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. 12

Survey of the Fishes found in Gulf Area 20 from 2-17 Fathoms and of Post-larval Fishes in Aransas Channel

Abstract: Information in the adult fish report is based on data from 85 trawl samples producing an estimated total of 30,857 fishes of 94 species for an estimated total weight of 5,805 pounds.

The two most abundant fishes were the croaker, Micropogon undulatus, and the Gulf sand trout, Cynoscion nothus.

Zonation of species in the Gulf was found even within the narrow limits of job sampling.

Many of the larger fish were taken in numbers and poundage commensurate with a possible commercial utilization.

Post-larval fin-fish taken in Port Aransas Ship Channel had two peaks of abundance. One peak occurred in March and April and was due mainly to menhaden, Brevoortia sp., and pinfish, Lagodon rhomboides, 9 to 25 mm long. The next peak, in October and November, was composed of croaker 3 to 20 mm long.

Post-larval menhaden and anchovies, Anchoa sp., were present in early spring, star drum, Stellifer lanceolatus, and croaker later in the year.

Flatfish, mostly Paralichthys sp., were taken only on the bottom. Star drum were caught almost exclusively on the bottom. Croaker and pinfish showed some preference for moving at the bottom; anchovies, menhaden, and banded croaker, Larimus fasciatus, were taken mainly from levels above the bottom.

By unit effort, the bottom beam trawl caught more fish than did the mid-water plankton net. No specific correlation between catch and temperature or catch and salinity was found.

Objectives: To determine the fishes present in the inshore Gulf of Mexico and their relative abundance, distribution, and size. To determine the seasonal types, abundance, and size of larval fin-fishes present in the Port Aransas Ship Channel. To record and evaluate hydrographic factors at time of sampling.

Procedure: Regular stations were set up for weekly samples in the inshore Gulf off Port Aransas, Texas, in depths of 2 to 17 fathoms. The area, as mapped in two previous reports, lies in the center of the U. S. Fish and Wildlife Service Area 20.

Daytime sampling was accomplished from the 38-foot Department shrimp boat Goby using a 42-foot flat otter trawl of 2-inch stretch mesh spread by 6-foot doors. Duration of each sample was 30 minutes. Detailed information sheets were completed for the catch.

Sampling stations were established at mid-jetty in the 40-foot deep Aransas Ship Channel, on the bottom and in mid-water between the bottom and the surface. Mid-water samples were made with a meter plankton net and bottom samples with a 32-inch beam trawl. The plankton net was towed just above the bottom for two minutes, twenty feet down from the surface for two minutes, and at the surface for two minutes. A centrally mounted flow meter was used to calculate sample volume. An average haul sampled 366.93 cubic meters of water. The beam trawl was towed along the bottom for six minutes. An average haul sampled 119.29 cubic meters of water.

A 5-foot pull seine used primarily for collecting larval shrimp was also used to check for fish in shallow water along the channel. Too few fish were taken to include the data from this gear in the report; however, for comparison with larval shrimp abundance and for possible later work in other areas on larval fish, the 70.14 cubic meters of water sampled in each haul of this net was used as a basis of unit effort in the larval fish catch calculation.

For a more complete coverage of these nets and volume comparison between them, see Job No. 2, Project MS-R-5.

Hydrographic data at time of sampling were obtained with a Kemmerer water bottle. Water temperature was taken on board with a centigrade thermometer calibrated in tenths of degrees; salinity was determined in the laboratory with hydrometers.

Adult Fish - Gulf Area 20

Findings and Discussion: In Table 1, information on the catch of fish is compiled. The depth zone under the Fathoms column represents that zone which produced the most of a certain species. Where only a few fish of a species were caught, the depth zone only indicates that catch and not any particular zonation of the species.

Among certain related fishes there existed a fairly clear depth separation. In the genus Synodus, S. foetens was common from 6 to 15 fathoms and tended to be more abundant inshore. S. poeyi was taken from the 11- to 15-fathom zone and deeper. With two Serranids the same zonation was apparent. The rock sea bass, Centropristes philadelphicus, was most common inshore; the sand perch, Diplectrum formosum, offshore.

The spiny sea robin, Prionotus alatus, was most common under five fathoms. The shortwing sea robin, P. stearnsi, was only taken beyond 11 fathoms. On the latter, it is possible to set this depth preference despite only two specimens being taken in 1963 as this is supported by samples from previous years. Most of the other sea robins caught were from an intermediate range in the 6- to 12-fathom zone. Among the whiffs of the genera Syacium, Citharichthys, and Etropus, the genus Syacium was the deeper water type and the latter two genera were found closer to shore.

Many fish, although most common in certain zones, were taken in other depths included in the job sampling. Other species were collected in depths under 5 or over 11 fathoms. Those fish more or less restricted to the shallow zone were the hardhead catfish, Galeichthys felis, the Atlantic moonfish, Vomer setapinnis, the barred grunt, Conodon nobilis, the guaguanche, Sphyraena guachancho, and the lined sole, Achirus lineatus. Fish representative of depths beyond 11 fathoms were the vermilion snapper, Rhomboplites aurorubens, the lookdown, Selene vomer, the rough scad, Trachurus lathami, the longspine porgy, Stenotomus caprinus, and the naked sole, Gymnachirus nudus.

The dates given as periods of smallest specimens are only for an indication of when spawning may occur, especially in certain fishes on which little is known

concerning this phase of life history. More extensive work on post-larval fishes and adult gonad development should add further knowledge of spawning activity.

Table 2 gives a three-year abundance breakdown on some of the more common and abundant species of fish taken. It can be noted that for all three years from 1961 through 1963 four fish were high on the scale of abundance. These were the croaker, Micropogon undulatus, the Gulf sand trout, Cynoscion nothus, the shoal flounder, Syacium gunteri, and the moonfish, Vomer setapinnis. Other common fish were abundant in one year, less so in another. In addition to giving some information on the apparent yearly variation in abundance for different fish, the table shows that the year 1962 was the best for most species, exceptionally so for certain of the more abundant ones.

Abundance curves for eight common fishes are graphed in Figures 1 through 4 for the years 1961, 1962, and 1963. Croaker, Gulf sand trout, and spot croaker, Leiostomus xanthurus, were very abundant in 1962. This was less apparent for the bay sand trout, Cynoscion arenarius, and the others graphed showed varying abundance patterns. The bay sand trout abundance curve closely followed that of the Gulf sand trout.

The two species of sand trout, the croaker, the spot, and the cutlassfish, Trichiurus lepturus, are active bottom and mid-water predators. The moonfish is a mid-water plankton feeder, on the larger plankton. The lizard fish is a voracious bottom predator on fair-sized prey while the shoal flounder utilizes smaller organisms in the same type habitat. The moon fish and the flounder were less abundant in 1962. The others, feeding on larger, active crustacea and fish, were more abundant in that year. Croaker, spot, and sand trout, presumably feeding both at the bottom and above it, showed an exceptional abundance in 1962 compared to the other years populations by sample.

In considering predator-prey relationships, the position of the commercial shrimp as prey naturally arises. For the fish under discussion, their 1962 abundance rise in July and August corresponds with a 1962 abundance drop for brown shrimp, and possibly white, in the same months. Probably of more importance is the fact that the whole 1962 shrimp season was poorer than that for 1963, or for 1961. This, coupled with a general 1962 greater abundance of many of the predaceous fish, certainly points the need for future investigation along these lines. (See Project MS-R-5, Job No. 11 for Gulf shrimp statistics.)

In the area covered by this job, the commercial trawl fishery is conducted solely for commercial shrimp. The fish in this report are at present "trash", not only ignored commercially but actually at times by their abundance forming a detriment to the size of the shrimp catch. In the future some need will probably arise for this source of protein.

In bottom trawls usually only the croaker, the sand trout, and the spot are caught in sufficient poundage to support some utulization as, for instance, pet food or fertilizer. To a lesser extent, goatfish, Upeneus parvus, Butterfish, Poronotus triacanthus, lizard fish, pinfish, Lagodon rhomboides, scad, bumper, Chloroscombrus chrysurus, rock sea bass, and some of the flatfish might have seasonal value. At present, T. lepturus enjoys a vogue as trolling bait in the Gulf sports fishery. Future work with Gulf trotlines, gill-nets, and mid-water trawls may give information on other types of fishes of possible commercial importance.

Hydrography: In the Gulf shrimp report, Project MS-R-5, Job No. 11, the salinity and temperature data pertinent to this job report are discussed and graphed.

Post-Larval Fin-Fish - Aransas Ship Channel

Findings and Discussion: The following is the number of post-larval fish taken by gear type:

Fish	Hoop Net	Beam Trawl
1. Brevoortia sp. (Menhaden)	40	15
2. Anchoa mitchilli (Anchovy)	111	31
3. Synodus foetens (Lizard fish)	0	1
4. Worm eel (Unidentified)	1	3
5. Eel larvae (Unidentified)	1	3
6. Oligoplites saurus (Leather-jacket)	1	0
7. Trachinotus carolinus (Pompano)	6	1
8. Larimus fasciatus (Banded croaker)	17	4
9. Menticirrhus littoralis (Whiting)	1	7
10. Micropogon undulatus (Croaker)	67	83
11. Stellifer lanceolatus (Star drum)	28	2
12. Lagodon rhomboides (Pinfish)	47	48
13. Gobies (Unidentified)	66	42
14. Prionotus sp. (Sea robins)	0	2
15. Kathetostoma albigutta (Stargazer)	1	0
16. Flatfish (Unidentified)	0	17
17. Unidentified	10	3
Total	397	262

Although the hoop net caught a greater number of post-larval fish, it sampled considerably more water each tow, and by unit of effort the beam trawl was more effective. On only a few of the fish caught can anything be stated as to probable area of movement through the channel. The flatfish, as could be expected, were taken only at the bottom. S. lanceolatus was taken almost exclusively in the water between the bottom and the surface. A. mitchilli, Brevoortia sp., and L. fasciatus showed an indicated preference for waters above the bottom. M. undulatus and possibly L. rhomboides showed some preference for movement along the bottom.

During the job, most of the months were characterized by types of post-larvae taken in general terms only, due mainly to the small total number of fish concerned in this report. This general classification as to occurrence is as follows:

February:	M. undulatus	12	specimens
March:	Brevoortia sp.	15	"
	L. rhomboides	14	"
April:	A. mitchilli	100	"
	L. rhomboides	17	"
	Gobies	17	"
	M. undulatus	16	"
	Brevoortia sp.	13	"
May:	Gobies	39	"
	A. mitchilli	30	"

June:	Gobies	35	specimens
	S. lanceolatus	28	"
	L. rhomboides	24	"
	A. mitchilli	14	"
October:	M. undulatus	85	"
	L. rhomboides	33	"
November:	M. undulatus	26	"

Entrance of post-larval menhaden and anchovies in early spring is indicated, as is the appearance of star drum in June and croaker later in the year. See Table 3 and 4 for complete breakdown of samples.

Catch per unit effort - The number of fish caught per 70.14 cubic meters of water sampled is graphed in Figure 5. The graph is erratic due to the small numbers of fish involved; however, there is some evidence of a March to April abundance peak with both nets due mainly to menhaden and pinfish, and an October to November peak due to croaker.

Temperatures and salinities for the larval sampling gear are graphed in the larval shrimp job report, No. 2, Project MS-R-5. There was no specific indication that temperature or salinity had any affect on the catch of the bottom trawl as compared with the mid-water gear.

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References

American Fisheries Society. 1960. A list of common and scientific names of fishes from the United States and Canada. Special Publ. No. 2, Ann Arbor, Michigan.

Bigelow, Henry B. and William C. Schroeder. 1948. Sharks in TeeVan, John, Fishes of the Western North Atlantic, Sears Foundation, Bingham Oceanographic Lab., New Haven.

_____ and _____. 1954. Fishes of the Western North Atlantic, Part two. Sawfishes, guitarfishes, skates, rays, chimaeroids. Sears Foundation, Bingham Oceanographic Lab., New Haven.

_____ and W. W. Welsh. 1925. Fishes of the Gulf of Maine. Bull. U. S. Bur. Fish., 40 (pt. 1): 1924:1-567.

Breder, C. M. Jr. 1942. On the behavior of young Oligoplites saurus (Block and Schneider). Copeia. 267, ill.

_____. 1948. Field Book of Marine Fishes of the Atlantic Coast. G. P. Putnam's Sons, New York and London.

Briggs, John C. 1963. Texas Fish Families with Suggested References for Identification of Species. Institute of Marine Science, The University of Texas, Port Aransas, Texas. (Mimeographed Form)

Ginsburg, Isaac. 1950. Review of the Western Atlantic Triglidae (fishes). Texas Journ. Sci., 1950, (4):489-527.

Hildebrand, H. H. 1954. A study of the brown shrimp (Penaeus aztecus Ives) grounds in the western Gulf of Mexico. Publ. Inst. Mar. Sci. Univ. Tex. 3(2): 233-266.

Hildebrand, S. F. and L. E. Cable. 1930. Development and life history of fourteen teleostean fishes at Beaufort, N. C. Bull. U. S. Bur. Fish. 46(1093): 383-488, ill.

_____ and _____. 1934. Reproduction and development of whitings or kingfishes, drums, spot, croaker, and weakfishes or sea trouts, Family Sciaenidae, of the Atlantic Coast of the United States. Bull. U. S. Bur. Fish. 48(16): 41-117.

_____ and _____. 1938. Further notes on the development and life history of some teleosts at Beaufort, N. C. Bull. U. S. Bur. Fish. 48(24): 505-642, ill.

Hoese, Hinton D. 1958. A partially annotated checklist of the marine fishes of Texas. Pub. Inst. Mar. Sci. Univ. Tex. 5:312-352.

Kuntz, A. 1916. Notes on the embryology and larval development of five species of teleostean fishes. Bull. U. S. Bur. Fish. 34: 407-429, ill.

Massmann, W. H., Ladd, E. C. and H. N. McCutcheon. 1954. Post-larvae and young of the menhaden (Brevoortia tyrannus) in brackish and fresh waters of Virginia. Copeia. 1: 19-23, ill.

Pearson, John C. 1929. Natural History and Conservation of Redfish and Other Commercial Sciaenids on the Texas Coast. Bull. Bur. Fisheries 44 (129-214).

Table 1
Gulf Fish Data

Species	Number	Fathoms	Size Spread in mm.	Abundant Months	Periods of Smallest Specimens
Aprionodon isodon (Smooth-tooth shark)	2	0-10	330, 600	May, Sept.	
Carcharhinus limbatus (Blacktip shark)	5	0-10	340-420	June/July	
Sphyrna tiburo (Bonnethead shark)	1	11-15	300	Sept.	
Rhinobatus lentiginosus (Atlantic guitar fish)	11	0-10	140-500	July/Aug.	Aug. 140 mm
Narcine brasiliensis (Electric ray)	34	0-10	90-430	June, Oct.	Nov. 90 mm
Raja texana (Texas clearnose skate)	14	0-15	160-500	Aug.	Aug. 160 mm
Dasyatis sabina (Atlantic stingray)	187	0-10	130-650	Feb.	Aug. 130 mm
Rhinoptera bonasus (Cownose ray)	2	0-10	320, 500	June, Aug.	
Brevoortia patronus (Largescale menhaden)	487	0-15	60-220	Aug.	Oct. 60 mm
Harengula pensacolae (Gulf sardine)	83	6-15	70-150	June	Oct. 70 mm
Opisthonema oglinum (Thread herring)	25	6-10	90-240	June	Oct. 90 mm
Sardinella anchovia (Spanish sardine)	230	6-10	70-145	July/Aug.	Sept. 70 mm
Anchoa hepsetus (Striped anchovy)	544	0-10	50-150	June - Oct.	Aug. 50 mm
A. mitchilli (Bay anchovy)	29	0-15	50-120	Aug.	July 50 mm
Synodus foetens (Inshore lizard fish)	801	6-15	90-400	Aug.	Oct. 90 mm
S. poeyi (Offshore lizard fish)	433	11-15 plus	60-140	May	May 60 mm
Bagre marinus (Gafftop catfish)	104	0-10	120-600	May	
Galeichthys felis (Hardhead catfish)	730	0-5	120-350	July	
Urophycis floridanus (Southern hake)	21	6-10	90-200	March	Feb. 90 mm
Hippocampus obtusus (Offshore seahorse)	7	6-10	80-130		
Syngnathus louisianae (Chain pipefish)	3	6-15	200-265	June/July	
Centropristes philadelphicus (Rock sea bass)	247	6-15	55-150	Jan., Mar.	Aug. 55 mm
Diplectrum formosum (Sand perch)	123	11-15 plus	70-130	Jan., May	Aug. 70 mm
Serraniculus pumilio (Pigmy sea bass)	1	6-10	90	March	
Lutjanus blackfordi (Red snapper)	98	6-10	65-130	June, Oct.	Sept. 65 mm
L. synagris (Lane snapper)	1	6-10	310	Aug.	
Rhomboplites aurorubens (Vermilion snapper)	26	11-15	90	May only	
Pomatomus saltatrix (Bluefish)	2	6-15	170, 220	June/July	
Caranx bartholomaei (Yellow jack)	1	11-15	100	Sept.	
C. hippos (Crevalle jack)	8	0-10	120-230		
Chloroscombrus chrysurus (Bumper)	596	0-10	70-200	June, Oct.	March 70 mm
Oligoplites saurus (Leather jacket)	35	6-10	120-150	June	
Selene vomer (Lookdown)	16	15 plus	95-180	Oct.	
Trachinotus carolinus (Pompano)	20	0-15	50-110		March 50 mm
Trachurus lathami (Rough scad)	489	11-15	80-330	May	May 80 mm
Vomer setapinnis (Atlantic moonfish)	2,197	0-5	40-210	Aug.	Oct. 40 mm
Eucinostomus gula (Silver mojarra)	268	0-10	60-190	June	Nov. 60 mm

Table 1--Continued

Species	Number	Fathoms	Size Spread in mm.	Abundant Months	Periods of Smallest Specimens
Conodon nobilis (Barred grunt)	28	0-5	80-170	July	
Orthopristis chrysopterus (Pigfish)	185	0-10	100-220	Oct.	
Bairdiella chrysura (Silver perch)	8	0-10	130-160	Feb.	
Cynoscion arenarius (Bay sandtrout)	1,527	6-10	60-410	Oct./Nov.	March 60 mm
C. nebulosus (Speckled trout)	1	0-5	250	Aug.	
C. nothus (Gulf sandtrout)	3,565	0-15	30-240	May/June, Nov.	Jan.- Mar. 30-45 mm, July, Sept./Oct. 30-45 mm
Larinus fasciatus (Banded croaker)	228	0-10	30-160	July/Aug.	Feb. 30 mm
Leiostomus xanthurus (Spot croaker)	974	0-10	100-250	Aug.	
Menticirrhus americanus (Southern kingfish)	428	0-10	110-360	May - July	Aug. 110 mm
M. littoralis (Gulf kingfish)	518	0-10	120-360	Jan. - Mar., Oct.	Oct./Nov. 120 mm
Micropogon undulatus (Croaker)	3,386	6-15	50-230	Aug.	Feb. 50 mm
Stellifer lanceolatus (Star drum)	293	0-10	60-150	Oct.	March 60 mm
Upeneus parvus (Dwarf goatfish)	1,836	6-10	60-140	May - Aug.	May 60 mm
Lagodon rhomboides (Pinfish)	640	0-10	90-150	June	
Stenotomus caprinus (Longspine porgy)	340	11-15 plus	50-90	Aug.	Aug. 50 mm
Chaetodipterus faber (Atlantic spadefish)	119	0-10	45-180	Oct.	Mar. 45 mm
Trichiurus lepturus (Atlantic cutlassfish)	1,532	0-15	90-460	May	Oct. 90 mm
Scomberomorus cavalla (King mackerel)	1	0-5	200	Oct.	
S. maculatus (Spanish mackerel)	28	0-15	120-300	Oct.	Oct. 120 mm
Bollmannia communis (Goby)	6	6-15	90-120		
Gobionellus gracillimus (Slim goby)	1	11-15	90	Feb.	
Prionotus alatus (Spiny sea robin)	35	0-5	20-110	Feb./Mar.	March 20 mm
P. ophryas (Bandtail sea robin)	35	6-15	105-130	Oct.	
P. rubio (Blackfin sea robin)	388	6-15	40-150	Aug./Sept.	March 40 mm
P. stearnsi (Shortwing sea robin)	2	11-15	70	May	
P. tribulus (Bighead sea robin)	23	0-10	110-155	Oct./Nov.	
P. martis (Barred sea robin)	19	6-10	65-120		June 65 mm
Astroscopus y-graecum (Southern stargazer)	2	0-5	70	Feb.	
Lepophidium brevibarbe (Short-beard cusk-eel)	10	0-15	90-300	Jan./Feb.	Feb. 90 mm
Ophidion welshi (Crested cusk-eel)	35	0-15	100-210	Mar.	March 100 mm
Peprilus alepidotus (Southern harvest fish)	32	0-10	70-180	Mar.	March 70 mm
Poronotus triacanthus (Butterfish)	1,493	6-15	60-190	May - Aug.	Feb. 60 mm

Table 1--Continued

Species	Number	Fathoms	Size Spread in mm.	Abundant Months	Periods of Smallest Specimens
Sphyraena barracuda (Great barracuda)	1	6-10	410	Aug.	
S. guachancho (Guaguanche)	41	0-5	35-275	Aug.	Sept. 35 mm
Mugil cephalus (Striped mullet)	8	0-5	210-220	June	
Polydactylus octonemus (Atlantic threadfin)	796	0-15	85-210	Aug. - Oct.	June 85 mm
Ancylopsetta quadrocellata (Ocellated flounder)	92	0-15	70-390	Aug.	May 70 mm
Citharichthys macrops (Spotted whiff)	431	6-15	60-130	Nov.	March 60 mm
C. spilopterus (Bay whiff)	33	6-10	90-280		
Cyclopsetta chittendeni (Mexican flounder)	6	6-15	70-100		
Engyophrys sentus (Spiny flounder)	1	0-5	80	June	
Etropus crossotus (Fringed flounder)	72	0-10	100-140	April	
Paralichthys lethostigma (Southern flounder)	28	0-15	120-400		
Syacium gunteri (Shoal flounder)	2,958	11-15 plus	50-140	Jan./Feb.	Feb. 50 mm
Achirus lineatus (Lined sole)	42	0-5	80-140	Feb.	
Gymnachirus nudus (Naked sole)	27	11-15	60-100	Feb.	
Trinectes maculatus (Hog choker)	60	0-10	80-160	Mar.	
Symphurus plaguisa (Blackcheek tonguefish)	381	6-15	90-180	Feb./Mar.	
Balistes capriscus (Gray triggerfish)	31	0-10	70-120	Aug./Sept.	
Alutera schoepfi (Orange filefish)	1	0-5	110	Jan.	
Monocanthus hispidus (Planehead filefish)	2	6-10	80, 90		
Lagocephalus laevigatus (Smooth puffer)	62	6-15	40-240	Aug.	Aug. 40 mm
Sphaeroides nephelus (Southern puffer)	111	6-10	40-120	Jan./Feb.	Mar. 40 mm
Chilomycterus schoepfi (Striped burrfish)	21	0-10	60-260	Oct.	Oct. 60 mm
Porichthys porosissimus (Midshipman)	42	0-15	90-180		
Halieutichthys aculeatus (Spiny batfish)	1	6-10	60	June	
Ogcocephalus nasutus (Shortnose batfish)	10	6-10	90-210		

Table 2
Gulf Fish--Number Sampled

Species	1963	1962	1961
C. nothus	3,565	14,958	1,422
M. undulatus	3,386	16,116	2,381
S. gunteri	2,958	1,420	1,757
V. setapinnis	2,197	1,608	285
U. parvus	1,836	2,198	320
T. lepturus	1,532	5,475	578
C. arenarius	1,527	437	766
P. triacanthus	1,493	563	473
L. xanthurus	974	10,361	697
S. foetens	801	1,319	682
P. octonemus	796	305	381
G. felis	730	659	387
L. rhomboides	640	859	104
C. chrysurus	596	1,235	3,444
A. hepsetus	544	896	307
M. littoralis	518	1,594	239
T. lathami	489	89	55
B. patronus	487	646	747
S. poeyi	433	352	153
C. macrops	431	99	39
M. americanus	428	20	0
P. rubio	388	213	161
S. plaguisa	381	68	105
S. caprinus	340	3,921	482
S. lanceolatus	293	819	1,036
E. gula	268	39	0
C. philadelphicus	247	369	208
L. fasciatus	228	940	165
D. sabina	187	14	30
O. chrysopterus	185	269	174
D. formosum	123	125	166
L. blackfordi	98	852	115
B. capriscus	31	167	4
C. nobilis	28	680	153
O. oglinum	25	166	247
Number of Samples:	85	90	90

Table 3
Larval Samples

(Temperature in degrees centigrade; salinity in parts per thousand)

Hoop Net Sample - Aransas Ship Channel

(Average sample strains 366.93 cubic meters of water)

Date	Organisms Collected	Temp.	Sal.
1/ 4	None	14.5	31.45
2/25	2 Brevoortia sp. (25 mm) 1 Anchoa mitchilli (30 mm) 1 Eel larva (60 mm) 7 Micropogon undulatus (6-10 mm) 2 Lagodon rhomboides (13 mm) 2 Gobies (11 mm) 1 Unidentified (9 mm)	11.8	32.71
3/ 7	1 Brevoortia sp. 1 Worm eel (55 mm) 2 L. rhomboides (11 mm)	15.9	33.10
3/11	5 L. rhomboides (11 mm)	16.3	32.75
3/26	13 Brevoortia sp. (11-18 mm) 2 M. undulatus (19 mm) 3 L. rhomboides (9 mm) 2 Trachinotus carolinus (25 mm) 2 Gobies (11 mm)	19.2	31.73
4/ 8	12 Brevoortia sp. (14 mm) 2 M. undulatus (18-25 mm) 10 L. rhomboides (11 mm) 2 T. carolinus (25, 33 mm)	20.7	33.71
4/18	100 A. mitchilli (21-26 mm) 2 T. carolinus (30, 35 mm) 5 Gobies (11 mm) 2 Unidentified (3, 12 mm)	23.9	36.39
4/23	1 Brevoortia sp. (10 mm) 2 L. rhomboides (8 mm)	25.3	35.85
5/22	7 Larimus fasciatus (6 mm) 1 Goby (10 mm)	25.6	36.28
5/27	11 Gobies (12 mm)	26.9	36.10
6/ 5	5 Brevoortia sp. (18 mm) 4 A. mitchilli (20 mm) 8 Stellifer lanceolatus (2-7 mm)	28.0	36.05

Table 3--Continued

Date	Organisms Collected	Temp.	Sal.
6/ 5 (Con.)	18 L. rhomboides (12 mm) 15 Gobies (13 mm) 2 Unidentified (2, 7 mm)		
6/14	10 S. lanceolatus (7 mm) 12 Gobies (7 mm)	29.0	37.49
6/20	10 A. mitchilli (16 mm) 2 L. fasciatus (5 mm) 1 Menticirrhus littoralis (9 mm) 10 S. lanceolatus (6 mm) 5 L. rhomboides (8 mm) 15 Gobies (12 mm) 1 Oligoplites saurus (18 mm)	29.1	36.95
10/10	1 Brevoortia sp. (15 mm) 3 Unidentified (3-6 mm)	27.0	32.71
10/18	6 L. fasciatus (2-15 mm) 49 M. undulatus (2-9 mm) 1 Unidentified Serranid (6 mm) 2 Gobies (7 mm) 1 Unidentified (3 mm)	25.6	36.68
10/23	1 L. fasciatus (2.5 mm)	25.5	36.72
10/29	1 L. fasciatus (3.5 mm)	25.1	35.41
10/31	1 M. undulatus (7 mm) 1 Goby (12 mm)	23.8	36.81
11/ 5	4 M. undulatus (5-8 mm)	23.4	36.39
11/12	1 M. undulatus (8 mm) 1 Kathetostoma albigutta (20 mm)	21.9	35.92
11/20	1 Brevoortia sp. (11 mm) 1 M. undulatus (2.5 mm)	22.7	36.48

Table 4
Larval Samples

Beam Trawl Sample - Aransas Ship Channel

(Average sample strains 119.29 cubic meters of water)

Date	Organisms Collected	Temp.	Sal.
2/19	2 Worm eels (45 mm) 3 M. undulatus (19-35 mm) 4 L. rhomboides (12 mm) 6 Unidentified flatfish (10 mm) 2 Gobies (27 mm)	11.7	29.03
2/27	1 Eel (80 mm) 2 L. fasciatus (35 mm) 7 M. undulatus (10-30 mm) 1 Prionotus alatus 5 Unidentified flatfish (7-11 mm) 3 Gobies (8 mm)	12.8	32.89
3/ 7	3 Eel larvae (60 mm)	14.2	33.10
3/26	1 Brevoortia sp. (18 mm) 4 M. undulatus (12-20 mm) 4 L. rhomboides (7-14 mm) 2 Unidentified flatfish (13 mm) 2 Gobies (11 mm)	19.2	31.73
4/ 8	1 Synodus foetens (25 mm) 13 M. undulatus (20 mm) 5 Unidentified flatfish (13 mm) 8 Gobies (10-14 mm)	20.7	33.71
4/18	1 M. undulatus (20 mm) 1 S. lanceolatus (10 mm) 2 L. rhomboides (12 mm) 1 T. carolinus (25 mm) 1 Unidentified flatfish (13 mm) 4 Gobies (12 mm)	23.9	36.39
4/23	3 L. rhomboides (10 mm)	25.3	35.85
5/22	None	25.6	36.28
5/27	5 Brevoortia sp. (22 mm) 30 A. mitchilli (25 mm) 1 S. lanceolatus (7 mm) 3 L. rhomboides (7 mm) 15 Gobies (16 mm)	26.9	36.10

Table 4--Continued

Date	Organisms Collected	Temp.	Sal.
6/ 5	1 L. rhomboides (9 mm) 3 Gobies (9-12 mm)	28.0	36.81
6/14	None	29.0	37.49
6/20	2 Gobies (10 mm)	29.1	34.98
10/1	9 Brevoortia sp. (5-20 mm) 1 Unidentified (4 mm) 1 Goby (7 mm)	25.6	32.68
10/18	2 L. fasciatus (13 mm) 4 M. littoralis (19-31 mm) 18 M. undulatus (5-8 mm) 1 Goby (10 mm)	25.6	36.68
10/23	1 A. mitchilli (30 mm) 3 M. littoralis (6-10 mm) 33 L. rhomboides (5-10 mm) 1 Goby (11 mm)	25.5	36.72
10/29	17 M. undulatus (4-10 mm) 2 Unidentified (10, 12 mm)	25.1	35.41
11/21	20 M. undulatus (10-20 mm) 1 Unidentified Prionotus sp. (12 mm)	22.9	35.62

Figure 1
Gulf Fish Abundance (Average No. Per Trawl)

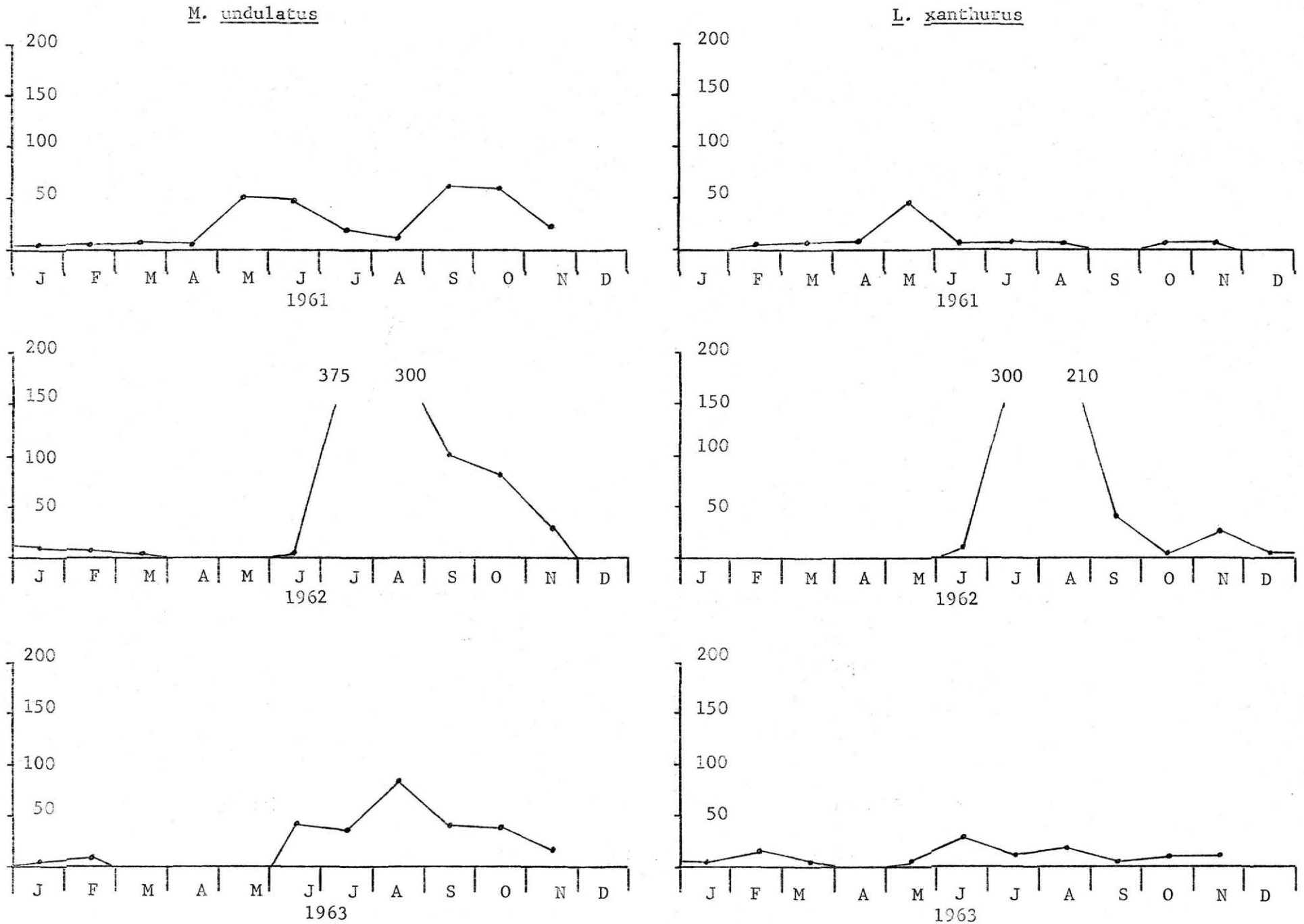


Figure 2
Gulf Fish Abundance (Average No. Per Trawl)

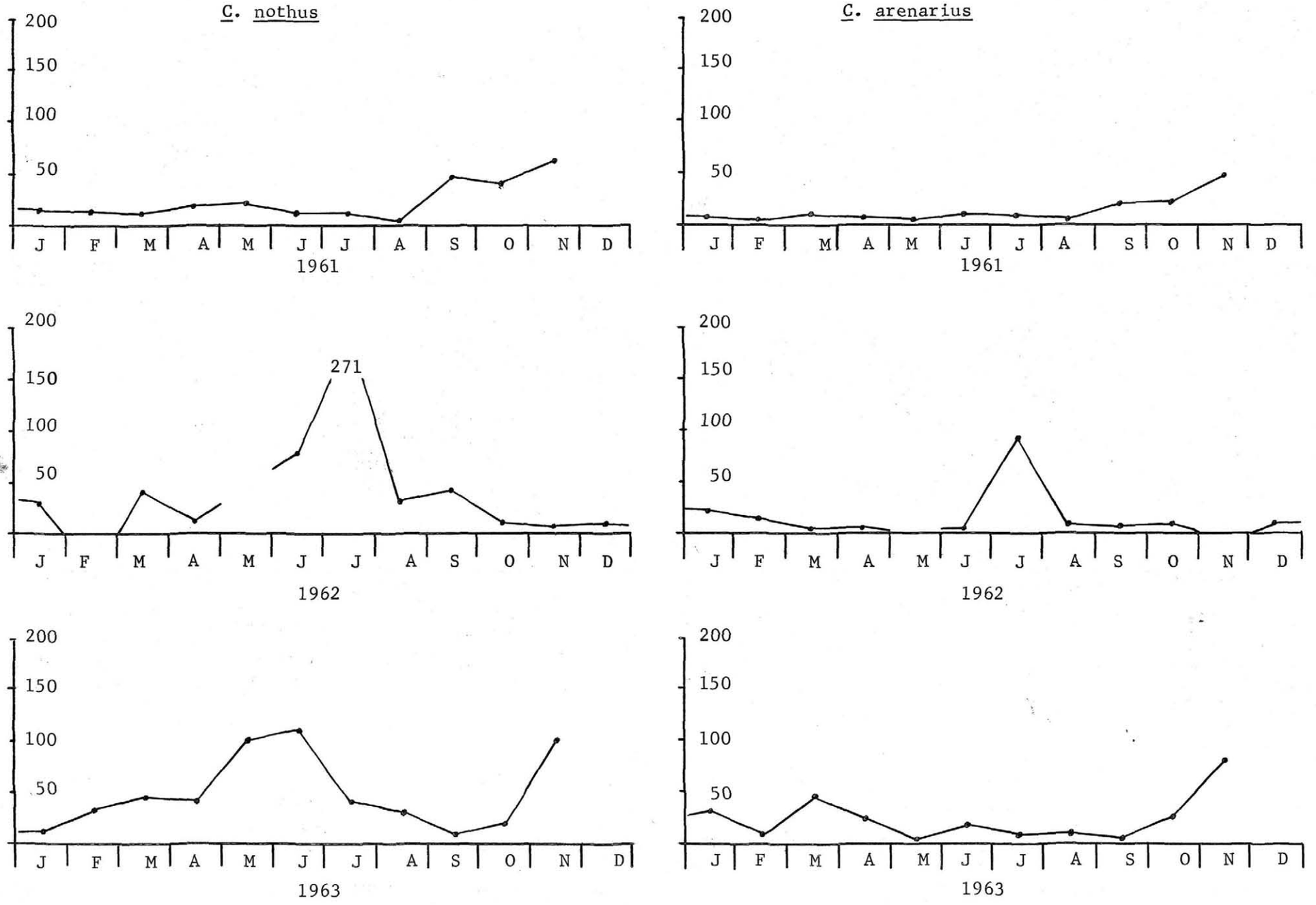


Figure 3
Gulf Fish Abundance (Average No. Per Trawl)

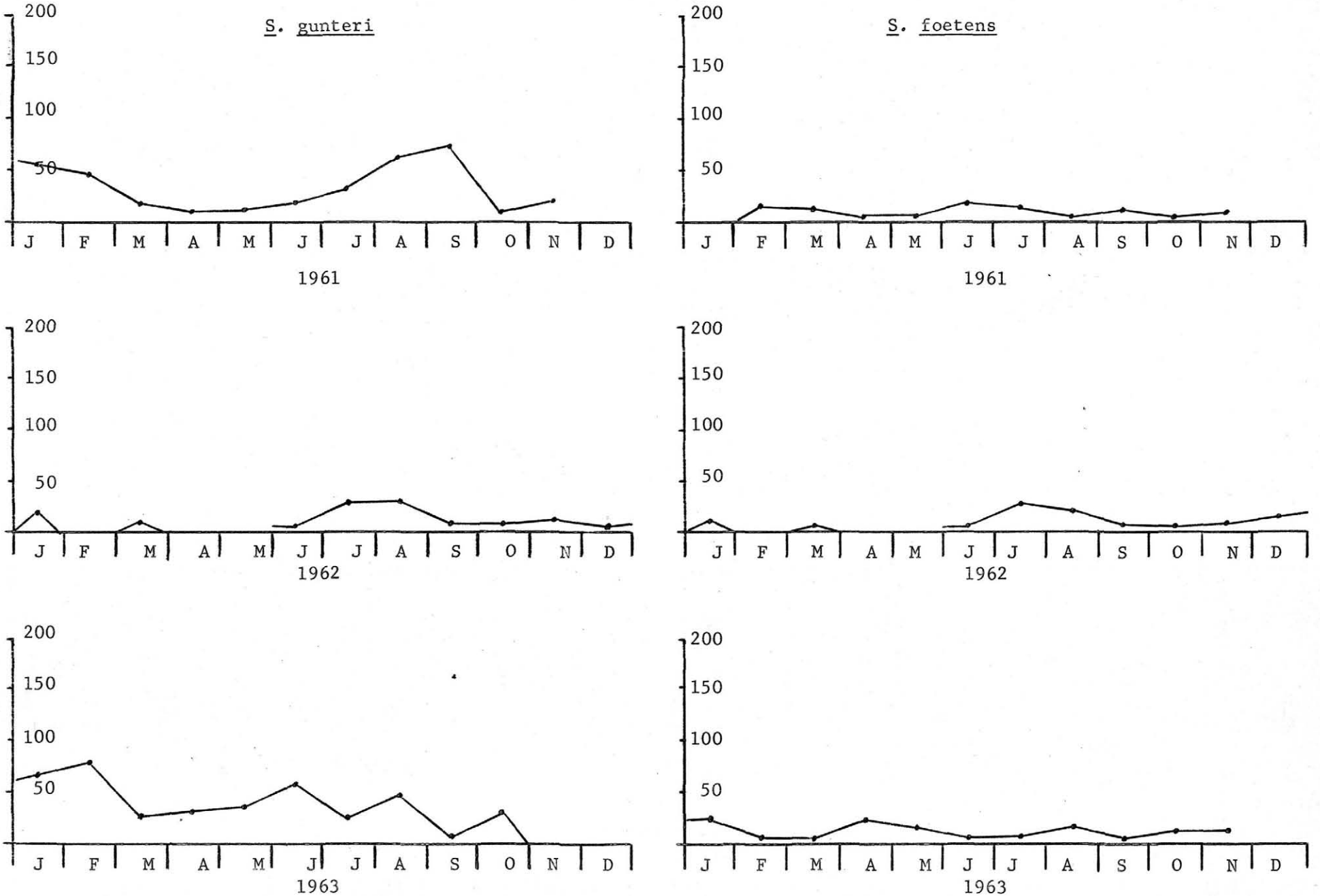


Figure 4
Gulf Fish Abundance (Average No. Per Trawl)

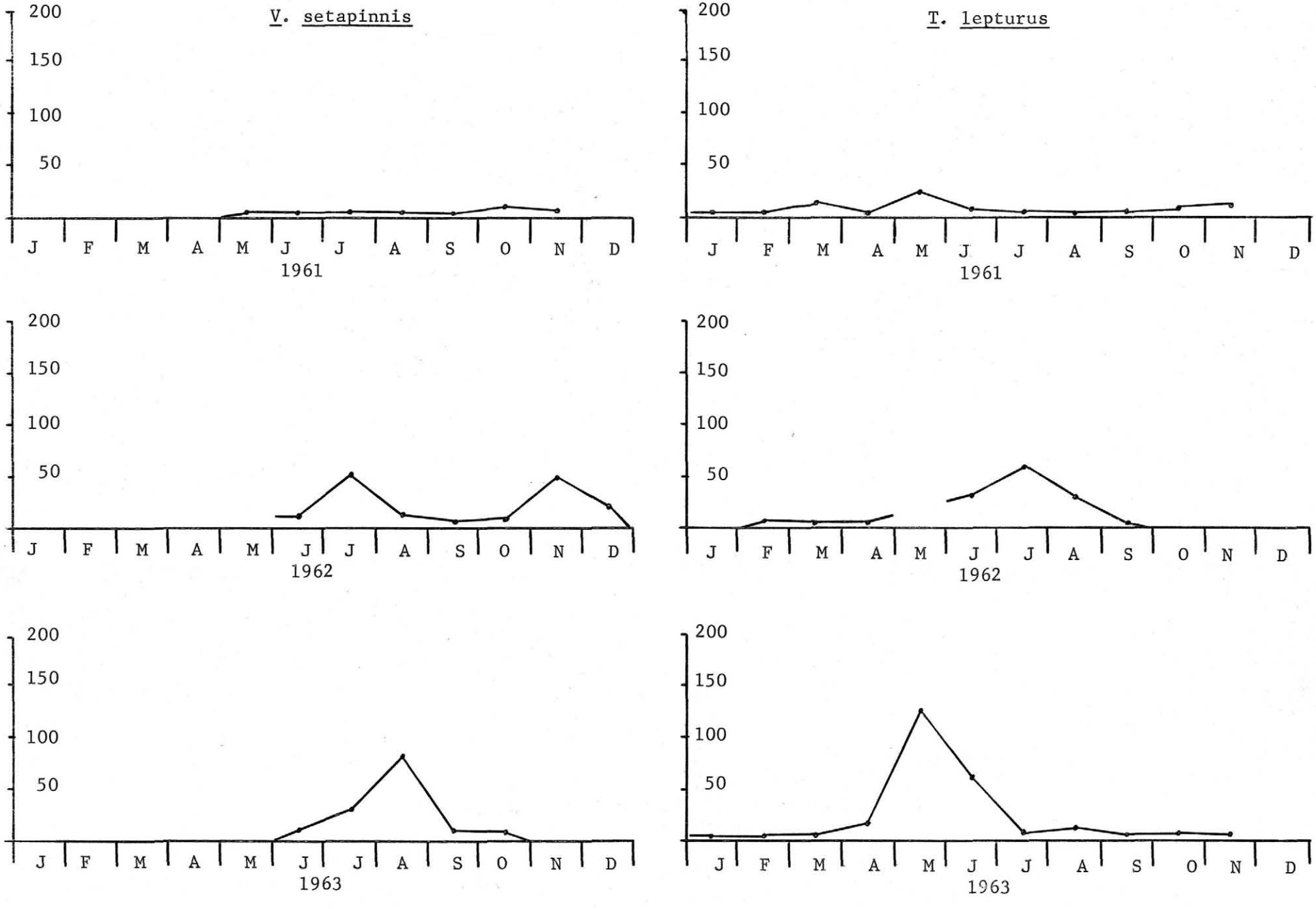
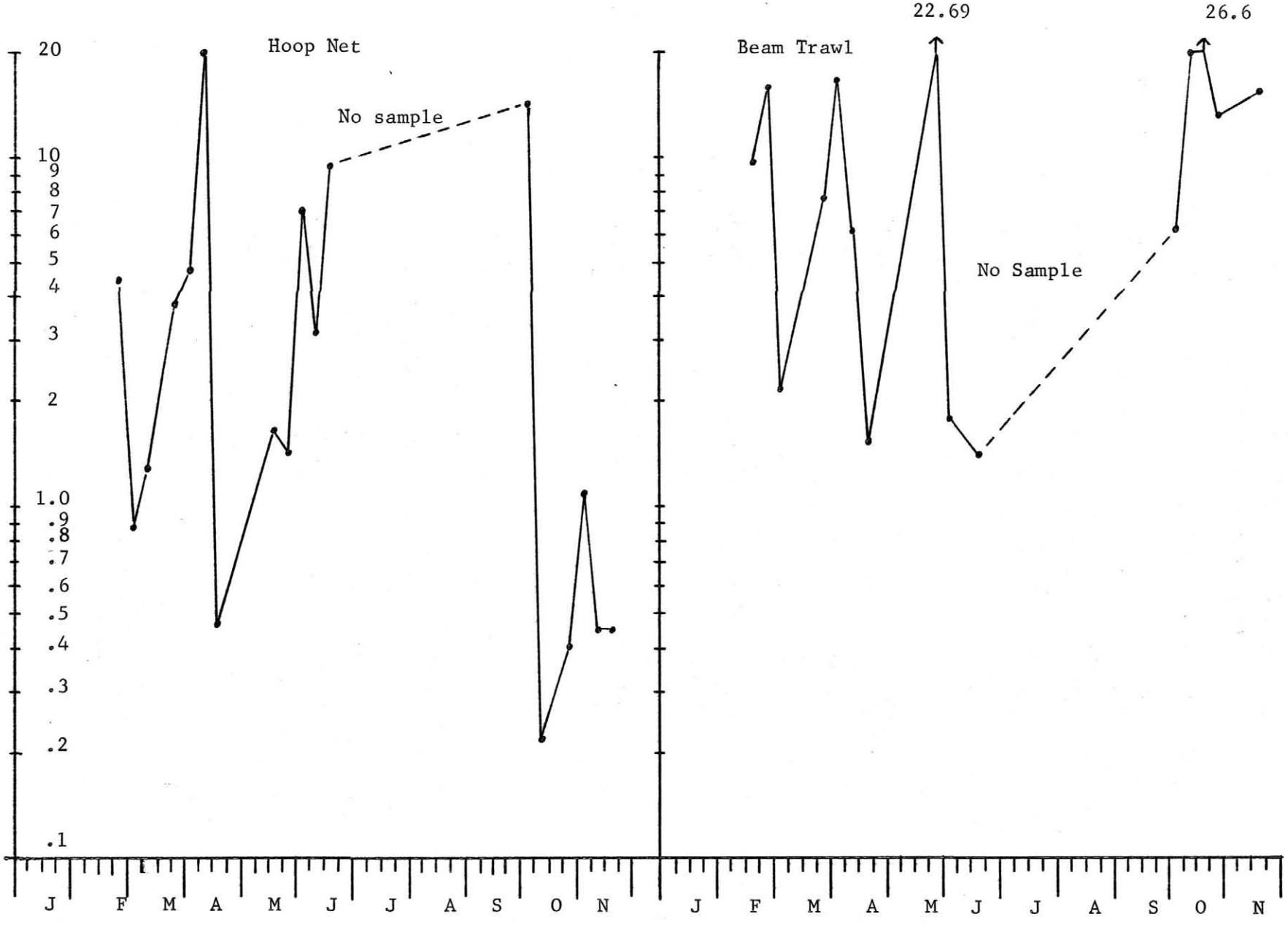


Figure 5
Abundance of Post-Larval Fin-Fish
1963



Number of Fish Per 70.14 M^3 of Water Sampled

Table 5

GULF SALINITY AND TEMPERATURE - YEAR 1963

LYDIA ANN CHANNEL EAST EDGE six inches to three foot depths:

DATE	TEMP.	SAL. (Bottom samples)
February		
11	9.3	27.63
19	10.1	28.34
25	12.2	30.92
March		
7	15.5	29.96
11	16.5	32.08
17	17.1	29.33
27	20.5	32.06
April		
3	26.9	32.29
8	21.8	31.45
18	23.9	36.27
23	25.4	36.01
May		
2	25.6	26.78
9	25.3	34.90
16	23.4	35.43
27	27.3	36.99
June		
6	28.8	36.60
14	29.4	36.60
20	29.2	36.32
July		
12	29.2	36.66
August		
9	31.5	37.26
16	28.5	35.49
22	30.8	37.66

Table 6

GULF SALINITY AND TEMPERATURE - YEAR 1963

ARANSAS SHIP CHANNEL 42-foot depths:

DATE	TEMP.		SAL.	
	SURFACE	BOTTOM	SURFACE	BOTTOM
January				
4	14.5	14.5	31.09	31.45
February				
19	9.8	11.7	27.53	29.03
25	11.6	11.8	31.82	32.71
27	12.4	12.8	32.07	32.89
March				
7	15.5	14.2	31.14	33.10
11	16.0	16.3	31.91	32.75
26	18.8	19.2	31.50	31.73
April				
8	21.5	20.7	31.45	33.71
18	23.9	23.9	36.24	36.39
23	25.4	25.3	35.58	35.85
May				
22	26.2	25.6	36.10	36.28
27	27.0	26.9	35.92	36.10
June				
5	28.2	28.0	36.05	
14	29.5	29.0	36.25	37.49
20	29.2	29.1	36.05	36.95
October				
1	25.9	25.6	30.40	32.68
18	25.7	25.6	33.88	36.68
23	25.5	25.5	33.91	36.72
29	24.6	25.1	33.39	35.41
31	23.9	23.8	35.74	36.81
November				
5	23.6	23.4	35.96	36.39
12	21.7	21.9	35.81	35.92
20	22.6	22.7	35.98	36.48
21	22.8	22.9	34.81	35.62

Table 7

GULF SALINITY AND TEMPERATURE - YEAR 1963 (Con't.)

GULF AREA 20

DATE	TEMP.		SAL.	
	SURFACE	BOTTOM	SURFACE	BOTTOM
January				
3-4 fathoms	14.8	14.8	31.78	31.91
3-14 fathoms	14.7	18.5	31.94	32.03
4-8 fathoms	14.6	14.8	31.63	31.70
9-10 fathoms	15.0	17.4	31.83	31.92
14-12 fathoms	14.7	18.5	31.94	32.03
February				
19- 4 fathoms	11.0	11.5	33.16	33.27
19- 8 fathoms	15.6	16.0	34.07	34.91
25- 8 fathoms	11.5	11.5	34.20	34.81
25-14 fathoms	13.5	14.0	34.84	35.10
March				
7- 4 fathoms	14.7	15.8	32.15	32.16
7- 8 fathoms	15.5	14.2	32.28	34.57
12- 8 fathoms	17.1	17.1	31.81	34.96
12-12 fathoms	17.4	17.2	31.79	35.42
27-12 fathoms	17.7	17.4	32.76	34.01
April				
23- 8 fathoms	24.3	24.3	34.77	35.15
May				
21- 3 fathoms	26.2	26.3	36.18	36.13
21- 8 fathoms	26.1	26.3	35.93	36.01
21-12 fathoms	25.3	25.9	35.85	35.69
21-16 fathoms	25.4	23.1	36.23	36.23
June				
13- 2 fathoms	28.5	28.5	36.10	36.10
13-10 fathoms	28.1	28.1	35.69	35.78
14- 4 fathoms	28.4	28.3	35.87	36.77
14- 8 fathoms	28.0	27.9	35.62	36.88
18- 6 fathoms	29.0	28.9	35.83	36.09
18-12 fathoms	28.2	26.7	35.62	35.73
18-16 fathoms	27.5	23.7	35.54	35.56
19- 2 fathoms	29.3	29.1	36.12	36.09
19- 7 fathoms	28.8	27.9	36.10	36.09
19-10 fathoms	28.1	27.0	36.09	36.09

Table 7 (continued)

GULF SALINITY AND TEMPERATURE - YEAR 1963 (Cont.)

GULF AREA 20

DATE	TEMP.		SAL.	
	SURFACE	BOTTOM	SURFACE	BOTTOM
July				
9- 4 fathoms	29.5	28.7	35.87	35.87
9- 8 fathoms	28.7	29.3	34.64	38.07
11- 2 fathoms	28.9	28.2	35.88	35.87
11-10 fathoms	28.6	26.4	35.87	35.87
16- 7 fathoms	26.9	25.1	35.89	36.08
16-12 fathoms	26.1	23.9	35.87	36.12
17- 4 fathoms	25.9	23.8	35.91	36.16
17- 9 fathoms	25.5	23.5	35.73	36.25
19- 4 fathoms	28.5	27.7	36.14	35.67
19- 9 fathoms	26.8	26.9	35.78	35.78
26-12 fathoms	28.6	24.2	36.23	36.01
August				
9- 6 fathoms	31.2	30.1	36.19	36.05
9-12 fathoms	29.2	28.8	35.60	36.03
12- 7 fathoms	29.6	29.7	35.85	35.92
14- 5 fathoms	29.8	29.6	35.53	35.92
14-10 fathoms	29.2	29.4	35.40	36.12
16- 2 fathoms	29.4	29.2	35.49	35.49
16- 9 fathoms	28.3	29.1	34.88	37.26
20- 7 fathoms	29.9	29.8	35.67	36.01
20-15 fathoms	28.7	28.2	35.67	35.67
22- 4 fathoms	29.9	28.8	35.98	35.77
22-10 fathoms	29.0	27.9	36.01	36.01
26- 3 fathoms	31.7	31.7	36.75	36.54
26- 9 fathoms	29.5	29.1	36.12	36.75
26-12 fathoms	29.3	28.3	36.19	36.75
28- 5 fathoms	30.8	30.7	36.99	37.78
28-10 fathoms	30.1	29.0	36.21	36.07
28-14 fathoms	29.3	26.6	36.67	36.74
29- 8 fathoms	29.5	30.3	35.53	35.78
29-16 fathoms	29.0	26.8	35.53	36.07
September				
3- 3 fathoms	29.6	30.2	36.65	36.23
3- 7 fathoms	29.5	30.1	36.33	35.26
3-12 fathoms	28.8	28.8	36.59	36.94
4- 5 fathoms	30.3	29.9	37.32	37.28
4-10 fathoms	30.1	29.9	36.88	37.18

Table 7 (Continued)

GULF SALINITY AND TEMPERATURE - YEAR 1963 (Cont.)

GULF AREA 20

Date	TEMP.		SAL.	
	SURFACE	BOTTOM	SURFACE	BOTTOM
October				
1-14 fathoms	26.5	26.9	33.97	33.50
2-17 fathoms	27.4	27.1	35.34	35.48
2- 8 fathoms	27.1	27.0	30.06	33.50
8-13 fathoms	26.4	26.7	33.21	34.80
8- 7 fathoms	26.6	26.6	31.81	32.93
9- 4 fathoms	26.7	26.4	31.52	31.24
23- 6 fathoms	25.8	25.7	32.69	34.06
23- 4 fathoms	25.9	25.4	33.42	34.61
29- 5 fathoms	25.0	25.1	34.01	35.23
November				
6- 6 fathoms	24.4	25.1	34.79	36.02
6-12 fathoms	23.7	25.1	35.01	35.96
7- 4 fathoms	24.2	24.3	34.21	35.47