 26 feet were installed in such a fashion that fish traveling from the gulf to the bays would be isolated from those moving in the opposite direction. In each trap box a removable net of very heavy mesh was placed so that the catch could be removed. Initially, pilings six inches in diameter and 20 feet long were used on the wings. Over these pilings, wire of two inch mesh was stretched and attached with two by fours. These pilings were later interspaced with larger ones and the mesh size of the wire was reduced. The long leads across the shallow water from Grass Island to Matagorda Island were also replaced with stronger equipment.

Most of the installation was done with the use of an "A" frame on a large barge. In addition to this barge the cabin boat ADA LEE was used, as was the skiff SKIPJACK. On a small barge was constructed a house complete with beds, stove and other items needed. A crew lived on this houseboat five days and nights of each week.

Other equipment included a trammel net which was used to check the population of the bayou in selected areas, hydrographical and meteorological equipment, tagging equipment and sundry other items.

ACTIVITIES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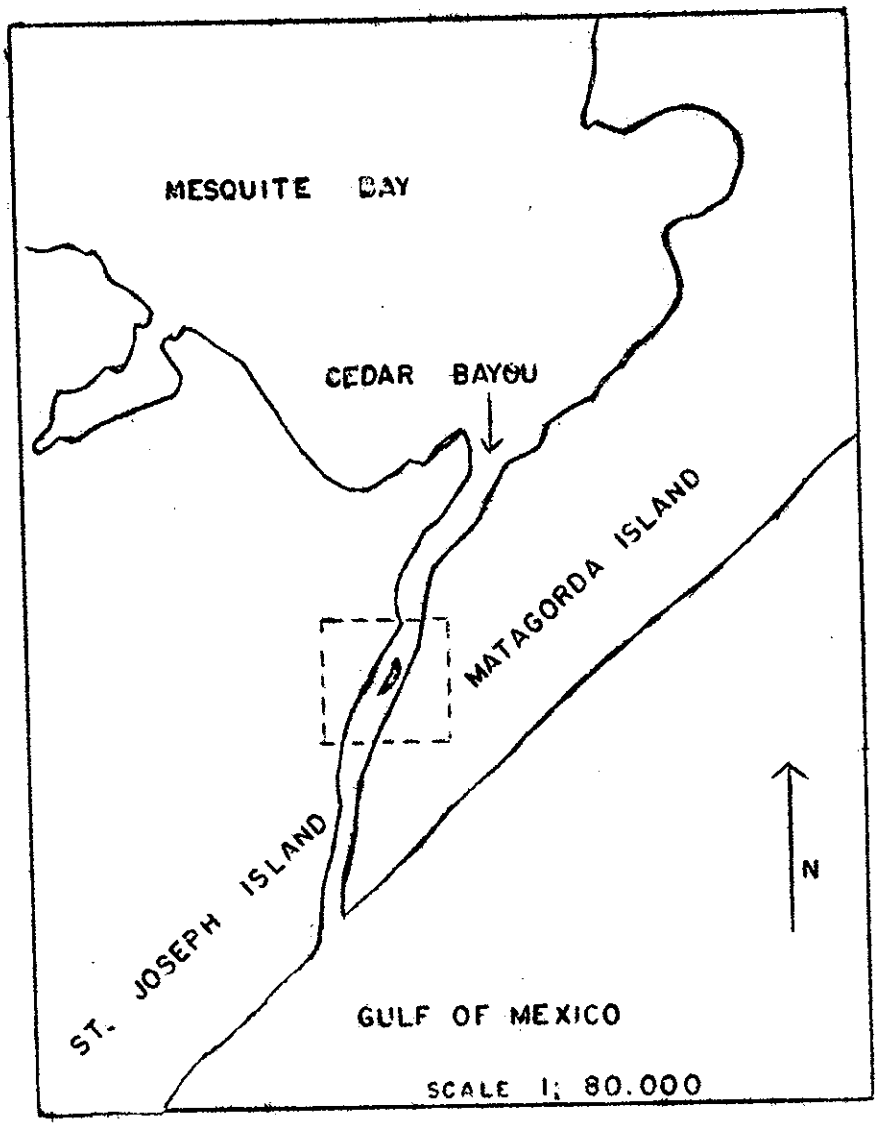
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MATAGORDA ISLAND
ST. JOSEPH ISLAND
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GULF OF MEXICO
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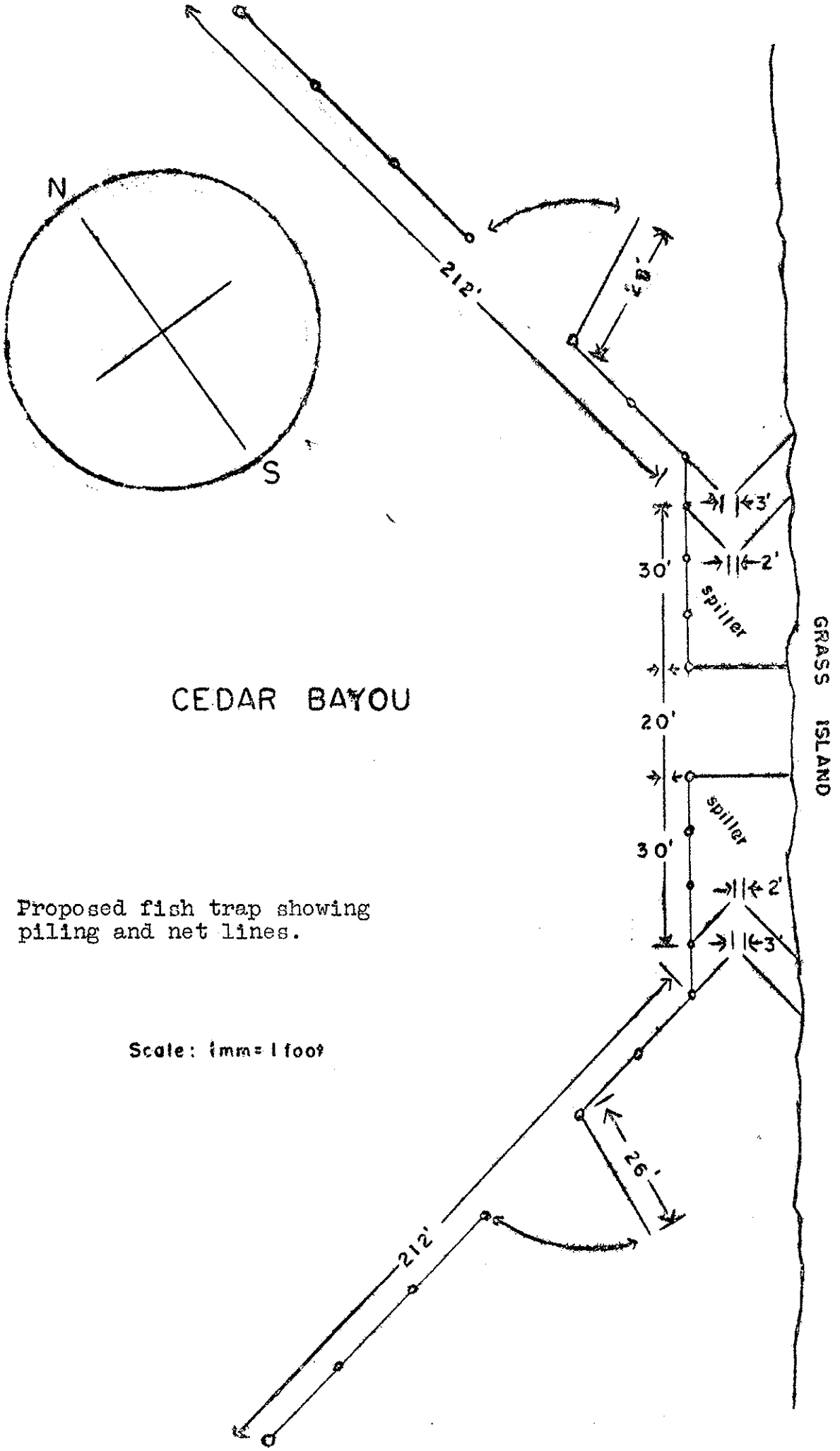
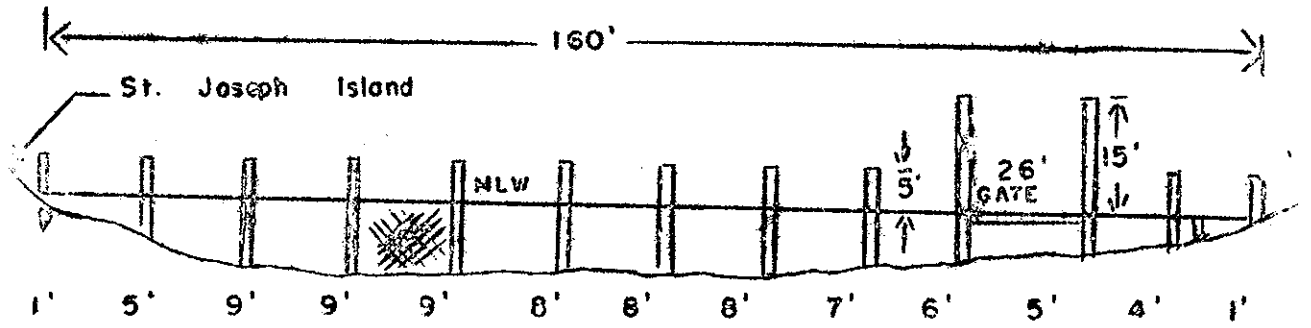


Proposed fish trap showing piling and net lines.

Scale: 1mm = 1 foot



GRASS ISLAND

Side view diagram of proposed fish trap looking NE and showing nets and piling.

All soundings in feet at mean low water.

Scale: 1mm = 1 foot

WORK PLAN I. A survey of the effects of a natural pass on fish populations.

Each trap was lifted twice daily at 0700 and 1800, thus giving a check on nocturnal and diurnal movement both from the gulf to the bays and from the bays to the gulf. As the tides come in during the night and go out during the day an indication was given of the effects of these tides on movement. Exceptions, of course, in the movements of the tide occurred from time to time. The north trap, taking species moving outward, proved to be more effective than did the south trap in its operation. A great deal of time was lost in repair operations.

The following species were taken in either or both traps during the period:

1. Carcharias littoralis (Sand Shark)
2. Sphyrna tiburo (Bonnet head Shark)
3. Apriondon isopon (Smooth toothed Shark)
4. Sphyrna zygaena (Hammer-head Shark)
5. Dasyatis americana (Southern Sting Ray)
6. D. sabina (Stingaree)
7. Lepisosteus spatual (Alligator Gar)
8. Bagre marinus (Gaff-topsail Catfish)
9. Galeichthys felis (Sea Catfish)
10. Tarpon atlanticus (Tarpon)
11. Elops saurus (Skipjack)
12. Dorosoma cepedianum (Gizzard Shad)
13. Brevoortia patronus (Menhaden)
14. B. gunterii (Menhaden)
15. Opisthonema oglinum (Thread Herring)
16. Anchoviella sp. (Anchovy)
17. Synodus foetens (Lizard Fish)
18. Syngnathus sp. (Pipe Fish)
19. Strongylura sp. (Bill Fish)
20. Hippocampus sp. (Sea Horse)
21. Menidia beryllina peninsulae (Silverside)
22. Mugil cephalus (Striped Mullet)
23. Sphyraena guachancho (Barracuda)
24. Polynemus octonemus (Eight-fingered Threadfin)
25. Scomberomorus cavalla (King Mackeral)
26. Trichiurus lepturus (Cutlass Fish)
27. Caranx hippos (Common Jack)
28. C. crysos (Hard-tailed Jack)
29. Chloroscombrus chrysurus (Bumper)
30. Selene vomer (Lookdown)
31. Trachinotus falcatus (Round Pompano)
32. Oligoplites saurus (Leather Jackpet)
33. Pomatomus saltatrix (Bluefish)
34. Peprilus alepidotus (Harvest Fish)
35. Poronotus triacanthus (Butterfish)

36. Lobotes surinamensis (Triple-tail)
37. Lutianus synagris (Spot Snapper)
38. L. griseus (Mangrove Snapper)
39. Orthopristis chrysopterus (Pigfish)
40. Lagodon rhomboides (Pinfish)
41. Archosargus probatocephalus (Sheephead)
42. Gerres cinereus (Gray Mojarra)
43. Cynoscion nothus (Sand Trout)
44. C. arenarius (Sand Trout)
45. C. nebulosus (Spotted Trout)
46. Larimus fasciatus (Banded Croaker)
47. Bairdella chrysura (Yellowtail)
48. Stellifer lanceolatus (Star Drum)
49. Sciaenops ocellatus (Redfish)
50. Leiostomus xanthurus (Spot)
51. Micropogon undulatus (Croaker)
52. Menticirrhus littoralis (Gulf Whiting)
53. M. americanus (Southern Whiting)
54. Pogonias cromis (Sea Drum)
55. Chaetodipterus faber (Spadefish)
56. Balistes carolinensis (Common Triggerfish)
57. Ceratacanthus schaepfi (Orange Filefish)
58. Lactophyrs tricornis (Cowfish)
59. Spheroides spengleri (Southern Swellfish)
60. Chilomycterus schaepfi (Spiny Boxfish)
61. Prionotus sp. (Sea Robin)
62. Erotelis smaragdus (Emerald Goby)
63. Remora sp. (Remora)
64. Astroscopus y-graecum (Southern Star-gazer)
65. Opsanus tau (Toadfish)
66. Porichthys porosissimus (Midshipman)
67. Urophycis floridanus (Florida Ling)
68. Paralichthys lethostigma (Southern Fluke)
69. P. albiguttus (Gulf Fluke)
70. Ancylopsetta quadrocellata (Ocellated Fluke)
71. Citharichthys spilopterus (Spot-finned Whiff)
72. Etropis sp. (Flounder)
73. Achirus lineatus (Striped Sole)
74. A. fasciatus (Hog Chocker)
75. Symphurus plagiusa (Tonguefish)
76. Histrio histrio (Sargassum Fish)
77. Lutianus apodus (Schoolmaster)

In addition to these fish there were catches of the blue crab (C. sapidus), the Gulf crab (C. danae), the stone crab (Menippe mercenaria), and the commercial shrimp.

During the seven months the trap has been in operation 116,084 fish, 4900 blue crabs, and approximately 20,000 commercial shrimp have been taken. Of this total catch of fish the breakdown is as follows:

Croaker	73,745	(Major months June-September)
Spot-fin Whiff	9,600	(May, June, September)
Sand Trout	6,452	(May, June)
Sea Catfish	3,765	(May)
Pinfish	3,422	(May)
Yellowtail	3,090	(May)
Mojarra	2,947	(September)
Ribbon Fish (Cutlassfish)	1,003	
Spotted Sea Trout	254	(May, June, July)
Flounder (Paralichthys sp.)	29	
Black Drum	20	
Sheephead	28	
Redfish	9	
Round Pompano	2	
All Others	9,665	

The following charts show the catch per hour for both traps, for each trap, for both traps nocturnally, for both diurnally, for each nocturnally and for each diurnally for each quarter of the year. The other charts give this information for each month of the year and for the whole year.

March 16--March 31, 1950

	Total Hrs.	Noc. Hrs.	Diur. Hrs.	Catch Total Hrs.	Catch Noc. Hrs.	Catch Diur. Hrs.	Total Fish
To Gulf							
North Trap	167	129	38	3.16	3.55	1.84	528
South Trap	141	103	38	.98	1.13	.55	138
Total	308	232	76	2.18	2.30	1.07	666

April 1--June 30, 1950

	Total Hrs.	Noc. Hrs.	Diur. Hrs.	Catch Total Hrs.	Catch Noc. Hrs.	Catch Diur. Hrs.	Total Fish
North Trap	833	517	316	70.1	92.6	33.4	58,457
South Trap	830	467	363	18.9	19.9	17.4	15,661
Total	1663	984	697	44.6	32.8	61.7	74,111

July 1--September 30, 1950

	Total Hrs.	Noc. Hrs.	Diur. Hrs.	Catch Total Hrs.	Catch Noc. Hrs.	Catch Diur. Hrs.	Total Fish
North Trap	757	439	318	40.3	46.4	32.0	30,537
South Trap	631	380	251	12.9	16.5	7.6	8,144
Total	1388	819	569	27.8	32.4	21.0	38,681

The breakdown by months is as follows:

April

	Total Hrs.	Noc. Hrs.	Diur. Hrs.	Catch Total Hrs.	Catch Noc. Hrs.	Catch Diur. Hrs.	Total Fish
North Trap	101	71	30	12.0	15.1	4.8	1215
South Trap	101	71	30	4.3	4.9	2.9	434
Total	202	142	60	8.1	9.9	3.8	1649

May

	Total Hrs.	Noc. Hrs.	Diur. Hrs.	Catch Total Hrs.	Catch Noc. Hrs.	Catch Diur. Hrs.	Total Fish
North Trap	471	306	165	17.3	14.7	22.0	8132
South Trap	355	201	154	17.9	18.2	17.8	6389
Total	826	507	319	17.6	16.1	19.8	14521

June

	Total Hrs.	Noc. Hrs.	Diur. Hrs.	Catch Total Hrs.	Catch Noc. Hrs.	Catch Diur. Hrs.	Total Fish
North Trap	261	140	121	184.8	263.0	123.9	49,123
South Trap	374	195	179	20.9	27.3	19.6	8,838
Total	635	335	300	102.9	75.6	141.3	57,961

July

	Total Hrs.	Noc. Hrs.	Diur. Hrs.	Catch Total Hrs.	Catch Noc. Hrs.	Catch Diur. Hrs.	Total Fish
North Trap	210	145	65	77.5	70.4	93.3	16280
South Trap	195	120	75	23.6	30.5	11.2	4501
Total	405	265	130	51.3	52.4	81.3	20781

August

	Total Hrs.	Noc. Hrs.	Diur. Hrs.	Catch Total Hrs.	Catch Noc. Hrs.	Catch Diur. Hrs.	Total Fish
North Trap	314	171	143	32.1	49.9	10.7	10072
South Trap	343	200	143	8.5	10.6	5.6	2912
Total	657	371	286	19.8	28.9	8.1	12984

September

	Total Hrs.	Noc. Hrs.	Diur. Hrs.	Catch Total Hrs.	Catch Noc. Hrs.	Catch Diur. Hrs.	Total Fish
North Trap	233	123	110	17.9	13.0	23.5	4185
South Trap	93	60	33	7.85	7.8	7.9	731
Total	326	183	143	15.1	11.3	19.9	4916

March 16--September 30, 1950

	Total Hrs.	Noc. Hrs.	Diur. Hrs.	Catch Total Hrs.	Catch Noc. Hrs.	Catch Diur. Hrs.	Total Fish
North Trap	1757	1085	672	52.4	63.3	34.8	92161
South Trap	1602	950	652	14.9	16.5	12.6	23923
Total	3359	2035	1324	34.5	42.2	24.7	116084

It will be noticed that in the overall picture the nocturnal movement appeared to be largest. This was actually true in most instances but the large nocturnal catches of croakers probably over emphasized the figures. For example, during the night of June 21, 1950 nearly 25,000 croakers were taken in the north trap. This north trap always had a larger haul than did the south trap but the catch was less diversified.

Sea trout seemed to mill around the bayou during the summer months and several were re-taken in the traps three times or more. It seems evident that a strong migratory urge must be present for these fish to enter the trap. Redfish are especially wary of a trap of this type, many having been observed moving up to the trap and then turning back. It is believed that a spiral type trap will take these fish and one is being constructed.

Trammel net strikes have been made in the bayou and in the adjacent waters of Benson's Slough and Mesquite Bay. Fish taken in these strikes were spotted trout, croaker, spot, redfish, sand trout, drum, sheepshead, and flounder.

WORK PLAN II. Tagging operations

The fish tagging program has been successful to date. All sea trout, redfish, drum, and flounder (Paralichthys sp.) caught in the traps or in trammel net operations have been marked. This work has been done in conjunction with D. W. Miles of the Copano Research Foundation. The antecessing trammel net operations have taken place in Cedar Bayou, Benson's Slough, Mesquite Bay, the Laguna Madre from Corpus Christi to Port Isabel, San Antonio Bay, St. Charles Bay, Mud Island, Trout Bayou and Turtle Bayou. As of the end of the year the following species have been tagged and released.

Cynoscion nebulosus (Spotted Sea Trout)	734
Sciaenops ocellatus (Redfish)	221
Pogonias cromis (Drum)	138
Micropogon undulatus (Croaker)	35
Paralichthys sp. (Flounder)	47
Leiostomus xanthurus (Spot)	15
Cynoscion arenarius (Sand Trout)	32
C. nothus (Sand Trout)	32
Archosargus probatocephalus (Sheepshead)	18
Tarpon atlanticus (Tarpon)	3
Lagodon rhomboides (Pinfish)	1
Caranx hippos (Jackfish)	1
Menticirrhus sp. (Whiting)	4
Total	1249

There have been 43 returns to date: 26 sea trout, 2 sand trout, 10 redfish, 2 drum, and 3 flounders. Returns are as follows:

Tag 108--C. nebulosus--Tagged VII/6/50 in Cedar Bayou: Recovered VII/11/50 in Cedar Bayou. Three days and no movement.

Tag 109--C. nebulosus--Tagged VII/6/50 in Cedar Bayou: Recovered VII/11/50 in Cedar Bayou. Five days and no movement.

Tag 771--C. nebulosus--Tagged VII/10/50 in Cedar Bayou: Recovered VIII/2/50 in Cedar Bayou. Twenty three days, no movement and no discernable growth.

Tag 353--C. nebulosus--Tagged V/17/50 in Cedar Bayou: Recovered VIII/2/50 in Cedar Bayou. Forty six days and no movement.

Tag 585--C. nebulosus--Tagged V/15/50 in Criss Flats, Espirito Santos Bay: Recovered VIII/17/50 in Cedar Bayou. Sixty three days--moved 65 miles.

Tag 812--S. ocellatus (redfish)--Tagged V/17/50 in Benson's Slough: Recovered VII/4/50 near South Jetty, Aransas Pass. Thirty eight days--moved 20 miles.

Tag 912--C. nebulosus--Tagged VI/29/50 in Cedar Bayou: Recovered VII/11/50 in Cedar Bayou. Thirteen days--no movement.

Tag 929--C. nebulosus--Tagged VI/28/50 in Cedar Bayou: Recovered VI/29/50 in Cedar Bayou.

Tag 963--C. nebulosus--Tagged VI/20/50 in Cedar Bayou: Recovered VII/10/50 in Cedar Bayou. Twenty days and no movement.

Tag 969--C. nebulosus--Tagged VI/21/50 in Cedar Bayou: Recovered VIII/2/50 in Cedar Bayou. Forty two days--no movement, 10 mm. growth.

Tag 939--Paralichthys lethostigma (flounder)--Tagged VI/27/50 in Cedar Bayou: Recovered VIII/4/50 in Cedar Bayou South. Thirty eight days--1/4 mile.

Tag 1026--Pogonias cromis (drum)--Tagged V/17/50 in Cedar Bayou: Retaken V/27/50 and VI/11/50 in North trap.

Tag 1028--P. lethostigma--Tagged V/25/50 in Cedar Bayou: Recovered VI/17/50 in Mud Slough. Twenty two days, 3/4 mile--no growth.

Tag 505--S. ocellatus--Tagged IV/11/50 in Redfish Bay: Recovered VII/15/50 in outer Redfish Bay. Fifty five days and moved 10 miles. Gained from 1.2 lbs. to 2.0 lbs.

Tagged 934--C. arenarius (sand trout)--Tagged VI/27/50 in Cedar Bayou: Recovered VII/25/50 in Cedar Bayou. No movement in 28 days.

Tag 608--C. nebulosus--Tagged VII/13/50 in Cedar Bayou: Recovered VIII/2/50 in Cedar Bayou. No movement and no growth.

Tag 872--C. nebulosus--Tagged VI/5/50 in Cedar Bayou: Recovered VII/13/50 in Cedar Bayou. 5 mm. growth but no movement.

Tag 605--C. nebulosus--Tagged VII/26/50 in Cedar Bayou: Recovered VIII/2/50 in Cedar Bayou. No movement.

Tag 1318--C. nebulosus--Tagged VIII/2/50 in Cedar Bayou: Recovered VIII/2/50 in Cedar Bayou. No movement.

Tag 624--S. ocellatus--Tagged VII/17/50 in Turtle Bayou: Recovered VIII/24/50 in Turtle Bayou.

Tag 516--P. lethostigma--Tagged VI/27/50 in Cedar Bayou: Recovered VIII/17/50 IBID.

Tag 934--C. arenarius--Tagged VI/27/50 in Cedar Bayou. Recovered VII/25/50 in Cedar Bayou.

Tag 1076--C. nebulosus--Tagged VIII/25/50 in Cedar Bayou: Recovered VIII/31/50 in Mesquite Bay. Two miles movement in 5 days.

Tag 659--C. nebulosus--Tagged VII/25/50 in Cedar Bayou: Recovered VIII/8/50 in Cedar Bayou.

Tag 686--C. nebulosus--Tagged VII/25/50 in Cedar Bayou: Recovered VIII/8/50 IBID.

Tag 1352--S. ocellatus--Tagged VIII/9/50 in Cedar Bayou: Recovered VIII/10/50 in Cedar Bayou. 1 BID.

Tag 682--C. nebulosus--Tagged VII/25/50 in Cedar Bayou: Recovered VIII/11/50 in Cedar Bayou.

Tag 692--C. nebulosus--Tagged VII/25/50 in Cedar Bayou: Recovered VIII/16/50 in Cedar Bayou.

Tag 665--C. nebulosus--Tagged VII/25/50 in Cedar Bayou: Recovered VIII/16/50 in Cedar Bayou.

Tag 660--C. nebulosus--Tagged VII/25/50 in Cedar Bayou: Recovered VIII/21/50. IBID.

Tag 1378--S. ocellatus--Tagged VIII/16/50 in Cedar Bayou: Recovered VIII/24/50 in Cedar Bayou.

Tag 1002--C. nebulosus--Tagged VIII/22/50 in Cedar Bayou: Recovered VIII/28/50. IBID.

Tag 1266--S. ocellatus--Tagged VIII/17/50 in Cedar Bayou: Recovered VIII/24/50. IBID.

Tag 100--C. nebulosus--Tagged VIII/17/50 in Cedar Bayou: Recovered VIII/24/50. IBID.

Tag 694--C. nebulosus--Tagged VII/25/50 in Cedar Bayou: Recovered VIII/25/50 Dagger Reef. Sixty five miles in 30 days.

Tag 1011--C. nebulosus--Tagged VIII/23/50 in Cedar Bayou: Recovered IX/14/50 Cedar Reef. Five miles in 22 days.

Tag 676--S. ocellatus--Tagged VII/26/50 in Cedar Bayou: Recovered IX/11/50 near Gulf. Traveled two miles and grew 34 mm. in 47 days.

Tag 1238--S. ocellatus--Tagged VIII/30/50 in Cedar Bayou: Recovered IX/10/50 near Gulf.

Tag 928--C. nebulosus--Tagged VI/27/50 in Cedar Bayou: Recovered IX/18/50 in Cedar Bayou. Eighty three days and grew 44 mm.

Tag 904--C. nebulosus--Tagged VII/6/50 in Cedar Bayou: Recovered X/4/50 in Cedar Bayou.

Tag 224--P. cromis--Tagged VIII/29/50 in Cedar Bayou: Recovered IX/23/50. IBID.

Tag 1378--S. ocellatus--Tagged VIII/15/50 in trap: Recovered X/13/50 near Gulf. Moved two miles in 59 days and grew 89 mm.

1. Tag 694--C. nebulosus (Sea Trout)--Tagged VII/25/50 in Cedar Bayou: Recovered VIII/25/50 Dagger Reef.

2. Tag 585--C. nebulosus--Tagged V/5/50 Criss Flats: Recovered VIII/17/50 in Cedar Bayou.

3. Tag 812--S. ocellatus (Redfish)--Tagged Benson's Slough V/17/50: Recovered South Jetty, Aransas Pass VII/4/50.

4. Tag 624--S. ocellatus--Tagged VII/17/50 in Turtle Bayou: Recovered VIII/22/50 in Turtle Bayou.

5. Tag 676--S. ocellatus--Tagged VII/26/50 in Cedar Bayou: Recovered in the Gulf IX/11/50.

6. Tag 1238--S. ocellatus--Tagged VIII/30/50 Cedar Bayou: Recovered in the Gulf IX/10/50.

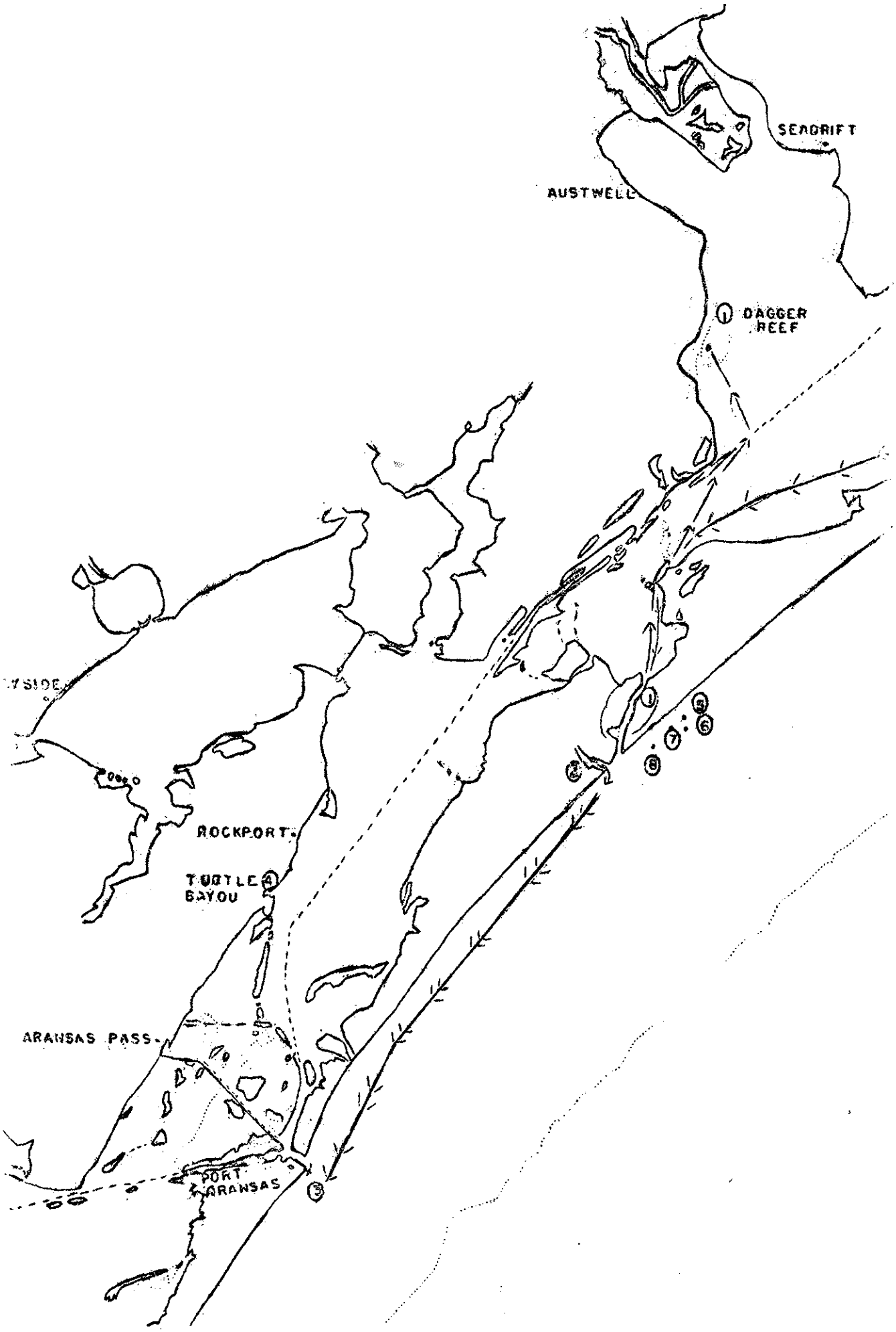
7. Tag 928--C. nebulosus--Tagged VI/27/50 Cedar Bayou: Recovered in the Gulf IX/18/50.

8. Tag 1203--S. ocellatus--Tagged VIII/30/50 Cedar Bayou: Recovered in the Gulf IX/24/50.

Movement of species has been of a much narrower scope than had been believed. During the months of June, July, and August the movement was practically nil; during the month of September the fish seemed to scatter and returns may come in from points more distant. In two instances growth has been more rapid than had been expected. Particularly the growth of 89 mm. (3-1/2 inches) in 59 days by a redfish was phenomenal. This growth, however, agrees with the maximum increment as shown by Miles. Lack of accurate measurements by sportsfishermen at the time of recapture has hampered the program.

WORK PLAN III. Stomach analysis and food habits:

Because of the fact that a large amount of data have already been collected on the food habits of the sea trout and the redfish, little additional examination was done on these species. The stomachs of all available flounders (Paralichthys lethostigma) of which little is known, were examined. A total of 254 flounders were examined for stomach contents during the months of June, July and September. The biologist was not present during the month of August and records were not kept for this period. Of the 254 total examined, 102 or 40.2%


SEADRIFT
AUSTWELL
1 DAGGER REEF
ROCKPORT
TURTLE BAYOU
ARANSAS PASS
PORT ARANSAS

contained food. The food habits discovered will be shown on the following charts. It is of interest to note that this fish is far more piscivoious than the sea trout or redfish. Fish formed 84% of the diet for the total period.

I. Total Flounder Examined--254

A. Empty--152 = 59.8%

B. With Food--102 = 40.2%

1. Fish--89 = 84.0% of all food

a. Croaker--29 = 32.6% of all fish, 27.4% of total food items.

b. Anchovie--16 = 18.0% of all fish, 15.1% of total food.

c. Mullet--11 = 12.4% of all fish, 10.4% of total food.

d. Unidentified Fish--9 = 10.1% of all fish, 8.5% of total food.

e. Silversides--7 = 7.9% of all fish, 6.6% of total food.

f. Citharichthys--5 = 5.6% of all fish, 4.7% of total food.

g. Mojarra--3 = 3.4% of all fish, 2.8% of total food.

h. Sciaenids--3 = 3.4% of all fish, 2.8% of total food.

i. Gobiidae--2 = 2.2% of all fish, 1.9% of total food.

j. Lizard fish--2 = 2.2% of all fish, 1.9% of total food.

k. Pin perch--1 = 1.1% of all fish, .9% of total food.

l. 8-fingered Threadfin--1 = 1.1% of all fish, .9% of total food.

2. Non Fish--17 = 16% of all food.

a. Shrimp--16 = 91 % of all non-fish, 15.1% of all food.

b. Squid---1 = 5.9% of all non-fish, .9% of all food.

The variation in food habits during June, July, and September will be shown as follows:

I. Total Flounder for June---28

A. Empty---11= 39.3%

B. With Food---17 = 60.7%

Total Food Items---17

1. Fish---12(items) = 70.6% of all food in June.

a. Croaker---6 = 50% of all fish, 35.3% of all food in June.

b. Unidentified---3 = 25% of all fish, 17.6% of all food in June.

c. Mullet---2 = 16.7% of all fish, 11.8% of all food in June.

d. Emerald Goby---1 = 8.3% of all fish, 5.9% of all food in June.

2. Non-Fish---5 = 29.4% of all food in June.

a. Shrimp---5 = 100% of all non-fish in June, 29.4% of food in June.

I. Total Flounder for July---168

A. Empty---109 = 64.9%

B. With Food---58 = 35.1%

Total Food Items---58

1. Fish---47 = 81.0% of all food in July.

a. Croaker---22 = 46.8% of all fish in July, 37.9% of all food.

b. Mullet---6 = 12.8% of all fish in July, 10.3% of all food.

c. Unidentified Fish---5 = 10.6% of all fish in July, 8.6% of all food.

d. Silversides--4 = 8.5% of all fish in July, 6.9% of all food.

e. Citharichthys--3 = 6.4% of all fish in July, 5.2% of all food.

f. Lizard Fish--2 = 4.3% of all fish in July, 3.4% of all food.

g. Unidentified Sciaenids--2 = 4.3% of all fish in July, 3.4% of all food.

h. Pin Perch--1 = 2.1% of all fish in July, 1.7% of all food.

i. Gobiidae--1 = 2.1% of all fish in July, 1.7% of all food.

j. Threadfin--1 = 2.1% of all fish in July, 1.7% of all food.

2. Non-Fish--11 = 19.0% of all food in July.

a. Shrimp--10 = 90.9% of all non-fish in July, 17.2% of all food.

b. Squid--1 = 9.1% of all non-fish in July, 1.7% of all food.

I. Total Flounder for September--58

A. Empty--35 = 60.4%

B. With Food--29 = 39.6%

Total Food Items--29

1. Fish--29 = 100% of all food in September.

a. Anchovie--15 = 51.7% of all fish in September.

b. Mojarra--3 = 10.3% of all fish in September, 10.3% of all food.

c. Silversides--3 = 10.3% of all fish in September, 10.3% of all food.

d. Mullet--3 = 10.3% of all fish in September, 10.3% of all food.

e. Citharichthys--2 = 6.9% of all fish in September, 6.9% of all food.

f. Unidentified Fish--1 = 3.4% of all fish in September, 3.4% of all food.

g. Croaker--1 = 3.4% of all fish in September, 3.4% of all food.

2. Non-Fish--0

It was noted that the catch of sea trout by every means increased in the bayou whenever commercial shrimp were present in large numbers and declined whenever this invertebrate moved out of the area. This observation, coupled with the findings in the fish tagging program, indicate that a major portion of the movement of this species is motivated by the available shrimp and the movement of these shrimp. Other factors, of course, are probably also involved.

WORK PLAN IV. Sex determination and study of spawning habits.

Whenever fish have been tagged in the trap or from the trammel net they have been examined for sexual condition. Male trout usually emitted milt on pressure but the females usually failed to respond. A pressure too great could not be applied if the fish were to survive. From early April until August a large portion of the trout entering the trap were found to be mature males from 7 inches to 12 inches in length. The smallest mature male found measured 167 mm. (6.7 inches). The largest mature male measured 22 inches. The peak of spawning males taken fell at 216 mm. (8.6 inches). These measurements seem to indicate that the first spawning takes place at the beginning of year Class I. Two mature females were taken in May, traveling to the Gulf. Unfortunately the trap was not in proper operation when the large female trout were coming in to spawn.

D. W. Miles, in trammel net operations in Aransas Bay in early October, took several large "bull reds" which had spawned and had entered the bays. Redfish 3 mm. long (.12 inches) were taken at this time entering the bays through the passes.

Flounders were examined whenever taken by methods other than the trap. Spawning had already occurred when the trap was first put into operation and had not yet occurred this year. The fish are, however, beginning to become mature and roe is forming. It appears likely that spawning will take place in the near future. Examination was made of the gonads

of 94 Paralichthys lethostigma during September (and October). Of this number 91 were females while only 3 measuring 11 inches to 11-1/2 inches were males.

Certain results were obtained in observing other Sciaenids. Yellowtails passed through the bayou in May and June in full roe. Numbers of these fish were later observed among the reefs in Mud Slough and Benson's Slough. Large sand trout passed through the bayou to the Gulf in May and June in full roe. Shortly thereafter many small sand trout were taken in the trap as they worked toward the bays. Spawning data on the blue crab is included in the report of F. M. Daugherty.

WORK PLAN V. Age determination.

Scales have been collected from the spotted sea trout, sand trout, redfish, black drum, sheepshead, flounder, spot, croaker, whiting, yellowtail, and pinfish. Permanent mounts have been made of 57 of these. The following scales have been mounted.

Sheepshead--12
Drum--------17
Redfish-----16
Spot-------- 2
Spotted trout----4
Sand trout-------1
Flounder---------3
Whiting----------1

Yellowtail-1

More than two hundred sets of scales are ready to be mounted to add to the collection. Experiments have been made using scale impressions but have not been successful. The study of scales might be of value if a large projecting screen were available.

Length-frequency records have been kept of tagged fish whenever the number was great enough to warrant this. Graphs on the sea trout, the redfish and the flounder follow in that order. The first chart shows in percentages all tagged trout in three representative months. This chart covers a range of 150 mm. to 449 mm. or from 6 inches to 18 inches. In May, peaks of population occurred in the 6 inch to 8 inch bracket, the 8 inch to 11 inch bracket, and probably in the 12 inch to 14 inch bracket. This seems to point out the year class I, II, and III with allowance made for the extreme spawning range from April throughout August. In June a small class was found in the 6 inch to 8 inch bracket, the largest class was found in the 8 inch to 11 inch group, and a smaller class was indicated in the 12 inch to 13 inch bracket. In August the 6 inch to 8 inch class was absent; the 8 inch to 10 inch group and the 11 inch to 13 inch bracket were nearly equal. The

modal lengths for trout of the year class I are as follows:

May 181.2	
June 191.2	increment 10 mm.
July 192.5	increment 1.3 mm.
August--	

Year Class II

May 234.4
June 248.6
July 228.2
August 238.7

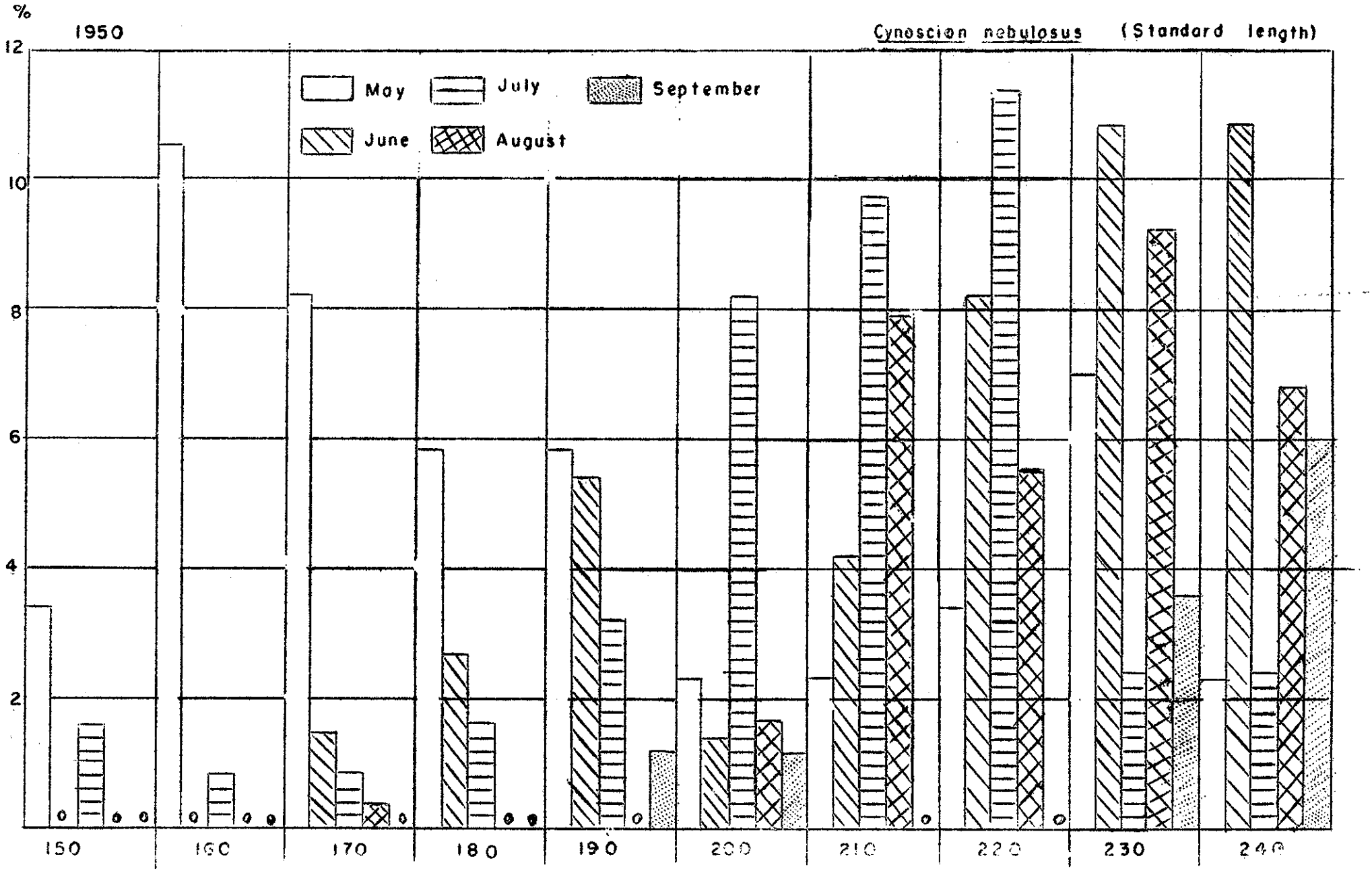
Year Class III is too indefinite to be resolved. These modal lengths serve not only to give an indication of growth, at least in the year Class I, but to show the overlapping of the spawning periods. From the modal lengths for the entire catch an indication can be given of the populations in the bayou during each month.

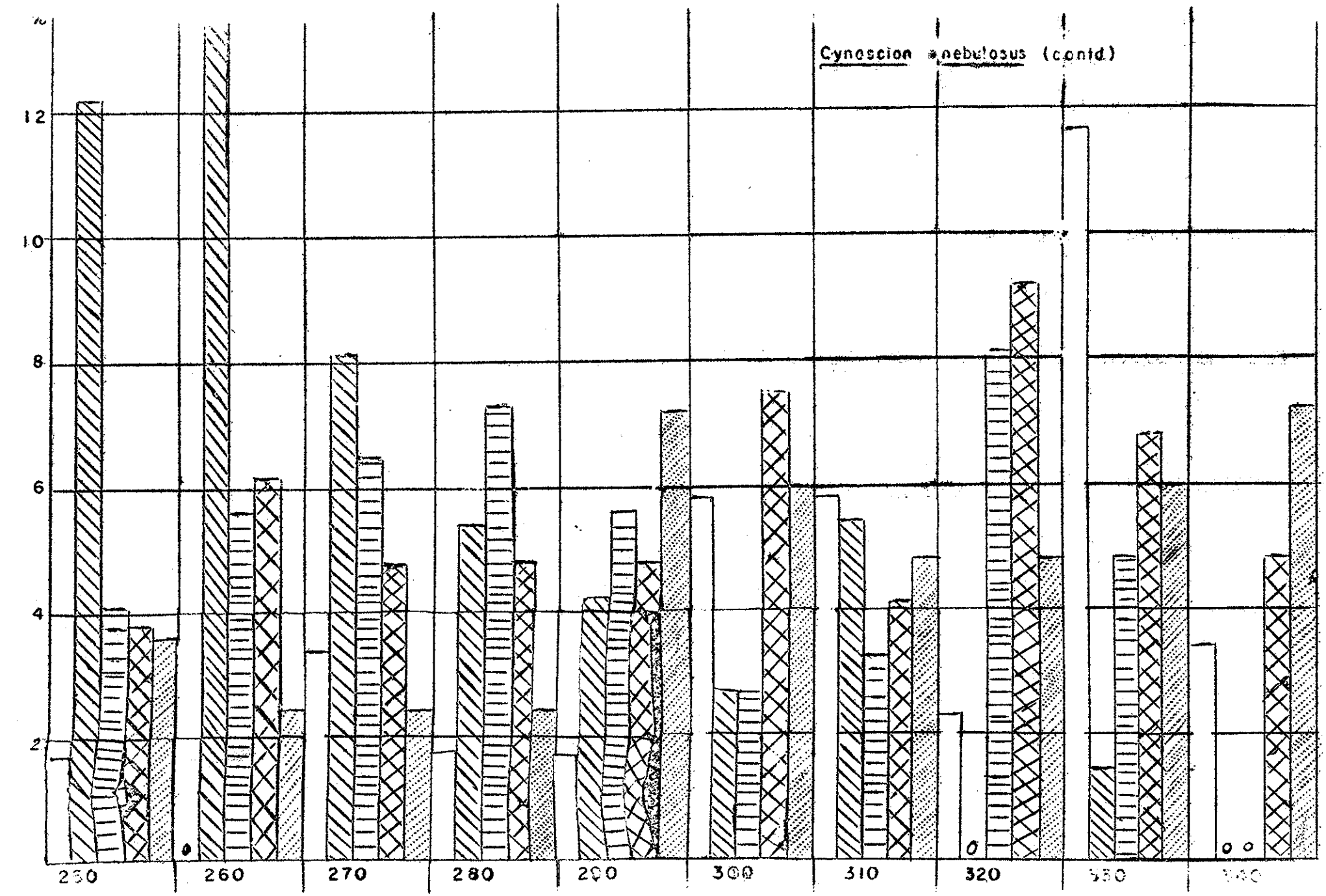
May 263.1 mm.	10.5 inches
June 251.2 mm.	10.0 inches
July 269.4 mm.	10.7 inches
August 292.5 mm.	11.7 inches
September 319.7 mm.	12.8 inches

Thus it can be seen that a population of small trout was present in May, June, and July but that large trout started passing through in August and September. These fish were taken in the trap, by rod and reel or in trammel nets. The majority were taken in trammel net operations and the fact that this method is selective would probably exaggerate the modal lengths somewhat.

The second set of charts show the catch of sea trout during May, June, July, August and September on a comparative basis. It will be noted that the first large peak fell in May from 6 inches to 8 inches, in June from 7 inches to 8.5 inches, in July from 7 inches to 9 inches, in August from 8 inches to 10 inches and in September from 9-11 inches. These figures agree fairly closely with those offered by Pearson and by Miles but again indicate the possibility of a more rapid growth rate and a proof of the overlapping of the spawning season as reported by Miles. Tagging returns should be of very great value in this work as they would eliminate misconceptions caused by this overlapping of age groups.

A total of 166 redfish were tagged and measured during the year, the majority in Cedar Bayou. The following modes do not necessarily indicate growth rates but serve to demonstrate the predominate population in the bayou during the summer


%
1950
Cynoscion nebulosus (Standard length)
May
June
July
August
September
12
10
8
6
4
2
150
160
170
180
190
200
210
220
230
240


Cynoscion nebulosus (cont'd.)
12
10
8
6
4
2
230
260
270
280
290
300
310
320

servations of the catch of flounders gigged in Cedar Bayou. All fish were taken regardless of size. All were measured for total length. The standard length, however, may be calculated within limits by this formula.

STANDARD LT. = TOTAL LT. --- .08 (TOTAL LENGTH).....

The following chart will show the catch per month in each size bracket.

The scatter-graph will show these flounder of the year class 0 taken by D. W. Miles. From this graph the spawning period is shown to fall in January and February with extremely scattered spawning prior to these months. The modal lengths are as follows:

	Min.	Max.	Mean	Increment
February	7mm.	60mm.	30.7	
March	17mm.	62mm.	32.5	1.8mm.
May	28mm.	82mm.	48.5	16.0mm.
June	27mm.	78mm.	55.2	6.7mm.

The total number of flounders measured from the bayou was 499; the largest numbers were found in July and September. It has been thought that this species reached a length of 12 inches in one year but this may prove to be inaccurate. The following are my reasons for this statement.

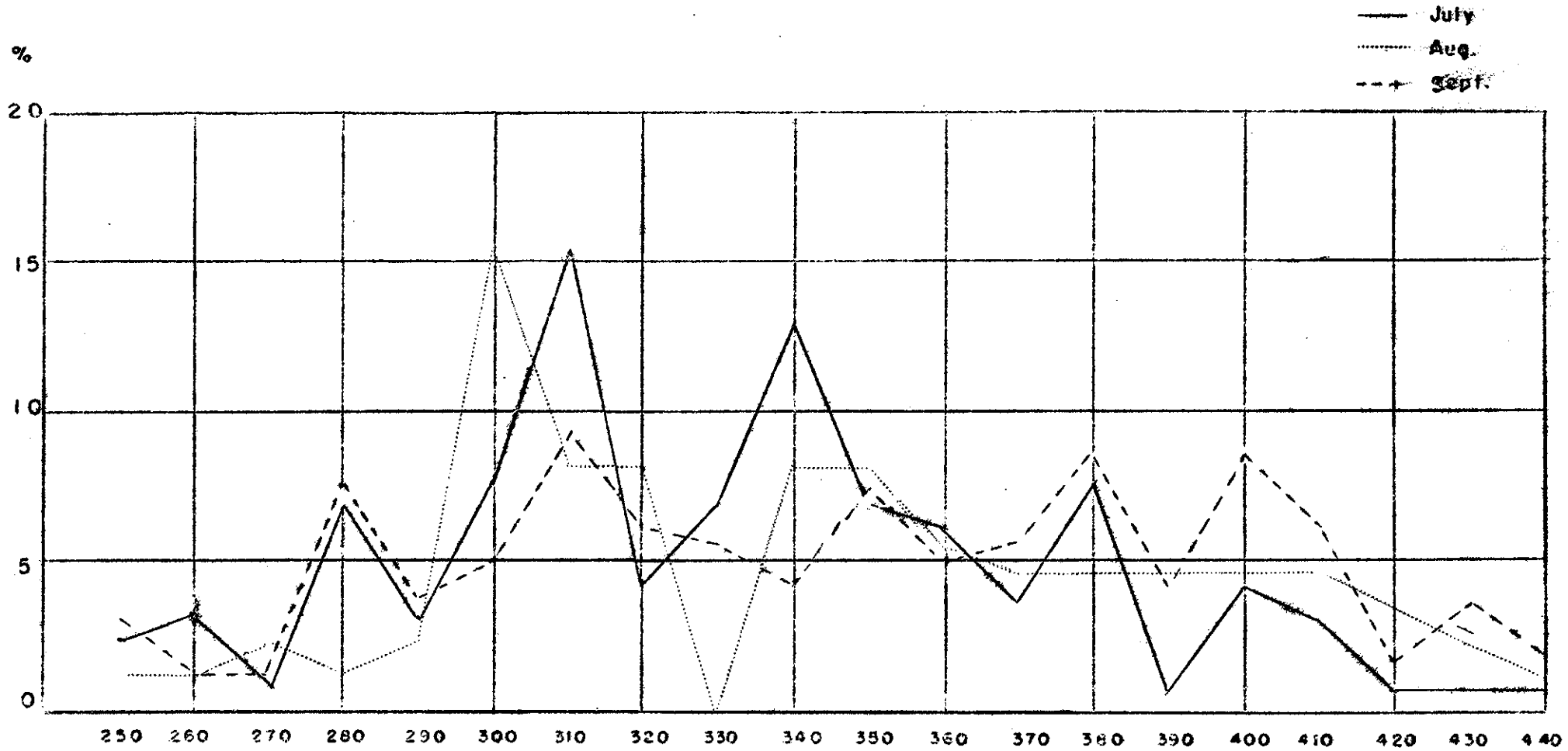
1. It is a known fact that spawning takes place in January and February with overlaps in November and December and in March.

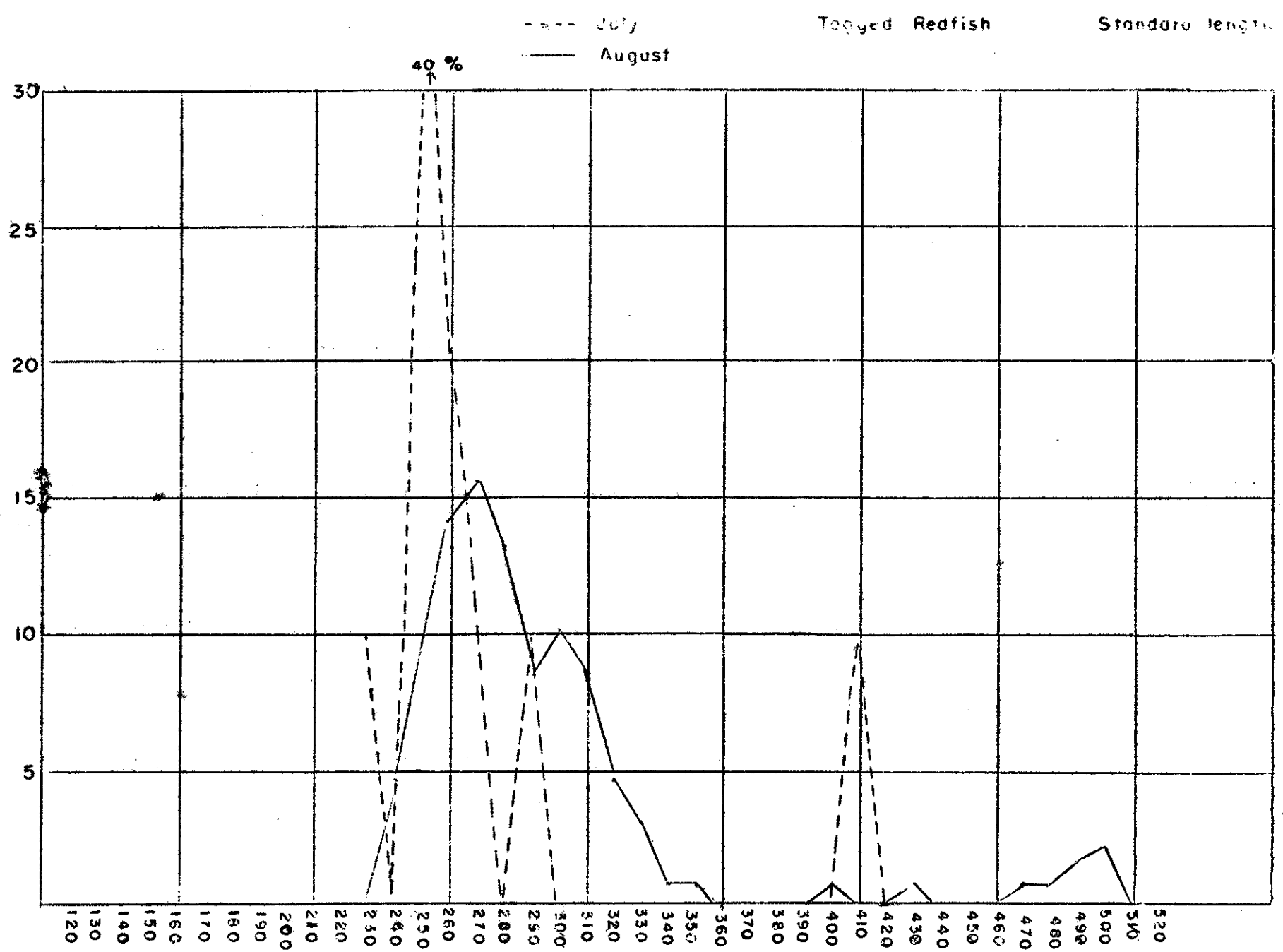
2. The flounder of year class 0 had reached a mean length of 55.2 mm. (2.2 inches) in June.

3. During this same month of June the flounders of Cedar Bayou had reached a total length of 285-299 mm. (11.4--12.0 inches) and a standard length of 252-275 mm. (10--11 inches).

4. The peak in July fell from 290-329 mm. (11.8--13.1 inches) total length, 267-303 mm. standard length (10.5--12 inches); the minimum total length was 210 mm. (193 mm. S.L).

Paralichthys lethostigmus (Total lengths)




July
August
Tagged Redfish
Standard length
40 %
30
25
20
15
10
5
120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520

5. The peak in August fell in the 290-349 mm. (11.8--14.0 inches) total length range, the 267-329 mm. (10.6--13.2 inches) standard length range.

6. Smaller peaks in each instance were found in the 11--11.8 (total) group. It is possible that these indicate, not a separate year class, but an extended spawning period.

7. Flounders in the 8-9 inch bracket were found in the early spring shrimp trawls in Port O'Connor.

8. Had the flounder reached a length of 12 inches in one year no peak of 12 inches should have occurred in the V to VIII of the year class I. Rather, this 12 inch peak would have been placed in the months I, II, and III.

9. The mean average of flounders of the year class 0 had reached only 55.2 mm. (2.2 inches) by the month IV, V, or VI.

These are statements based on the data at hand. The hypothesis is that a length of 6-8 inches is reached in one year as shown by the population of a slightly larger size in early spring. It is probable that a flounder of 12 inches will have reached the age of 1.5 years. From the chart on hypothesis may be reached that the major spawning occurs in January and February with a smaller spawning occurring in December and March and scattered spawning prior to and after these months. Observations of sexual condition during the ensuing months may offer proof of this. In September a very small percentage of the fish were seen to be semi-ripe, many showed a trace of development, and others were entirely immature. Fish of 11-12 inches showed this development as did the larger flounder. It should be emphasized that all of this data concerns the southern fluke (P. lethostigma).

Age length data during the following year will be gathered with the sexes separated. Certain previous measurements indicate that the female of both the sea trout and the southern fluke grow faster than does the male of these species.

WORK PLAN VI. Hydrographical and meteorological data.

Salinity and temperatures have been recorded throughout the year. Variation is present in the bayou itself. Some of the material was secured from the files of F. M. Daugherty.

It is doubtful that salinity has had a great deal of affect upon the migrations of fish. It is interesting to note, however, that during the months of high salinity and high

Salinity	Temperature	Location	Average Salinity
		September, 1949	
33.5		Gulf entrance	
20.0		Grass Island	
33.0		Bay entrance	
		October, 1949	
29.9	26.9	Gulf	
29.5	27.1	Grass Island	28.8
26.9	28.1	Bay	
		November, 1949	
23.6	18.1	Gulf	23.1
22.5	18.1	Bay	
		December, 1949	
31.1	22.4	Gulf	24.9
22.7	22.1	Grass Island	
21.1	22.7	Bay	
		January, 1950 (Week I)	
27.9	18.8	Gulf	
31.0	18.8	Grass Island	
28.2	19.6	Bay	
		Week II	
26.2	20.5	Gulf	26.6
27.7	20.6	Grass Island	
21.7	21.6	Bay	
		February, 1950 (Week I)	
25.8	21.2	Gulf	
25.7	21.5	Grass Island	27.1
25.1	22.0	Bay	
		Week II	
28.5	20.4	Gulf	
28.3	20.4	Grass Island	
28.1	20.6	Bay	
		Week III	
28.4	20.4	Gulf	
24.9		Bay	

Salinity	Temperature	Location	Average Salinity
		March, 1950 (Week I)	
24.1	17.5	Gulf	
22.9	19.0	Bay	
		Week II	
24.1	16.8	Gulf	
23.8	18.6	Grass Island	
23.8	19.0	Bay	
		Week III	
20.1	20.3	Gulf	
26.4	21.3	Grass Island	
25.8	21.3	Bay	24.5
		Week IV	
27.6	21.6	Gulf	
25.9	21.5	Bay	
		April, 1950 (Week II)	
26.0	23.4	Gulf	
26.3	24.7	Grass Island	26.2
		Week III	
26.3	24.1	Gulf	
26.2	24.5	Bay	
		May, 1950	
25.1		Gulf	
25.4	27.6	Grass Island	
25.4	27.9	Bay	
24.1		Gulf	
24.2	28.1	Grass Island	
24.2	28.3	Bay	
26.2	29.0	Grass Island	
26.2	29.1	Bay	
25.4	27.2	Gulf	
25.4	27.7	Bay	25.1
23.7	28.2	Gulf	
24.2	28.2	Bay	
26.3	29.1	Gulf	
26.2	28.6	Bay	

July, 1950			
Salinity	Temperature	Location	Average Salinity
36.9	30.0	Gulf	36.9
36.9	29.6	Grass Island	

(28.0--30.0°C.) temperature the sea trout and the commercial shrimp were prevalent in the bayou and that these forms moved out when the temperature began to fall in September. It is probable that the movement of the sea trout was due to the outward movement of the shrimp.

The following chart shows the variation in salinity with the time, the tide and the wind. All of these data were recorded at Grass Island.

WORK PLAN VII. Maintenance of equipment.

Maintenance of equipment has probably consumed more time than have all other activities combined. Fences are eternally being washed out, broken or undermined. Destructive forces are present in mass led by the common wood borer. This small invertebrate, during the warmer months, feeds indiscriminately on untreated panels, copper painted boards, and creosoted pilings. In many cases the two by fours which support the wire have been completely destroyed just above the ground, causing the fence to fall down. In other cases small pilings have been so weakened that they collapsed with the advent of high winds.

A very swift current runs through the bayou at certain times of the year. This current washed the soil from around the pilings leaving big gaps and causing the two by fours to tear loose. The occasional high winds serve to increase this current tremendously. The influx of sargassum through the pass can be very destructive. This vegetation is brought in by the strong currents and high winds and will pile up against the wire until small pilings break, two by fours break or loosen and staples pull out of the wood.

Repair work is a constant factor:

The fish trap was originally constructed by William L. Haskell of the Texas Game, Fish and Oyster Commission in November, 1949. By the time the present biologist took charge the trap had been partially destroyed by high winds and tides. Work was resumed January 23, 1950. During the next three weeks reconstruction was undertaken and completed using material at

hand. Pilings were replaced and wire was restrung. It was then discovered that the removable nets to be used in the trap boxes were of improper size. These were enlarged. A very strong south wind, supplemented by high tides and large masses of aquatic vegetation, destroyed several portions of the trap on the night of February 9, 1950. It was decided to rebuild using the same pattern but stronger material. Pilings 26 feet long and 14 inches in diameter were placed at least 10 feet into the ground. Extra heavy 2-inch mesh wire was stretched on these posts. Smaller posts were spaced between these large pilings where water depth permitted. On the shallow leads smaller posts and wire were used but these posts were placed well into the sandy bottom. Guy lines were used to re-enforce the wire. Gates were placed in quiet water near the St. Joseph's shore at which depth passage was allowed to any boat that could enter the bayou. The trap was completed by March 15, 1950.

The trap operated properly until the end of the quarter when the two by fours used to hold the wire succumbed to the attacks of wood borers. Old fences were accordingly replaced with new, heavy duty, one-inch mesh wire and heavily creosoted timbers. The trap continued in operation until late September when borers again destroyed the wood. At the present time a new spiral type trap is being constructed.

OTHER ACTIVITIES

Trips were made during the course of the year for various purposes. The first of these was on January 5, 1950 to Freeport with A. W. Anderson for the purpose of checking reported fish mortality in the Dead River. Results were inconclusive. Trammel net operations were conducted in Green Lake, the San Antonio River and Hog Bayou for the purpose of obtaining gar for biological purposes. A journey was made with Mr. D. W. Miles to Washington, D. C., to interview certain men in the U. S. Fish and Wildlife Service. Informative interviews were obtained with Mr. Anderson of Commercial Fisheries, Messr. Dahlgren and Thompson of Fisheries Biology, Mr. John Pearson of the Aquarium, and Dr. Isaac Ginsburg, taxonomist of the Service. All information is covered in a separate report.

With D. W. Miles a joint paper, The Menhaden Fishery, was prepared for publication. A report on the fish trap was prepared for publication in the Texas Game and Fish magazine. A period of 26 days was spent at the Port Arthur Menhaden Fishery and the Quinn Menhaden Fishery in a survey of purse seining procedures. This was done in order to determine the percentage of food and game fish taken by these nets.

SUMMARY

1. The fish trap in Cedar Bayou has been in intermittent operation from March 16, 1950 to September 30, 1950. During this time 116,084 fish of 77 species, 20,000 shrimp and 4900 blue crabs have been taken. Of this total, croakers numbered 73,745. The greatest movement was in June and July. Sea trout and redfish must have a strong migratory urge to enter the trap. The majority of the movement was nocturnal and to the gulf.

2. A total of 1,249 fish were tagged during the year, the greatest part of which were trout and redfish. There have been 44 returns. These returns have shown that movement is nil during the summer months, although distances of 65 miles have been traveled in two instances. With a decline in temperature movement has become more widespread.

3. The presence or absence of the commercial shrimp seems to govern the movement of the sea trout to a great extent. Fluctuations in temperature and salinity also have some effect.

4. The major emphasis in the study of food habits was on the southern fluke (Paralichthys lethostigma). Contents of 254 stomachs were examined; 102 contained food. Of the total food items 84% was fish. Evidently the flounder is extremely piscivorous. The item most often found was the croaker.

5. All tagged sea trout were examined for sexual condition. Spawning was found to occur from April through August. Very few large trout were analysed in the trap. Flounders were found to be developing roe in late September and early October.

6. A scale library has been set up but this has not been very successful. Length-frequency records have been kept of sea trout, redfish and flounder.

7. Records of tagged sea trout indicate that growth may be slightly more rapid than had been thought. Records of redfish seem to show only the populations available at different times. During August, however, the catch agreed closely with the findings of Pearson and those of Miles. The redfish evidently reaches a length of 12.5 - 13 inches in one year.

8. Records of the southern fluke show that this species reaches, not 12 inches in one year as had been thought, but probably a length of 6 - 8 inches. Flounders of 12 inches may be 1.5 years old.

9. Growth rates can probably be more accurately determined if the sexes are separated.

10. Equipment maintenance is extremely difficult. Wood borers, high winds, strong currents and masses of sargassum have caused great destruction.