# FISHES TAKEN IN MONTHLY TRAWL SAMPLES OFFSHORE OF PINELLAS COUNTY, FLORIDA, WITH NEW ADDITIONS TO THE FISH FAUNA OF THE TAMPA BAY AREA

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ABSTRACT

Monthly collections of fishes were made at nine stations offshore of Pinellas County, Florida, from November, 1962, to June, 1963. Data on 2,317 fishes, representing 72 species, are reported. Occurrence of various species, relative abundance at certain depths and environmental descriptions are presented. Growth and other biological data are given for the 12 species most numerous in the catch. Salinity differences were not considered significant since the observed range between highest and lowest values was only 6‰. Complete temperature data with a generalized analysis are also presented. Distinctive differences in the fish fauna at depth ranges of 15 to 18 ft, 25 to 45 ft, and 75 to 105 ft are demonstrated. Fifteen of the species collected are new to the ichthyofauna of the Tampa Bay area. Another 27 species new to the area are included, although they were not taken during the study. The number of fish species reported from the Tampa Bay area is extended to 312.

## INTRODUCTION

This account, with the exception of new additions to the Tampa Bay ichthyofauna, concerns the fishes taken during sampling for adult shrimp at established stations offshore of Pinellas County from November, 1962 through June, 1963. This restriction limits the majority of the species listed to the smaller, slow-moving bottom fishes.

Data on 2,274 fish taken from November, 1962, through June, 1963 and 43 fish taken prior to this period at the same stations are included in this account. This is a relatively small number, but it represents one of the most extensive systematic collections from offshore stations in the Gulf of Mexico.

Since our study extended for only eight months, seasonal patterns exhibited by the fishes on their offshore range are not completely disclosed. Sampling was conducted only at night and may have influenced the composition of the fish catch. Sampling was limited to one or two 15-minute trawls at each station using a 16-foot trynet (otter trawl). Obviously only a representation of the species present could be collected, thus these data are interpreted by species rather than by habitat. Effort at each station was not consistent because of inclement weather and unsuitable bottom for trawling. Some stations were trawled five times during the study and others were trawled up to 13 times. Except for one of the authors (Martin), the personnel and the vessel varied during the course of the study.

Certain factors limit the value of all systematic sampling programs of offshore biotopes. Most important is the extreme difficulty of repeatedly sampling exactly the same area. The problems of determining exact position at sea are well known and need no elaboration here. We are reasonably certain that all of our samples were taken

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from the same general area at each station. Our certainty is based on compass headings, running time, approximate depth, and visual orientation points for most stations.

A primary work on the ecology of the Gulf fishes, conducted on the Texas coast, is by Gunter (1945). Many papers dealing with the biology of typical eastern Gulf of Mexico fishes of inshore, nearshore, or closely adjacent waters have appeared. The more extensive of these, in order of their geographic location from south to north, are: Longley and Hildebrand (1941) at the Tortugas Islands; Springer and McErlean (1962) at Matecumbe Key; Tabb and Manning (1961) at northern Florida Bay; Springer and Woodburn (1960) at Tampa Bay; Kilby (1955) at Cedar Keys and Bayport; Reid (1954) at Cedar Keys; Joseph and Yerger (1956) at Alligator Harbor; Miles (1951) at Apalachicola Bay; Bailey, Winn, and Smith (1954) at the Escambia River; Boschung (1957) at Mobile Bay; Gunter (1938) at Barataria Bay; and Darnell (1958) at Lake Pontchartrain. The locations of these studies are spaced over six degrees of north latitude and span approximately 1,000 linear miles of the Gulf of Mexico shoreline.

Systematic analyses of the fishes taken during commercial shrimping operations in various offshore areas for the Gulf are presented by Hildebrand (1954 and 1955) and the Florida Board of Conservation (1951). These studies, especially those of Hildebrand, provide invaluable data on commercially important areas by listing the species present and their relative abundance in the catch. Even though very little hydrographic, seasonal, or specific habitat data were included in those studies, these papers form the bulk of our ecological knowledge of the shore fishes in the eastern sector, and offshore areas generally, of the Gulf of Mexico.

Springer and Woodburn (1960) contributed significantly to our knowledge of the biology and ecological relationships of fishes in the Tampa Bay area. The present paper extends this knowledge into the offshore range of several species, thus complementing their extensive work.

## Station Location and Description

Most stations are within the region affected by tidal flushing of Tampa Bay. Each station covered an area of one square mile and, with a few exceptions (primarily the stations farthest offshore), all samples were taken within this boundary.

Two generalized bottom types were encountered: a flat bottom of hard, fine sediments isolated from any reef formations, and a flat bottom of coarse lightweight sediments in the immediate vicinity of limestone base reefs. The limestone reef environment is, according to Springer and Woodburn (1960), "one of the least known biocoenoses in the Gulf of Mexico." Phillips and Springer (1960) reported on the algae typically found on these reefs and presented a physical description of the general reef configuration. Springer and Woodburn (1960) and Moe (1963) also discussed the offshore reef environment of this general area. These reefs were avoided as much as possible during our trawling, but as damaged nets testify, we were not always successful. Many of the fishes that appeared in our nets are common in the vicinity of these reefs: sparids, pomadasyids, sciaenids, and serranids. Small pieces of rocky reef, shell, and sponge were often taken in the nets also, thus we feel that we obtained many of the smaller fishes that dwell on or around the reef.

Stations 2, 3, 4, and 6 are the only stations that yielded fish each month of the eight-month period, and these stations are essentially the basis of our analyses. A total of 2,050 fishes, representing 90.1% of the fishes taken during the eight months, were trawled at the above stations. Stations 1, 7, 8, and 9 were not always fished and then only yielded fishes sporadically because of trawling difficulties. The production at these latter stations, 267 fishes collected in 14 successful trawl hauls, supplements the data from the four main stations. The stations are grouped according to the general depth range in which they occur to facilitate comparisons. Stations 1 and 7 are respectively the shallow and deep extremes of the 1, 4, 6, and 7 grouping. Stations 8 and 9, though not thoroughly sampled, indicate extensive changes in the fish fauna of the deeper waters.

Stations 1 through 9 are mapped in Figure 1 and the physical data for stations 1, 2, 3, 4, 6, 7, 8, and 9 are cumulatively presented in Table 1. Stations 4, 6, and 7 are in an area that is frequented by commercial shrimp harvesters.

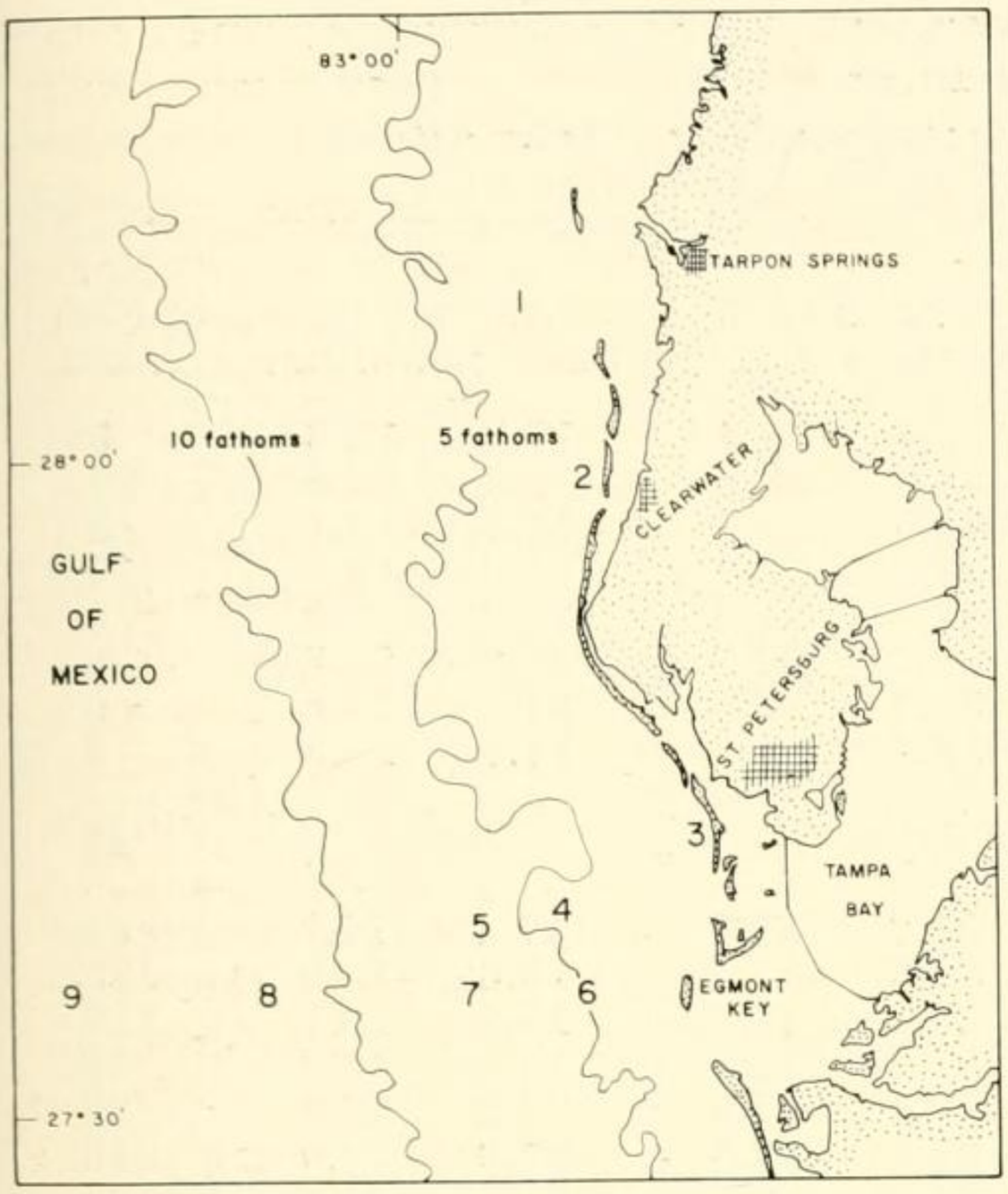


Figure 1. The Tampa Bay area and adjacent offshore waters. Numerals indicate the locations of stations 1 through 9.

## STATION 1: 28°07′N 82°54′W

Station 1 is the northernmost station and is least affected by the discharge of Tampa Bay, although the discharge of the Anclote River creates the same general environmental conditions. This station is located about four miles from the Anclote Key lighthouse of an azimuth of 228°. Depths ranged from 18 to 30 feet, but almost all specimens collected were taken within a few feet of the mean depth of 23 feet.

Station 1 was trawled five times. Suitable bottom for trawling could not easily be found and this difficulty prevented consistent sampling. Trawls were generally made on a north-south axis whenever an area of flat bottom could be found. This station was especially destructive to our nets as they frequently caught on the bottom and were damaged. This was always the first station visited, thus our operations usually took place during the early hours of the night. Station 1 typifies the general bottom type of coarse lightweight sediments in the immediate vicinity of limestone reefs.

Station 1 was visually examined by the senior author with SCUBA gear to augment the fathometer recordings. These observations were made during daylight on November 19, 1963, on the northwest quadrant of the station. A flat bottom evenly covered with lightweight, coarse sediments mixed with a finer silt covered most of the area examined. This lightweight sediment layer (30 to 50 mm deep) could easily be disturbed and produced a dense cloud that settled in a matter of minutes. The sediments became more compact and finer grained as they extended downward. The sediment surface was investigated to a depth of about 165 mm. Many small pieces of shell and coral were recognizable, and these became more frequent and larger as the sediments graded into the rocky patch reef. There were one major and several minor patches of limestone rock reef in the area examined, a total of about 900 square yards of bottom. These rocky areas were 2 to 3 feet high and were very irregular with many cliffs, caves, and crevices. These reef areas were the center of almost all observed life. Attached invertebrates were profuse and formed much of the reef cover. Several large loggerhead sponges, *Spheciospongia (vesparia?)*, were observed. One was measured and was approximately four feet high and three feet across. Much of the general area offshore of Tarpon Springs has been described to a limited degree by Dawson and Smith (1953) and de Laubenfels (1953) in conjunction with surveys on sponge disease.

Many fish were observed during the dive, but few of these were taken during the sampling at night. Larger serranids, sparids, and pomadasyids were seen most frequently.

## STATION 2: 27°58′30″N 82°51′W

This station is located due west of Clearwater Beach about one mile offshore of the surf line. The buoy lights of the ship channel to the south and prominent shore lights allowed rapid orientation during night sampling. Depths varied from 15 to 20 feet.

Sampling conditions were always excellent at this station, thus a relatively large number of trawl hauls was made. Trawl hauls were made parallel to the beach, and always yielded many small fishes.

Station 2 typifies the general bottom type of a flat surface of hard, fine sediments isolated from any reef formations. Visual examination was made by the senior author during daylight on November 19, 1963, and the following observations were recorded. The bottom was hard, flat, marked with low ripples, and consisted of homogeneous sedi-

TABLE 1

*Data summary for all stations from November, 1962 to June, 1963. All tows were made with a trynet unless otherwise specified.*

| Station | Date | No. of Tows | Depth (Ft.) | Salinity ‰ Surface | Salinity ‰ Bottom | Temp. °C Surface | Temp. °C Bottom | No. of Fish Taken |
|---|---|---|---|---|---|---|---|---|
| 1. | Nov. 14, 1962 | 1 | 24 | 34.4 | 34.4 | 17.8 | 17.8 | 5 |
| | Dec. 19, 1962 | 1 | 23 | 33.4 | 33.8 | 13.3 | 12.4 | 17 |
| | Jan. 15, 1963 | 1 | 18 | 34.5 | 34.8 | 15.1 | 15.1 | 5 |
| | Feb. 23, 1963 | 2 | 22 | 31.2 | 33.4 | 14.6 | 14.3 | 14 |
| | Mar. 18, 1963 | 0 | 25 | 32.1 | 32.8 | 23.2 | 22.0 | 0 |
| | Apr. 17, 1963 | 0 | 26 | 35.0 | 34.7 | 21.2 | 21.2 | 0 |
| | May 12, 1963 | 1 (dredge) | 28 | 34.9 | 34.9 | 24.2 | 24.6 | 0 |
| | June 4, 1963 | 1 | 24 | 36.7 | 36.3 | 27.7 | 27.9 | 0 |
| | TOTALS | 7 | | | | | | 41 |
| 2. | Nov. 14, 1962 | 1 | 18 | 33.2 | 33.4 | 17.4 | 17.9 | 48 |
| | Dec. 19, 1962 | 1 | 17 | 32.3 | 33.4 | 13.6 | 12.5 | 195 |
| | Jan. 15, 1963 | 2 | 16 | 35.1 | 34.4 | 15.3 | 15.4 | 119 |
| | Feb. 23, 1963 | 2 | 20 | 31.8 | 32.9 | 14.6 | 14.4 | 32 |
| | Mar. 18, 1963 | 2 | 15 | 32.1 | 32.5 | 24.2 | 23.8 | 78 |
| | Apr. 17, 1963 | 1 | 18 | 34.5 | 34.0 | 22.0 | 22.0 | 45 |
| | May 13, 1963 | 1 | 18 | 34.9 | 35.5 | 25.0 | 24.6 | 39 |
| | June 4, 1963 | 1 | 15 | 36.1 | 35.8 | 27.8 | 28.0 | 7 |
| | June 7, 1963 | 1 | 15 | 36.0 | 35.7 | — | — | 78 |
| | TOTALS | 12 | | | | | | 641 |
| 9. | Nov. 15, 1962 | 1 | 18 | 32.6 | 32.5 | 17.9 | 17.9 | 34 |
| | Dec. 20, 1962 | 2 | 17 | 33.5 | 34.1 | 13.6 | 13.3 | 274 |
| | Jan. 16, 1963 | 2 | 19 | 34.8 | 35.1 | 16.0 | 16.0 | 44 |
| | Feb. 24, 1963 | 2 | 18 | 32.8 | 33.0 | 15.9 | 15.5 | 35 |
| | Mar. 19, 1963 | 2 | 15 | 32.8 | 33.2 | 23.8 | 22.4 | 394 |
| | Apr. 18, 1963 | 1 | 16 | 34.5 | 34.6 | 21.9 | 21.9 | 65 |
| | May 13, 1963 | 1 | 12 | 35.6 | 36.2 | 25.0 | 23.7 | 17 |
| | June 5, 1963 | 1 | 12 | 36.6 | 36.6 | 28.2 | 28.5 | 3 |
| | June 6, 1963 | 1 | 15 | 36.1 | 36.6 | 28.3 | 28.5 | 61 |
| | TOTALS | 13 | | | | | | 927 |
| 4. | Nov. 15, 1962 | 1 | 30 | 33.6 | 34.6 | 18.6 | 18.6 | 11 |
| | Dec. 20, 1962 | 1 | 32 | 34.0 | 34.6 | 13.6 | 13.9 | 0 |
| | Jan. 16, 1963 | 1 | 30 | 34.7 | 35.7 | 16.0 | 16.0 | 11 |
| | Feb. 24, 1963 | 2 | 28 | 34.0 | 34.4 | 15.5 | 15.4 | 23 |
| | Mar. 19, 1963 | 2 | 30 | 34.0 | 33.8 | 23.2 | 21.5 | 68 |
| | Apr. 18, 1963 | 1 | 33 | 35.9 | 35.8 | 21.7 | 21.5 | 20 |
| | May 13, 1963 | 1 | 30 | 36.8 | 37.0 | 24.6 | 22.0 | 5 |
| | June 5, 1963 | 1 | 27 | 36.8 | 36.8 | 27.5 | 27.5 | 9 |
| | June 6, 1963 | 1 | 27 | 36.1 | 36.0 | 27.9 | 27.0 | 27 |
| | TOTALS | 11 | | | | | | 174 |
| 5. | Discontinued prior to 8 months study. | | | | | | | |
| 6. | Nov. 15, 1962 | 1 | 30 | 33.1 | 35.5 | 18.4 | 18.4 | 10 |
| | Dec. 20, 1962 | 2 | 30 | 33.4 | 34.7 | 14.5 | 14.6 | 105 |
| | Jan. 16, 1963 | 2 | 29 | 35.5 | 36.0 | 16.2 | 17.0 | 44 |
| | Feb. 24, 1963 | 1 | 32 | 33.5 | 33.3 | 15.8 | 16.4 | 24 |
| | Mar. 19, 1963 | 1 | 30 | 34.8 | 34.3 | 23.9 | 23.8 | 28 |
| | Apr. 18, 1963 | 1 | 30 | 36.8 | 35.7 | 21.2 | 21.0 | 26 |
| | May 13, 1963 | 1 | 31 | 36.9 | 36.8 | 22.8 | 22.5 | 5 |
| | June 6, 1963 | 1 | 27 | 36.3 | 36.3 | 28.0 | 27.7 | 23 |
| | TOTALS | 10 | | | | | | 265 |

TABLE 1 (Continued)

| Station | Date | No. of Tows | Depth (Ft.) | Salinity ‰ Surface | Salinity ‰ Bottom | Temp. °C Surface | Temp. °C Bottom | No. of Fish Taken |
|---|---|---|---|---|---|---|---|---|
| 7. | Nov. | 0 | | | | | | 0 |
| | Dec. 21, 1962 | 2 | 42 | 35.0 | 35.1 | 16.1 | 15.7 | 7 |
| | Jan. 16, 1963 | 1 | 50 | 35.8 | 36.2 | 16.2 | 16.6 | 9 |
| | Feb. 24, 1963 | 2 | 50 | 34.5 | 34.6 | 16.0 | 16.2 | 4 |
| | Mar. 20, 1963 | 1 | 42 | 34.4 | 34.3 | 22.7 | 20.1 | 23 |
| | Apr. 18, 1963 | 1 | 48 | 36.9 | 36.9 | 20.4 | 19.3 | 14 |
| | May 13, 1963 | 1 | 44 | 36.2 | 36.4 | 21.2 | 23.3 | 0 |
| | June 5, 1963 | 0 | | | | | | 0 |
| | TOTALS | 8 | | | | | | 57 |
| 8. | Nov. | 0 | | | | | | 0 |
| | Dec. | 0 | | | | | | 0 |
| | Jan. 17, 1963 | 1 | 70 | 36.8 | 36.3 | 17.4 | 17.3 | 3 |
| | Feb. 25, 1963 | 1 | 84 | 35.4 | 35.7 | 16.4 | 16.6 | 4 |
| | Mar. 20, 1963 | 1 | 72 | 34.8 | 34.7 | 22.4 | 18.3 | 0 |
| | Apr.18, 1963 | 1 | 81 | 36.8 | 36.5 | 20.3 | 18.3 | 3 |
| | May 14, 1963 | 1 (dredge) | 81 | 35.8 | 36.4 | 23.5 | 21.0 | 0 |
| | June 6, 1963 | 0 | | | | | | 0 |
| | TOTALS | 5 | | | | | | 10 |
| 9. | Nov. | 0 | | | | | | 0 |
| | Dec. | 0 | | | | | | 0 |
| | Jan. | 0 | | | | | | 0 |
| | Feb. 25, 1963 | 1 | 102 | 35.7 | 35.8 | 17.2 | 17.6 | 9 |
| | Mar. 20,, 1963 | 1 | 100 | 36.1 | 36.0 | 21.2 | 16.2 | 0 |
| | Apr. 18, 1963 | 0 | 108 | 36.5 | 37.5 | 21.0 | 19.0 | 0 |
| | May 14, 1963 | 1 (dredge) | 108 | 35.8 | 36.9 | 23.2 | 22.0 | 0 |
| | June 6, 1963 | 2 | 105 | 37.2 | 36.8 | 27.0 | 22.8 | 150 |
| | TOTALS | 5 | | | | | | 159 |

Total number of fish taken from all nine stations ..... 2274
Fish taken prior to November, 1962 ..... 43

TOTAL 2317

ment layers. The surface layer was very lightweight and consisted of a brown, organic, drifting material which was concentrated in shallow depressions and between the crests of the bottom ripples. The primary sediment layer consisted of sand and bits of shell and coral which produced a silty cloud when disturbed and appeared to be of the same composition as, but more finely grained than, the analogous sediments of the first station. This primary sediment layer was about 50 mm thick and gradually graded into compact gray clay infused with particles of shell. Approximately 600 sqaure yards were examined at the offshore edge of station 2. No fish were observed, but visibility was limited to about eight feet. The most abundant animal was an anemone, *Anemonia sargassensis*, which was attached to everything that offered a large enough base, including parchment worm tubes, shells, sticks and other organic debris.

STATION 3: 27°43′N 82°45′W

This station is located offshore of St. Petersburg Beach about one mile west of the surf line and offshore of the Don-Ce-Sar building. Depths ranged from 12 to 19 feet, although the extreme variations from the mean of 16 feet were usually not frequent.

This station was sampled most (thirteen 15-minute trawls, one more than station 2) and produced the greatest number of fishes. Trawling operations were conducted parallel to the beach, and depth was consistent during each haul. Trawling was always smooth and no rock or other irregularities were detected by the net or fathometer.

The topography of stations 2 and 3 are the same. These two stations represent the

same general habitat and are often grouped together in the analysis of data.

STATION 4: 27°39′N 82°52′W

This station is located about 2¾ miles due north of the entrance to the Egmont ship channel. Depths ranged from 27 to 33 feet and the mean depth was 30 feet. Little difficulty was experienced in finding and trawling this area.

This station had a bottom type intermediate to stations 1 and 2. Reef formations were present, but of such low relief that trawling was not hindered. Although visual examinations were not attempted, fathometer recordings and net production suggest that the general bottom configuration consisted of hard flat sediments with occasional low rocky reef areas and patches of shell.

STATION 5: 27°39′N 82°56′30″W

This station is located approximately 5 miles due west of station 4. It is most analogous to station 1, although it exhibits a greater extent of rugged limestone reef. Sampling was discontinued in June, 1962, because trawling was not feasible on the rugged bottom, and it is not part of our eight-month study. It is mentioned because it contributed a few specimens to our collection before being discontinued.

STATION 6: 27°34′45″N 82°51′W

This station is located approximately 0.2 miles due west of Buoy R-2, at the mouth of the Egmont Ship Channel, on an azimuth of 253° from the Egmont Key Lighthouse. Depths ranged from 27 to 32 feet with a mean of 30 feet. Difficulties were seldom encountered during trawling operations. This station is most analogous to station 4 in depth and bottom composition, although there seemed to be fewer and less extensive patches of low reef and shell. For our purposes, stations 4 and 6 represent the same general habitat.

STATION 7: 27°35′N 82°56′W

This station is located about 1 mile due west of the sea buoy of the Egmont Ship Channel. Sampling at this station began in December, 1962, and continued through April, 1963. May and June samples were not taken because of lack of suitable bottom for trawling. Depths ranged from 42 to 52 feet and the mean depth was 46 feet. Location was indefinite at these distant offshore stations since visual reference points were either vague or absent. Depth and running time due west of the sea buoy were the criteria for station identification. Gross error in locating station 7 was avoided since the sea buoy was nearby.

Operational difficulties similar to those at station 1 were encountered. Depth varied during trawling to a greater extent at this station than at the others. Bottom contours recorded on the fathometer included slopes and reef formations. The physical description of station 1 is generally applicable to station 7.

STATION 8: 27°35′N 83°07′W

This station is located about 20 miles due west of Egmont Key. Depth and running time from the Egmont channel sea buoy were the criteria for station location. This station was sampled once a month from January through May at depths ranging from 70 to 84 feet, and averaging 77.4 feet. The bottom type of station 8 appears similar to that of station 7.

STATION 9: 27°35′N 83°17′W

This station is located about 30 miles due west of Egmont Key. Depth and running time were also employed to locate this station each month. Samples were taken during four months. Depths ranged from 98 to 108 feet and averaged 100 feet. The bottom type is basically similar to stations 1, 5, 7, and 8.

## Temperature and Salinity

Salinity differences between stations during this eight-month period were not great enough to be considered significant. Surface salinities ranged from 31.2 ‰ at station 1 in February to 37.2 ‰ at station 9 in June. Bottom salinities ranged from 32.8 ‰ at station 1 in March to 37.5 ‰ at station 9 in April. There was a difference of only 6.3 ‰ between the highest and lowest recorded salinity during the eight months of the study. The greatest range at any station, irrespective of surface or bottom reading, was 5.5 ‰ at station 1 and the smallest range was 1.8 ‰ at station 9. Salinity tended to gradually incrase from November to June and gradually increased and stabilized with depth.

Temperatures were generally lowest during December, ranging from 12.4°C to 16.1°C at stations 1 through 7. The highest

temperatures were taken in June and ranged from 27.6°C to 28.4°C at stations 1 through 6. The greatest range between surface and bottom (4.2°C) was recorded at station 9 during June in 105 feet of water. At the shallow and mid-depth groups, stations 2 and 3, and stations 1, 4, 6, and 7, average surface and bottom temperatures did not vary more than 1°C during any one month. Temperatures were lowest in December, January and February, and rose sharply about 8°C in March. After a small drop in April, they rose steadily through June. Data are incomplete for stations 8 and 9, but the same general pattern of temperature change was present for surface temperatures. Bottom temperatures for this depth group did not fluctuate as rapidly as the shallow groups and lagged noticeably behind the surface readings during the spring temperature rise. All readings were taken at night.

## Methods and Materials

Trips were conducted on board chartered commercial fishing vessels. These vessels were all equipped with fathometers which were used in determining depth and finding trawlable areas. A 16-foot balloon trynet (otter trawl) was the basic gear used for the collection of shrimp and fish. Whiteleather (1948) stated that the balloon trawl is built to open high and full at the mouth allowing the net to take fish well off the bottom. Nets were constructed of tarred, number 15 Duracot twine tied at a 2-inch stretched mesh. The 3-foot cod end was constructed of 1-inch stretched mesh. The head rope or cork line included floats and measured 18 feet, and the foot rope or lead line measured 18½ feet. These were attached to 30 by 15 inch wooden otter doors.

Hildebrand (1954) mentions that the fishing effort of otter trawls, measured in units of time per tow, is vague because the fishing characteristics of these nets have not been analyzed. However, some recent articles of analytical nature are based on observations, measurements, and photographs of otter trawls in operation (Sand, 1959; de Boer, 1959; and Scharfe, 1959). It is still difficult to standardize otter trawl operations. Some variables that prevent units of time from being accepted as exact standards are, nonuniformity in rigging of the nets, variation in net shapes, differences in weights affixed to the foot rope, speed and other variables of the vessels, and sweep of the net both empty and full. We kept our nets as standard as possible during the study to allow a general comparison of effort on a unit of time basis. The foot rope was always weighted with chain rather than lead and whenever the net was changed due to loss or damage the same style of rigging was used. The net was always set on the surface off the stern and any fouling was cleared before the net was lowered. Evidences of proper operation were obtained through yields of large amounts of flora and fauna characteristic of the bottom habitat.

On three occasions a steel dredge, 37 inches long, 30 inches wide and 14 inches high with a ¾-inch expanded metal liner was used when the bottom was too rugged to effectively use the trynet. The dredge was productive only at station 9, before the beginning of our eight-month study. This dredge sample yielded seven species of reef dwellers that were not taken at any other station.

Temperatures were determined *in situ* with a Whitney Underwater Thermometer Model TC 10 (Whitney Underwater Instruments, Box 521, San Luis Obispo, California) and later in the study with an Electrodeless Induction Salinometer Model RS-5 (Industrial Instruments Inc., 89 Commerce Road, Cedar Grove, Essex County, New Jersey). Before use of the salinometer, salinities were determined with calibrated salinometer bulbs (G. M. Manufacturing Company, 12 East 12th Street, New York, New York) and the readings then corrected for temperature.

Specimens were preserved in 10% formalin. A representative sample of each species was retained after counting and usually after measurement when large amounts of certain species were taken in a single trawl. All fishes retained from these collections are deposited in the collection of the Florida Board of Conservation Marine Laboratory.

Fishes taken during the first 10 months of the offshore sampling program, when specimens were only casually collected for the laboratory's ichthyological reference collection, are also included in this account. These 43 fishes were taken with the same gear (15 by dredge and 28 by trynet) and at the same stations as those during the eight months of our study. Their inclusion supple-

TABLE 2

*Fishes taken in offshore waters of Pinellas Co., Florida*

| Species | approximate depths 15′ to 18′ Stations 2 | 3 | 25′ to 45′ Stations 1 | 4 | 5 | 6 | 7 | 75′ to 105′ Stations 8 | 9 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| *Gymnura micrura* | – | 2 | – | – | 1 | – | – | – | – | 3 |
| *Harengula pensacolae* | – | 3 | – | – | – | – | – | – | – | 3 |
| *Synodus intermedius* | – | – | 1 | 1 | – | 2 | 2 | 2 | 1 | 9 |
| *Bagre marinus* | 1 | – | – | – | – | – | – | – | – | 1 |
| *Galeichthys felis* | – | 13 | – | – | – | – | – | – | – | 13 |
| *Urophycis floridanus* | 1 | – | – | 1 | – | – | 1 | – | – | 3 |
| *Centropristes melanus* | 5 | 2 | 2 | – | – | 2 | – | – | – | 11 |
| *Diplectrum formosum* | 3 | 2 | 1 | 8 | – | 11 | 4 | – | 5 | 34 |
| *Ephinephelus morio* | 1 | – | 1 | – | – | – | – | – | – | 2 |
| *Serranus subligarius* | – | – | – | – | – | – | – | – | 1*** | 1 |
| *Serranus pumilio* | – | – | – | – | – | – | – | – | 1*** | 1 |
| *Lutjanus synagris** | 4 | 4 | – | – | – | 1 | – | – | – | 9 |
| *Apogon alutus* | – | – | 1 | – | – | – | – | – | 1*** | 2 |
| *Apogon conklini* | – | – | – | – | – | – | – | 1 | – | 1 |
| *Apogon pseudomaculatus** | – | – | – | – | – | – | – | | 1*** | 1 |
| *Eucinostomus gula* | 6 | 4 | – | 2 | – | 3 | – | – | – | 15 |
| *Haemulon plumieri* | – | – | 1 | – | – | – | – | – | – | 1 |
| *Orthopristis chrysopterus* | 186 | 123 | 9 | 12 | – | 22 | 23 | 1 | – | 376 |
| *Bairdiella chrysura* | 98 | 247 | 3 | – | – | 1 | – | – | – | 349 |
| *Cynoscion arenarius* | – | 3 | – | – | – | 1 | – | – | – | 4 |
| *Cynoscion nebulosus* | – | – | 1 | – | – | – | – | – | – | 1 |
| *Equetus lanceolatus* | – | – | – | – | – | – | – | 2 | – | 2 |
| *Leiostomus xanthurus* | 16 | 16 | – | – | – | 3 | – | – | – | 35 |
| *Menticirrhus americanus* | 12 | 51 | – | – | – | 7 | – | – | – | 70 |
| *Menticirrhus littoralis* | 2 | 1 | – | – | – | – | – | – | – | 3 |
| *Micropogon undulatus* | – | – | – | – | – | 2 | – | – | – | 2 |
| *Calamus artifrons* | – | – | 3 | – | – | – | – | 1 | – | 4 |
| *Diplodus holbrooki* | – | – | 8 | – | – | – | – | – | – | 8 |
| *Lagodon rhomboides* | 198 | 322 | 8 | 13 | – | 47 | 2 | – | – | 590 |
| *Chaetodipterus faber* | 5 | 5 | 1 | – | – | 4 | – | – | – | 15 |
| *Chromis enchrysurus** | – | – | – | – | – | – | – | – | 3*** | 3 |
| *Ioglossus calliurus* | – | – | – | – | – | – | – | 1 | – | 1 |
| *Garmannia macrodon* | – | – | – | – | – | – | – | – | 1*** | 1 |
| *Scorpaena brasiliensis* | 2 | – | 1 | – | – | 1 | 1 | 2 | – | 7 |
| *Scorpaena calcarata** | – | – | – | – | – | – | – | 1 | 4 | 5 |
| *Bellator militaris* | – | 1 | – | – | – | – | – | – | – | 1 |
| *Prionotus pectoralis* | – | 3 | – | 1 | – | 1 | – | – | 1 | 6 |
| *Prionotus roseus** | – | – | – | – | – | – | – | – | 4 | 4 |
| *Prionotus scitulus latifrons* | 28 | 47 | – | 88 | – | 90 | 12 | – | – | 265 |
| *Prionotus tribulus crassiceps* | 9 | 15 | 1 | – | – | 2 | – | 1 | – | 28 |
| *Astoscopus y-graecum* | – | – | – | 1 | – | – | – | – | – | 1 |
| *Blennius marmoreus* | – | – | – | – | – | – | – | – | 2*** | 2 |
| *Ophidion beani** | – | – | – | – | – | – | 1 | – | – | 1 |
| *Otophidion grayi** | – | – | – | – | – | – | 1 | – | – | 1 |
| *Ophidion holbrooki* | – | 1 | – | – | – | – | 1 | – | – | 2 |
| *Ophidion welshi** | 1 | 3 | – | – | – | – | 2 | – | – | 6 |
| *Lepophidium jeannae** | – | – | – | – | – | – | – | – | 1 | 1 |
| *Peprilus alepidotus* | 2 | 7 | – | – | – | – | – | – | – | 9 |
| *Ancylopsetta quadrocellata** | 4 | 1 | – | – | – | – | – | – | – | 5 |
| *Bothus ocellatuso* | – | – | – | – | – | 1 | – | – | 1 | 2 |
| *Bothus ocellatus** | – | – | – | – | – | 1 | 1 | – | – | 2 |
| *Citharichthys macrops** | – | – | – | 5 | – | 1 | 1 | – | 4 | 11 |
| *Cyclopsetta fimbriata** | – | – | – | – | – | – | – | 1 | – | 1 |

TABLE 2 (Continued)

| | approximate depths 15′ to 18′ Stations | | 25′ to 45′ Stations | | | | | 75′ to 105′ Stations | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 1 | 4 | 5 | 6 | 7 | 8 | 9 | |
| *Etropus crossotus atlanticus* | 11 | 14 | – | 19 | – | 21 | – | – | – | 65 |
| *Etropus rimosus** | – | – | – | – | – | – | – | – | 57 | 57 |
| *Paralichthys albigutta* | 8 | – | – | – | – | 1 | 3 | – | – | 12 |
| *Syacium papillosum** | – | 2 | – | – | – | 8 | – | – | 67 | 77 |
| *Achirus lineatus** | – | 1 | – | – | – | – | – | – | – | 1 |
| *Symphurus diomedianus** | – | – | – | – | – | – | – | – | 3 | 3 |
| *Symphurus plagiusa* | 33 | 28 | 1 | 20 | – | 26 | 2 | 3 | – | 113 |
| *Gobiesox strumosus* | – | – | – | – | – | – | – | – | 1*** | 1 |
| *Alutera schoepfi* | – | 2 | – | – | – | – | – | – | – | 2 |
| *Stephanolepis hispidus* | 1 | – | – | – | – | – | – | – | 4 | 5 |
| *Lactophrys quadricornis* | 2 | 3 | 3 | – | – | 1 | – | – | – | 9 |
| *Sphaeroides nephelus* | 1 | – | – | – | – | – | – | – | – | 1 |
| *Chilomycterus schoepfi* | 1 | 1 | – | – | – | – | – | – | – | 2 |
| *Diodon holocanthus** | 2 | – | – | – | – | – | – | – | – | 2 |
| *Opsanus pardus* | – | – | 1 | – | – | 1 | – | – | – | 2 |
| *Porichthys porosissimus* | 1 | 6 | – | 4 | 2 | 4 | – | 1 | 1 | 19 |
| *Antennarius ocellatus* | – | – | – | – | – | 1 | – | – | 3*** | 4 |
| *Ogcocephalus cubifrons* | 1 | – | – | – | – | – | – | – | – | 1 |
| *Halieutichthys aculeatus** | – | – | – | – | – | – | – | – | 7 | 7 |
| TOTALS | 645 | 933 | 47 | 175 | 3 | 266 | 57 | 17 | 174 | 2317** |
| EFFORT (Number of 15-minute trawls during 8-month survey period) | 12 | 13 | 7 | 11 | – | 10 | 7 | 5 | 5 | |
| NUMBER OF SPECIES: | | | | | | | | | | |
| by depth divisions | 39 | | 41 | | | | | 30 | | |
| by station | 30 | 30 | 18 | 13 | 2 | 27 | 15 | 12 | 23 | |

* Not reported from the Gulf of Mexico in the area of Tampa Bay by Springer and Woodburn (1960) during the period of their study, but recorded by them from Tampa Bay, Old Tampa Bay, or Boca Ciega Bay.
** Including 43 fishes taken prior to November, 1962.
*** Fishes taken by dredge June 5, 1962 (37.1 ‰, 21.8°C)

ments the species taken during that period, although their data do not contribute to our species analyses.

Measurments were made on a standard 1-meter fish measuring board, usually after the fishes had been in 10% formalin for several days. In instances when the catch was extensive, measurements were made aboard the collection vessel. Fork length (FL) was taken on fishes with forked tails and total length (TL) was taken on fishes with lunate or truncate tails. Standard length (SL) is given wherever possible to facilitate comparison with other studies, but it was not taken consistently since it was not considered an accurate field measurement on small fishes.

Tables and graphs are based on either TL or FL, although the approximate SL for each 3 mm grouping is also listed. These standard lengths were obtained from fishes that were retained and do not represent the entire number collected; thus they are considered approximate, but accurate enough for comparative purposes.

## SYSTEMATIC ACCOUNT

Nomenclature and phyletic family listing follow the presentation of the American

Fisheries Society (Bailey *et al.*, 1960). Only bottom temperatures are mentioned in the text unless otherwise stated. Figure 2 identifies the various graph symbols used in Figures 3 through 5. The 12 species of fishes that were most numerous (89.4% of the total catch) are discussed individually, and Table 2 summarizes the data for all species.

### *Diplectrum formosum* (Linnaeus), Sand Perch

This species, unlike *Centropristes melanus* which commonly dwells on the reef areas, is usually found on the sandy interstices between reef formations. We collected 34 individuals, 99 to 229 mm TL, distributed through every month and every station except station 8. The largest collection, five individuals, occurred in June at station 9. Stations 4 and 6 yielded 56% of our specimens of sand perch. The only evident distributional pattern in regard to month or station was the occurrence of the largest fish on the stations farthest offshore, 7 and 9. Our data agree with the findings of Longley and Hildebrand (1941), Reid (1954) and Hildebrand (1955) who reported *D. formosum* from deep, sandy bottoms. This species is usually evident in the catches of party boats and during SCUBA diving excursions.

### *Orthopristis chrysopterus* (Linnaeus), Pigfish

This species was taken during every month and was the second most numerous fish, 376 individuals, in our total catch. Springer and Woodburn (1960) presented an extensive analysis of the occurrence of young pigfish in Tampa Bay during the course of their study. Our data (Figure 2) supplement theirs by extending the area of investigation into the offshore waters. The months of our largest collections were December through March. These months are the period of scarcity for species on the inshore grounds as both Springer and Woodburn *(op. cit.)* and Reid (1954) indicated. The size range of our November through January collections from stations 2 and 3 corresponds to the October through December collections of Reid *(op. cit.)* and Springer and Woodburn *(op. cit.)*. Our data indicate that these fish, which apparently move to offshore locations, remain offshore and undergo more rapid growth with the advent of warmer temperatures. The lowest temperature at which this species was taken was 12.5°C.

*O. chrysopterus* is common in the more northern and more saline coastal environments of the Gulf. As Springer and Woodburn mentioned, its abundance in shallower coastal waters decreases in southern Florida. Hildebrand (1955) commented that this species was common in 6 to 10 fathoms on the pink shrimp grounds in the Gulf of Campeche during February and July, and Tabb and Manning (1961) classified them as abundant in Joe Kemp-Conchie Channel during the cold winter of 1957-58. The pigfish may be more abundant offshore than inshore in the southern regions of the Gulf of Mexico.

### *Bairdiella chrysura* (Lacepede), Silver perch

This species was the third most numerous, 349 individuals, in our total catch. With the exception of four large specimens taken in deep waters, all silver perch were collected from our shallowest depth range, stations 2 and 3. Station 3, the sampling area nearest to Tampa Bay, produced 71.8% of the total collected. *B. chrysura* was present in our collections during every month except May, but was poorly represented during April and February. Springer and Woodburn (1960) did not take this species in April and took only the very young during May; however, their gear was not effective for the larger fish. Spawning for this species probably takes place about that time as Springer and Woodburn (1960), Reid (1954) and Gunter (1963) took the first young of the year in May.

We assume that the paucity of specimens in our collections for April and May is due to a spawning migration to inshore waters. Springer and Woodburn (1960) concurred with Gunter (1945) that spawning takes place in the bays. Our June collection is indicative of a return to the Gulf after spawning. Four individuals from the June collection were examined; two were gravid females (160 and 173 mm TL) with well-developed ova, and two were males (153 and 156 mm TL) in gross appearance, although sperm were not observed. This indicates that spawning may continue into June in the Tampa Bay area. The length and time of the spawning season may vary with annual me-

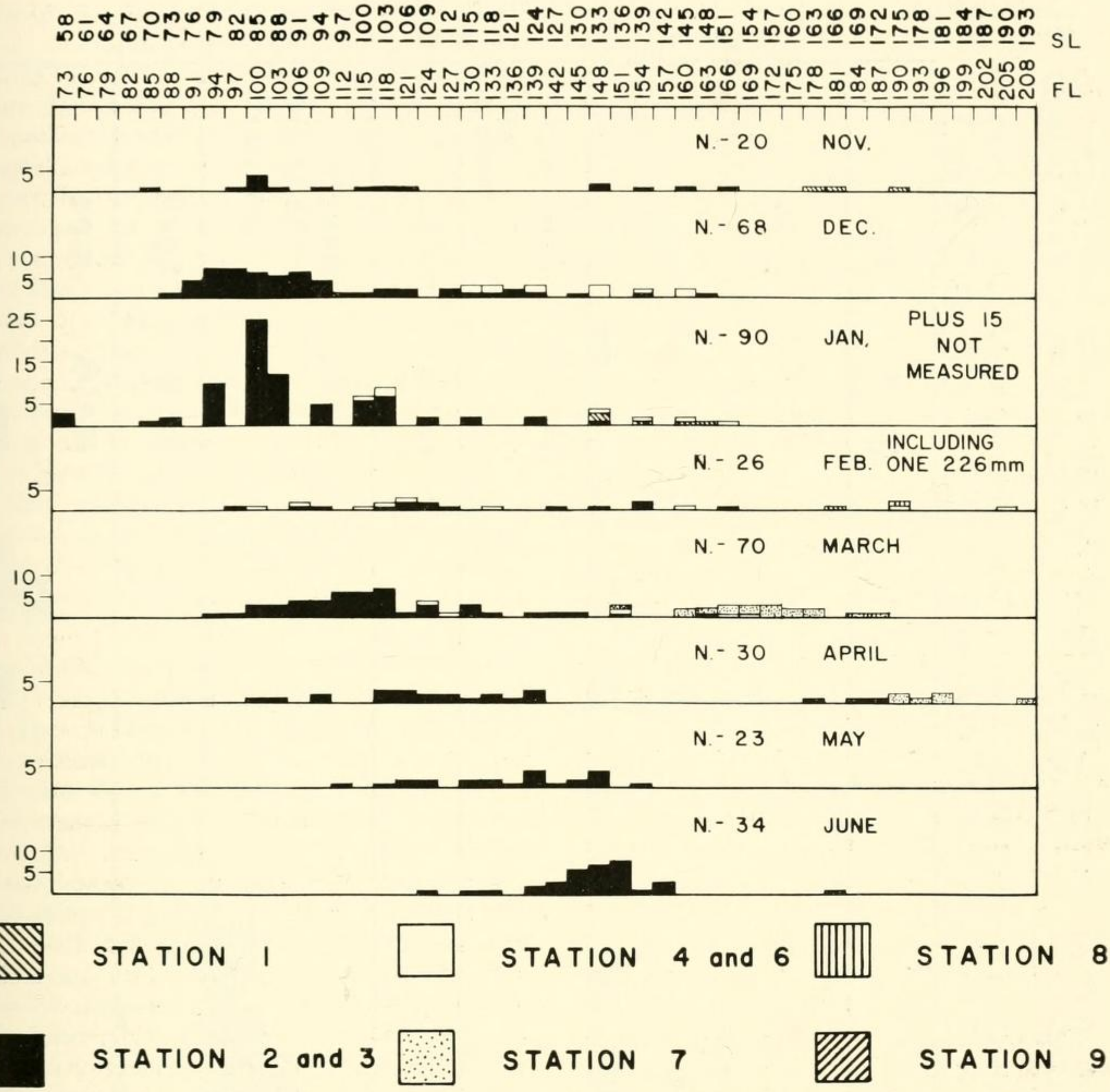


Figure 2. Monthly length-frequency dis- tributions of *Orthopristis chrysopterus*.

teorological conditions. Tabb and Manning (1961) collected running ripe silver perch during late February in the Florida Bay area, and Joseph and Yerger (1956) mentioned collecting young in June and September. Gunter (1945) reported that *B. chrysura* spawns during rising temperatures and moves into the open Gulf waters in fall and winter.

Our data (Figure 3) illustrate that the November and the large December collections approximate the size range of the specimens that both Springer and Woodburn (1960) and Reid (1954) took during those months. Growth in this first year class appears to speed up as the water warms. Gunter (1938) suggested that the life history of this species is short and implied that sexual maturity may be achieved during the first year. The normal life history probably spans only two annual cycles.

*Leiostomus xanthurus* (Lacepede), Spot

A total of 35 spot was collected from December through June. All of these, with the exception of three from station 6, were taken at stations 2 and 3. The collections for December and June represent 77.1% of total spot taken. Our specimens ranged in size from 125 to 205 mm TL. There were no tendencies toward monthly increments or regressions in size evident in our samples. *L. xanthurus* (particularly juveniles) is very abundant in coastal areas from Tampa Bay northward along the Gulf Coast. Bailey *et al* (1954) and Gunter (1963) recorded the

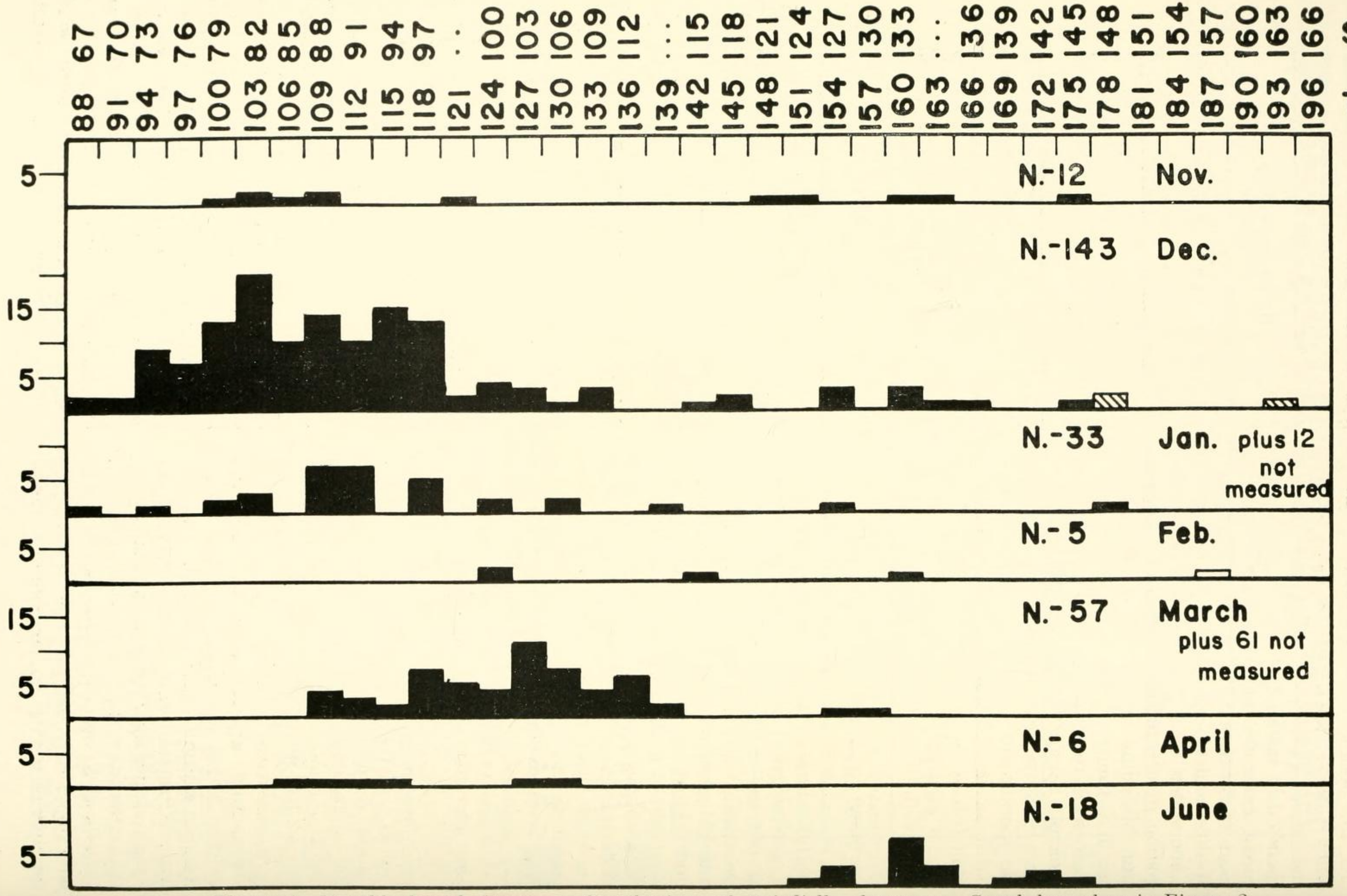


Figure 3. Monthly length-frequency distributions of *Bairdiella chryssura*. Graph legend as in Figure 2.

young of this species from freshwater habitats, and Springer and Woodburn (1960), Kilby (1955), Joseph and Yerger (1956), and Miles (1951) all listed the spot as abundant in shallow waters. There is an apparent movement of young spot from inshore to offshore waters as they grow, and Springer and Woodburn *(op. cit.)* postulated a late winter spawning and an offshore migration in late summer for the Tampa Bay area. Spawning occurs primarily in December and January along the South Carolina coast with two and three-year-olds as the principle spawners (Dawson, 1958). Gunter (1938) suggested that the life cycle of the spot is short. Our findings of only a rather small, randomly sized population of adult fish in the offshore waters during and several months after the peak of spawning agree with the findings of the above authors.

*Menticirrhus americanus* (Linnaeus), Southern kingfish

This whiting was taken every month except November and May. Fifty-six percent of our 70 specimens were taken during December. All but seven individuals were collected at stations 2 and 3. Sizes ranged from 132 to 281 mm TL. The smallest fish was taken in January and the largest in April. As with the spot, no monthly size increments or regressions were evident. The gonads of specimens collected in February were examined, but were not ripe and sex was not distinguishable. One female (280 mm TL, station 2) was found among the four fish examined from the March collection. The other three (208 to 214 mm TL, station 3) appeared to be males. One female (216 mm TL) and one apparent male (214 mm TL) occurred in the April collection at station 3, and one female (186 mm TL) and an apparent male (191 mm TL) from station 2 comprised the June collection. All females had well-developed ova.

*M. americanus* is uncommon in waters of low salinity and according to Hildebrand (1954, 1955) and Miles (1951) it is the common whiting of the open Gulf. Our data indicate that the adults are commonest in the open Gulf during the winter and that spawning occurs from March to at least June. This agrees with Springer and Woodburn (1960) who suggested a May and June spawning at the time of their study, and Gunter (1945) who mentioned that this whiting leaves the bays in the winter.

*Lagodon rhomboides* (Linnaeus), Pinfish

The pinfish is one of the most abundant and characteristic fishes along the coastal region of the eastern and northeastern Gulf of Mexico. This species was taken during every month except November and, although it varied greatly in monthly abundance, it was the most numerous fish (590 individuals) in our total catch. Our data (Figure 4) will be discussed only where it adds to the findings of Caldwell (1957) and Springer and Woodburn (1960).

Pinfish first appeared in our collections in December. This December collection was the largest single collection of any species at any time during our study. The 261 individuals were taken at both the shallow and mid-depth stations with a strong pattern of size distribution according to depth evident. The size range of the smaller fishes (79 to 109 mm TL) from the shallower stations, 2 and 3, closely approximates the size ranges of the first year class collected by Springer and Woodburn (1960), Caldwell (1957) and to some extent Reid (1954). We believe this influx of pinfish at the shallower stations in December to be the migration of the first year class into the offshore waters as Caldwell postulated an offshore migration in cold weather, and Springer and Woodburn's first year class diminishes in average size and number inshore after December. The size range of the fishes from the mid-depth stations 1, 4, 6, and 7 indicates the presence of the second year class in the deeper waters. Spawning is thought to take place offshore in the Gulf during the winter months and our findings place Caldwell's first spawners, the second year class, in about 6 fathoms at this time. This second year class is no longer evident in our sampling after December, but few pinfish were taken in the following two months. We cannot adequately explain the sharp increase in numbers each third month of our study. No other species reflected this pattern of abundance. Growth apparently speeds up as the water warms since the size range of our June collection approaches those taken at the mid-depth stations in December. During the March collection, 149 pinfish were discarded from the catch at station 3 before

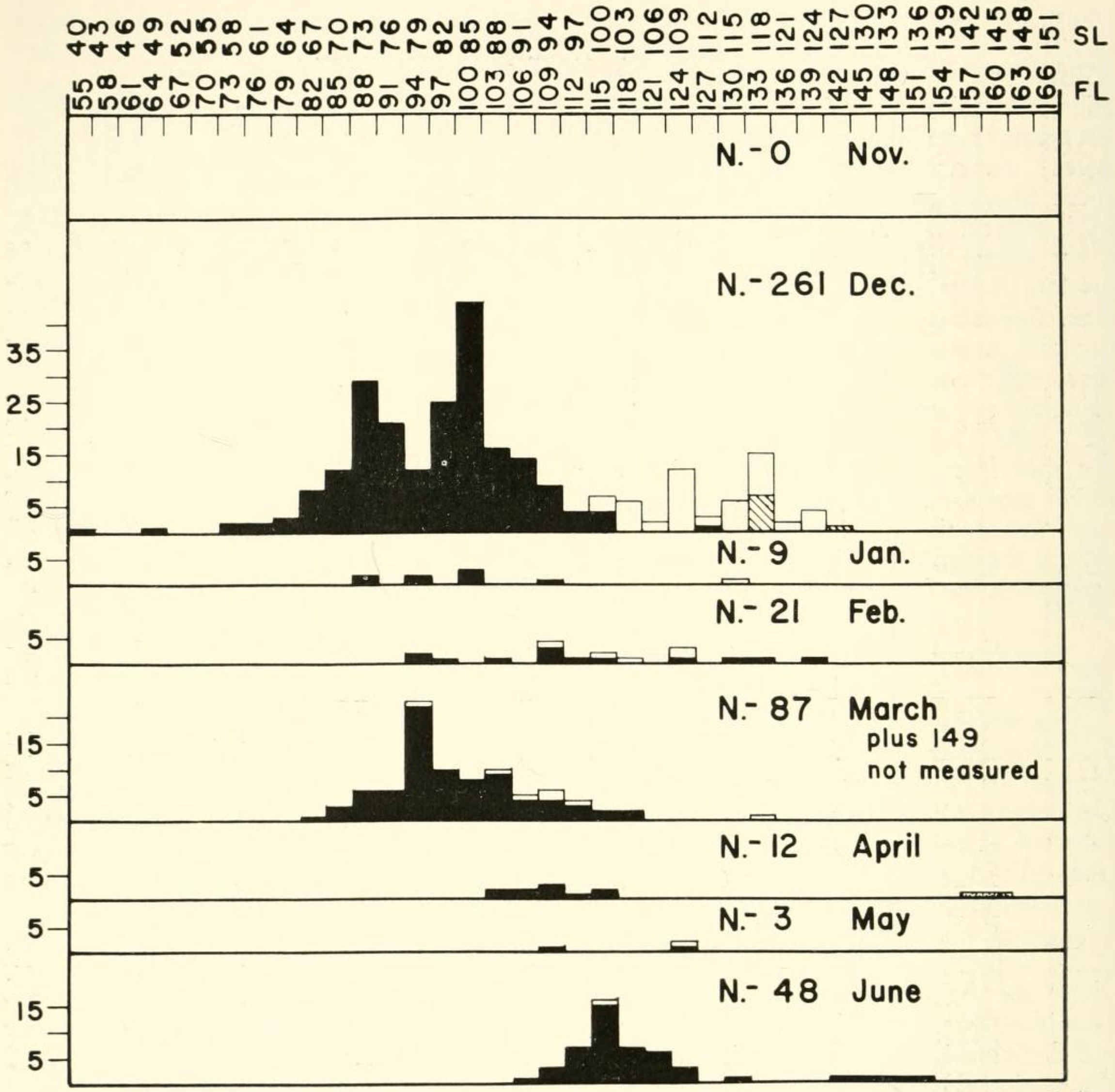


Figure 4. Monthly length-frequency distributions of *Lagodon rhomboides*. Graph legend as in Figure 2.

measurement. These fish were within the size range of the 87 that were measured.

*Prionotus scitulus latifrons* (Ginsburg), Leopard searobin

A total of 265 leopard searobins was collected. They were taken during every month with little variation in abundance. The largest collection occurred in March at the time of the strongest recruitment of young fish into our trawl catches. This subspecies is reported by Hildebrand (1955) as one of the most common and most characteristic fishes on the pink shrimp grounds off Campeche, and Springer and Bullis (1956) recorded this species from 14 stations in the Gulf. Our data (Figure 5) also indicate that this species strongly favors the offshore environment. Table 3 shows 69.7% of our specimens were collected at mid-depth stations. Springer and Woodburn (1960), Reid (1954) and Tabb and Manning (1961) did not take the leopard searobin in abundance during their studies, and the latter two papers report its occurrence adjacent to relatively deeper waters.

Our gear did not catch fishes smaller than 50 mm SL so the presence of fishes under this length would not be detected. Small individuals appeared in our trawls of the mid-depth stations during February and March and were present through June. Fish from the February through June collections were examined for sexual development and fe-

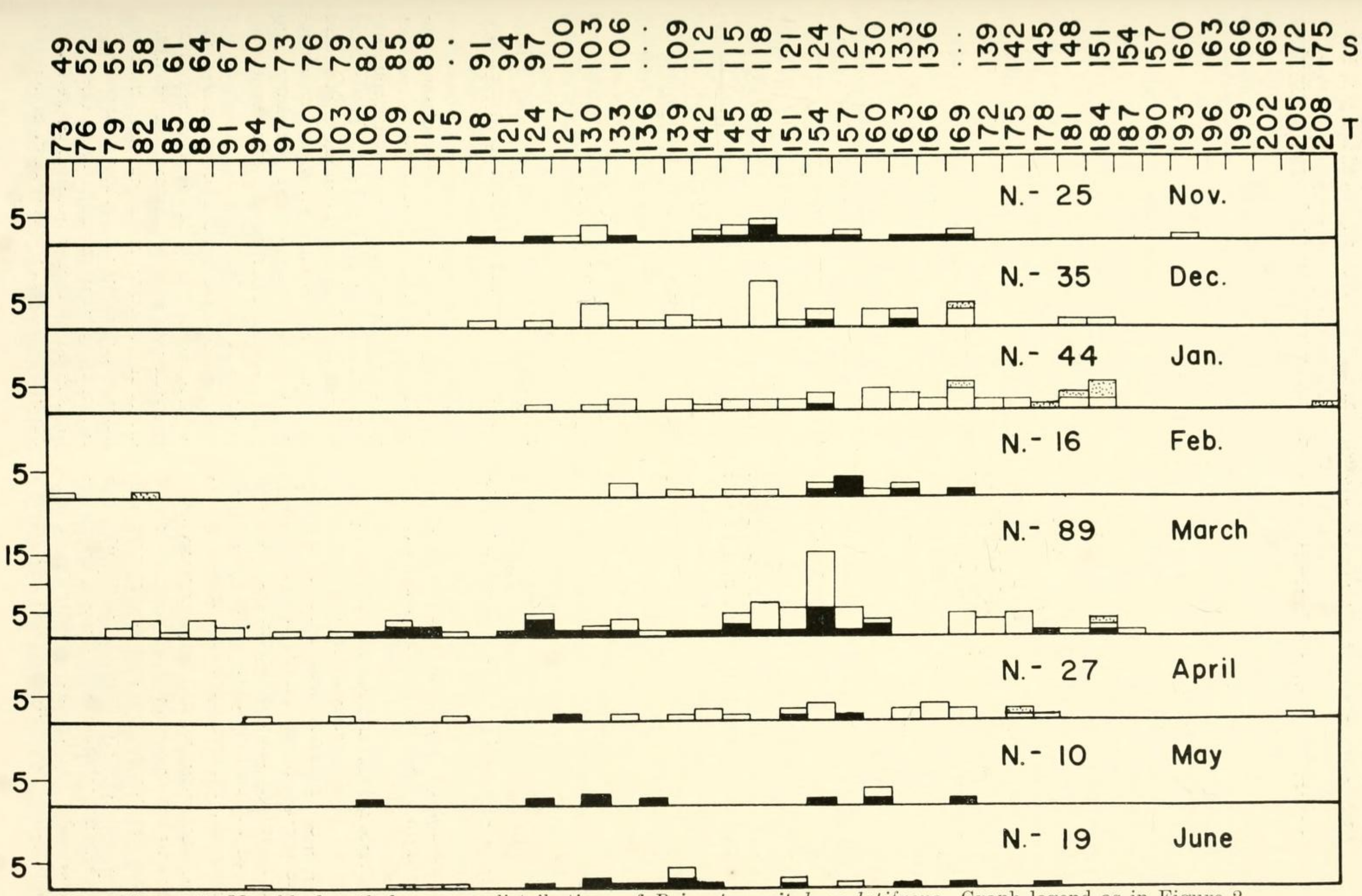


Figure 5. Monthly length-frequency distributions of *Prionotus scitul us latifrons*. Graph legend as in Figure 2.

TABLE 3

*Percentages of fishes taken at each depth range for the 12 most numerous species in the catch*

| Species | Total Collected | depths 15′ - 18′ Percent | 25′ - 45′ Percent | 75′ - 105′ Percent |
|---|---|---|---|---|
| *Bairdiella chrysura* | 349 | 98.9 | .2 | 0 |
| *Leostomus xanthurus* | 35 | 91.4 | 8.6 | 0 |
| *Menticirrhus americanus* | 70 | 90.0 | 10.0 | 0 |
| *Lagodon rhomboides* | 590 | 88.1 | 11.9 | 0 |
| *Prionotus tribulus crassiseps* | 28 | 85.7 | 10.1 | 3.6 |
| *Orthopristis chrysopterus* | 376 | 82.2 | 17.5 | .3 |
| *Symphurus plagiusa* | 113 | 54.0 | 43.4 | 2.7 |
| *Etropus crossotus atlanticus* | 65 | 38.5 | 61.5 | 0 |
| *Prionotus scitulus latifrons* | 265 | 28.3 | 71.7 | 0 |
| *Diplectrum formosum* | 34 | 14.7 | 70.6 | 14.7 |
| *Syacium papillosum* | 77 | 2.6 | 10.4 | 87.1 |
| *Etropus rimosus* | 57 | 0 | 0 | 100 |
| Total number of fishes taken at all depths | 2317 | 1578 | 548 | 191 |
| Percentage of total number of fishes | | 68.1 | 23.7 | 8.2 |
| Number of trawls producing fish | 66 | 25 | 32 | 9 |
| Percentage of the total effort | | 37.9 | 48.4 | 13.6 |

males with well-developed ova were observed in every month during this period. These females varied from 141 to 180 mm TL and were taken at both shallow and mid-depth ranges. The fish examined in February had well-developed ova; those fish examined from the March through May collections appeared to be nearing spawning condition; those examined from the June collection would extrude eggs upon pressure. Reid (1954) collected young fish (20 to 25 mm SL) in June, August, October, January, and May, a female in November with "slight ovarian development", and a male in December which "appeared to be near breeding condition." Springer and Woodburn (1960) collected small fish in every month except December, 1957 and August, 1958. The influx of small specimens in our mid-depth trawls of February and March, apparent breeding conditions of adults from December to at least June, and appearance of young fish at various times throughout the year indicate an extensive spawning season.

*Prionotus tribulus crassiceps* (Ginsburg), Bighead searobin

Twenty-eight bighead searobins were taken, 27 during the eight months of sampling and one (233 mm TL) at station 6 in March of 1962. Two additional large fish were taken, one 228 mm TL at station 6 in November and one 247 mm TL at station 8 in April. The remaining 25 specimens were collected at stations 2 and 3 every month from February through June. These fish ranged in size from 69 to 113 mm TL. A trend toward increasing size was noted for each monthly collection.

Several authors, Miles (1951), Joseph and Yerger (1954), and Tabb and Manning (1961) reported this species as commonly occurring at inshore locations, and Hildebrand (1955) considered it to be more abundant inshore than offshore. Our data, although limited, agree with this view since 85.7% of our specimens were taken at the shallowest stations.

Joseph and Yerger (1954) postulated a late summer and fall spawning and Gunter (1963) suggested a late fall and early winter spawning for *P. tribulus tribulus.* Hildebrand (1954) found a nearly ripe female on the Obregon shrimp grounds (Texas) in early August. Springer and Woodburn (1960) found young fish from October through February in the Tampa Bay area. We first found small individuals of *P. tribulus* at the same time of the appearance of small *P. scitulus,* February and March. These observations indicate that some spawning takes place in early fall, although spawning activity may extend over a greater period.

*Etropus crossotus atlanticus* (Parr),
Fringed flounder

Fringed flounder were taken during every month for a total catch of 65 individuals. Total lengths ranged from 76 mm to 169 mm with the smallest fish taken in November and the largest in April. The June collection, 22 specimens, represented 33.8% of the total catch of this species. Ripe females were found every month from March through June and varied from 111 to 169 mm TL. The ovaries of fish from the June collection were turgid with eggs. Our data did not reveal any pattern of growth.

*E. crossotus* appears to be generally more common offshore than inshore. Hildebrand (1954, 1955) found it quite common in depths less than 17 fathoms offshore of Texas and Louisiana and on the Campeche Banks. Springer and Woodburn (1960) and Tabb and Manning collected very few, although it was common in the inshore collections of Reid (1954), Joseph and Yerger (1956), Miles (1951) and Gunter (1938). The center of abundance of this fish appears to move farther offshore in the more southern areas of the Gulf of Mexico. Reid (1954) found two young fish, 23 and 25 mm SL, in June and October, respectively, and postulated an "extended breeding season during spring and summer." Our data indicate that spawning takes place offshore from March until at least June, thus agreeing with Reid's findings.

*Etropus rimosus,* (Goode and Bean),
Gray flounder

Fifty-seven gray founders were collected, all during June and only at station 9. Total length ranged from 101 to 133 mm and were arranged in two well-defined groupings which were probably composed of different sexes. All the fish (10 individuals) examined between 101 and 118 mm TL, were ripe females; and all fish (5 individuals) examined between 124 and 133 mm TL appeared to be male, although no milt was observed. No other species in our collections, except *Syacium papillosum,* displayed this sexual dimorphism of size. These data indicate an early summer spawning for this species.

*E. rimosus* is quite distinct from *E. crossotus* when comparative material is available. Our specimens agree with the description given by Longley and Hildebrand (1941). The snout of both sexes is covered with strongly ctenoid scales, and the pectoral fin on the ocular side is longer and larger than that of *E. crossotus* and has three to four horizontal, dark narrow bands which Longley and Hildebrand did not mention. The dark blotch on the lateral line just in advance of the dorsal and anal fin terminations varies from dark and well-defined to rather obscure. *E. rimosus* has three dark blotches equally spaced along the lateral line, although the posterior blotch, about the size of the eye, is largest and most distinct. The scales of *E. rimosus* are strongly ctenoid on the ocular side and mildly ctenoid on the blind side, whereas scales of *E. crossotus* are mildly ctenoid on the ocular side and smooth on the blind side.

Springer and Bullis (1956) and Hildebrand (1955) did not encounter this species, but Joseph and Yerger (1956) recorded it offshore of Alligator Harbor, and Briggs (1958) reported it from the southern Atlantic coast and the northeastern Gulf of Mexico. Evidently, *E. rimosus* is fairly uncommon and restricted to the offshore waters of the eastern Gulf.

*Syacium papillosum* (Linnaeus),
Dusky flounder

Seventy-seven specimens were collected, and only 10 of these came from stations inshore of station 9. *S. papillosum* was taken in every month except March and May. The largest collection of 59 individuals came from station 9 in June, and the smallest and largest fish (76 and 229 mm TL) were included in this sample. About half of this collection was examined for sexual development, and 14 ripe fish were found. The eight females were mildly distended with roe and varied from 137 to 175 mm TL. The six males strongly exhibited the sexual dimorphic traits characteristic of the males of this species, *i.e.,* a cinereous blind side, two parallel blue lines between the right eye and the snout area, and long filamentous extensions on the dorsal rays of the pectoral fin of the ocular side. Several smaller males with their external sexual characters not fully developed were also included in the collection. These data indicate an early summer spawning, although activity may take place over an extended period. No growth data were available through our collections. Longley and Hildebrand (1941), Hildebrand

(1955), and Joseph and Yerger (1956) all reported *S. papillosum* from the offshore waters, and Springer and Bullis (1956) reported it from 36 *Oregon* stations in the Gulf of Mexico.

*Symphurus plagiusa* (Linnaeus),
Blackcheek tonguefish

The blackcheek tonguefish was present every month, although it was rather scarce from December through February. A total of 113 specimens was taken from stations 1 through 8, but 54.0% came from the shallowest stations. Ginsburg (1951) considers it an inshore species since it ranges to only 14 fathoms. Our gear was selective for the larger individuals since most of the fish taken (124 to 174 mm TL) were wedged in the mesh of the net. Ripe females were found in the March through June collections and varied from 145 to 168 mm TL. Spawning appeared to occur in June; some of the females examined from that month had flaccid ovaries with many free eggs.

*S. plagiusa* is common in the offshore waters in many areas of the Gulf (Hildebrand, 1954, 1955; Gunter, 1945; Miles, 1951; and Joseph and Yerger, 1956) and the young are also occasionally taken in salinities below 7 ‰ (Springer and Woodburn, 1960; Gunter, 1963). Hildebrand and Cable (1930) postulated a May through October spawning period based on the appearance of juveniles off North Carolina. We agree with this concept of an extended spawning period since Gunter (1945) took a ripe female in April; Joseph and Yerger (1956) found young fish in July; Tabb and Manning (1961) reported taking small specimens of 20 mm (total length, we presume) in March and September; Springer and Woodburn (1960) and Gunter (1963) reported their smallest tonguefish, 19 mm SL and 29 mm TL respectively, in October; and Springer and McErlean (1962) found 26 and 21 mm SL tonguefish in January and February respectively.

Table 2 is both a summary and analysis of each species present in our collections. We do not feel the need to comment on each species taken since the sparsity of our data in most cases would allow only occurrence to be mentioned. The stations are arranged by depth, shallowest to deepest. A summary of the effort expended and the number of species taken at each station and depth range is included at the end of the table. The 43 fishes taken prior to the eight months of the study are included in this table, and since they represent only 1.9% of the total fishes taken, they are not distinguished unless they were part of a dredge collection. Springer and Woodburn (1960) discussed distribution and relative abundance of the species they observed in the Tampa Bay area. In Table 2, we have distinguished the species collected during our study that were not reported from the Gulf of Mexico by Springer and Woodburn (1960) in their Tables 20 or 22. Some of these fish were reported from the bay environs, but not the Gulf.

Only three specimens of *Urophycis floridanus* were taken, two in February at station 2 (92 mm SL) and at station 7 (114 mm SL) and one in March at station 4 (92 mm SL). According to Gunter (1945), Reid (1954) and Springer and Woodburn (1960), this species is found on the inshore areas during January through April. These individuals are generally juveniles as were our specimens.

Eight specimens of *Lutjanus synagris* (65 to 110 mm SL) were taken during November, three at station 2, four at station 3, and one at station 6. Another individual taken on September 13, 1962 (87 mm SL, 34.6 ‰, 30.6°C) at station 2 augments our collection to nine fish. Large individuals of this species are occasionally taken by party boats fishing the deeper waters during the summer, and Hildebrand (1955) reported *L. synagris* to occur frequently on the Campeche Banks between 6 and 16 fathoms. Juveniles appear to move inshore during the fall of the year. Reid (1954), Springer and Woodburn (1960) and Tabb and Manning (1961) found *L. synagris* to be either present or abundant only during September to December.

*Menticirrhus littoralis* was collected only three times during our study. Two specimens, 160 and 165 mm TL, were taken in November at station 2, and one near-ripe female, 260 mm TL, was taken at station 3 in March. Springer and Woodburn (1960) found this species abundant in the summer at their beach station only one mile distant from our collection site. These fish, in their larger size ranges up to 169 mm SL, would have been more frequent in our trawls if they were present at the nearshore stations.

Springer and Woodburn's data indicate a spring spawning, probably May, and our data corroborate theirs. The winter habitat of *M. littoralis* remains unknown.

One specimen of *Bellator militaris,* 56 mm TL, was taken at station 3 in June. It was evidently a stray from deeper waters since this species is common in collections from 100 fathoms offshore of the lower west coast of Florida.

Two species of *Bothus* were taken, *B. ocellatus* and one recently recognized, but not named, which was identified by Dr. C. R. Robins. These fish were taken at both mid-depth and deep stations. Springer and McErlean (1962) probably took both species at their shallow water station in the Florida Keys, and Tabb and Manning (1961) did not record these species from the more inshore area of Florida Bay. Hildebrand (1955) reported *B. ocellatus* as the commonest flatfish on the Campeche Bank in 6 to 10 fathoms in February, and common in 13 to 16 fathoms in July.

*Citharichthys macrops* was reported as very common on the Campeche Bank by Hildebrand (1955), but Longley and Hildebrand (1941) only reported two specimens. This species was not rare at our mid-depth and deep stations. Two ripe females, 144 and 205 mm TL, were taken in March at stations 7 and 9. Spawning probably takes place in the spring.

One specimen of *Gobiesox strumosus,* 65 mm TL, was taken in a dredge sample at station 9 on June 5, 1962 (37.1 ‰, 21.8°C). The collection of this individual offers a contrast to Springer and Woodburn's (1960) statement that this species is "strictly an inshore shallow water form." *G. strumosus* was also reported from the Gulf by Springer and Bullis (1956) who recorded it at 16 and 25 fathoms.

One large specimen of *Ogcocephalus cubifrons,* 267 mm TL, was taken at station 2 in June. Our identification is based on a similarity with the *O. cubifrons* of Longley and Hildebrand (1941) and the opinion of Springer and Woodburn (1960) that the common species of the Tampa Bay area is this form.

Dr. C. R. Robins kindly identified the Ophidiidae, *Bothus,* and *Chromis enchrysurus;* and Dr. Ernest Lachner graciously identified the Apogonidae for us. All other identifications are the responsibility of one of us (Moe).

## Depth Relationships

It was not possible to ascertain the exact habitat from which each species was taken since our nets moved over a variety of bottom types and probably sampled several different biotopes during each haul. As a result, our analysis is restricted to the depth relationships of the 12 most numerous fishes in the total catch. Table 3 lists these fishes in order of their relative abundance at the shallowest stations. The depth preferences of these fish, within the limits of this study, are evident in Table 3.

The shallowest stations 2 and 3, produced the greatest number of fishes (68.1% of the total catch), although only 37.9% of the effective effort (trawls that took fish) was expended at these stations. The mid-depth stations received 48.4% of the effective effort and produced only 23.7% of the total catch. Our deep range, stations 8 and 9, was better balanced with 13.6% of the effective effort producing 8.2% of the total catch. The mid-depth stations had their own characteristic fishes and also exhibited fringe populations of typical inshore and offshore species. Although the analysis is very general, it demonstrates the distinctness of the bottom fishes at various depths offshore of Pinellas County.

Gunter (1945, 1950 and 1961) showed that salinity can be correlated with size in marine fishes, although a direct relationship may not exist. Larger fish are generally found in higher saline waters, and consequently are found deeper and farther offshore than smaller fish. Our data consistently exhibit the larger fish of most species occurring at the deeper stations. The salinity differential was probably too small to be significant in this distributional pattern. Depth then becomes one of the most obvious variables with a direct correlation to increasing size.

## Appendix

During the course of this study, 15 species of fish were taken that have not been reported from the Tampa Bay area. An additional 27 species new to the area were taken in incidental collections since the publication of the above papers, and these records are also listed here. Springer and Wood-

burn (1960) and Springer (1961) recorded 271 species of fishes from the waters of the Tampa Bay area. The number of species of fishes now known from the Tampa Bay area is 312. The specimens on which the following records are based are deposited in the laboratory reference collection unless noted otherwise.

*Carcharodon carcharias* (Linnaeus). On February 10, 1965, a female white shark 11 ft. 10 in. total length was taken by the collecting crew of the Aquatarium with a 12 in. stretched mesh porpoise net. The capture occurred in four feet of water on a sand bar just offshore of Bunce's Pass at the north end of Mullet Key. The animal was photographed and discarded. There are two unconfirmed reports of white shark taken in the Tampa Bay area during the previous year.

*Carcharinus obscurus* (LeSueur). Springer (1961) reported two large specimens of *Eulamia (Carcharinus) floridana* stranded on a sand bar in Boca Ciega Bay on December 24 and 25, 1960. Garrick, *et. al.* (1964) demonstrated that these specimens were incorrectly identified and are actually *C. obscurus,* not previously reported from the Tampa Bay area by that name. *Carcharinus falciformis (C. floridana)* has not been taken in the Tampa Bay area.

*Raja eglanteria* Bosc. Two males, 490 and 540 mm TL, were taken with hook and line about 10 miles offshore of Clearwater Beach on February 2, 1963. Depth was 50 feet and bottom salinity and temperature were 33.8 ‰ and 14.9°C. Since that time, three other specimens of the clearnose skate, two females and a male, have been taken from offshore waters in the Tampa Bay area.

*Raja texana* Chandler. One female, 378 mm TL, was taken in a large trawl from the R/V *Hernan Cortez* on December 21, 1964, at approximately 27°23′N, 83°20′W in 120 ft. of water. This specimen was taken in the same trawl haul as *Bregmaceros atlanticus.* Although the location is just suoth of the defined Tampa Bay area, these records are considered applicable since both species have been reported north and south of this region (Springer and Bullis, 1956).

*Sardinella brasiliensis* (Steindachner). One individual, 179 mm SL, was found in a box of frozen bait obtained from the Pinellas Seafood Company. The fish was captured in a commercial shrimp trawl in March of 1964 about 8 miles offshore of Pass-a-Grille, Florida.

*Saurida brasiliensis* Norman. Two specimens, 51 and 52 mm SL, were taken in 80 ft. of water due west of Egmont Key on December 17, 1964. They were obtained in a dredge sample of the R/V *Hernan Cortez.*

*Saurida normani* Longley. One specimen, 273 mm SL, was taken in 20 fathoms at 27°52′N, 83°37′W on April 30, 1965. It was captured with a 40-foot fish trawl during operations of the R/V *Hernan Cortez.*

*Trachinocephalus myops* (Forster). This species is common in the offshore areas of Pinellas County, but not nearly as abundant as associated species of *Synodus.* Our record is based on a specimen, 162 mm SL, taken by the R/V *Hernan Cortez* with a trynet on December 17, 1964, in 80 ft. of water due west of Egmont Key.

*Ophichthus ocellatus* (LeSuer.) One specimen, 359 mm TL, was taken by Tom Stokel, a commercial bait shrimper, on January 23, 1964 on the south bank of Bunce's Pass channel in the vicinity of the Sunshine Skyway. It was captured in a frame trawl at about 2:00 A.M.

*Bregmaceros atlanticus* Goode and Bean. One specimen, 42 mm SL, was collected in a trawl haul on December 21, 1964, at 27° 23′N, 83°20′W in 120 ft. of water. Temperature was 20.3°C (bottom).

*Holocentrus bullisi* Woods. One individual, 123 mm SL, was taken on hook and line in 24 fathoms at 27°28′N on August 15, 1963 by a commercial grouper fisherman.

*Rypticus arenatus* Cuvier. Two specimens, 61 and 82 mm SL, were taken in 26 fathoms at 27°30′N, 83°48′W on May 24, 1965. They were captured in a 40-foot fish trawl during operations of the R/V *Hernan Cortez.*

*Serranus phoeby* Poey. One individual was collected in 32 fathoms at 27°31′N, 84° 01′W on May 24, 1965. It was taken with a 40-foot fish trawl during operations of the R/V *Hernan Cortez.*

*Pseudopriacanthus altus* (Gill). One specimen, 67 mm SL, was taken in a wire fish trap at 27°56′N, 83°81′W on March 30, 1965 during operations of the R/V *Hernan Cortez.* Depth was 18 fathoms.

*Apogon pseudomaculatus* Longley. One individual, 52 mm SL, was taken at station 9 on June 5, 1962.

*Decapterus punctatus* (Agassiz). Seven specimens (128 to 138 mm SL) were taken in a purse seine about 8 miles offshore of Clearwater Beach on June 17, 1964. Depth was 42 feet and surface salinity and temperature were 35.6 ‰ and 29.8°C.

*Mullus auratus* Jordan and Gilbert. Three individuals, 90 to 96 mm SL, were taken at 28°05′N, 83°25′W in a commercial shrimp trawl on June 20, 1964. The haul was made at night at a depth of 80 feet. Surface salinity and temperature were 35.6 ‰ and 30°C.

*Pagrus sedecim* Ginsburg. One specimen, 317 mm SL, was taken by hook and line on May 23, 1963 about 65 miles offshore of Egmont Key. It was caught on a rocky bottom at about 25 fathoms.

*Bellator militaris* (Goode and Bean). One individual, 42 mm SL, was taken at station 3 in the June collection.

*Prionotus ophryas* Jordan and Swain. One specimen, 104 mm SL, was taken in 18 fathoms at 27°46′N, 83°35′W on May 23, 1965, with a 40-foot fish trawl during operations of the R/V *Hernan Cortez.*

*Prionotus pectoralis* Nichols and Breder. One specimen, 81 mm SL, was taken in the March collection at station 4.

*Opisthognathus lonchurus* Jordan and Gilbert. One specimen, 105 mm SL, was found in the spewings of a large red grouper taken in 25 fathoms at 27°42′N on May 23, 1963. The jawfish is in excellent condition and had evidently been ingested only a short while before the capture of the red grouper.

*Kathetostoma albigutta* (Bean). Three specimens, 70, 100, and 239 mm SL, were taken in the same trawl haul as the previously listed *Rypticus arenatus* and the same data apply to this record.

*Dactyloscopus tridigitatus* Gill. One specimen was taken in a frame trawl by Tom Stokel on March 16 ,1965 in 4 ft. of water on the bay side of Egmont Key. A stand of *Thalassia testudinum* covered the sandy bottom.

*Paraclinus fasciatus* (Steindachner). One specimen, 39 mm SL, was collected in a dip net at the surface near the St. Petersburg Municipal Pier on May 31, 1963 by Tom Stokel. The Municipal Pier is located on Tampa Bay at about 27°46′N. Depth varies from 20 to 25 ft.

*Blennius nicholsi* Tavolga. One individual, 27 mm SL, was taken by W. K. Porter from near the dock on his property, 8430 Gulf Boulevard, St. Petersburg Beach, in August of 1963.

*Ophidion welshi* (Nichols and Breder). Two individuals, 252 and 265 mm TL, were taken in December at station 7. Four other specimens of *O. welshi* were subsequently taken at stations 2 and 3.

*Ophidion beani* Jordan and Gilbert. One specimen was taken at station 7 in the March collection.

*Otophidium grayi* Fowler. One specimen, 200 mm TL, was taken at station 7 in the March collection.

*Lepophidium jeannae* Fowler. One individual, 287 mm TL, was taken in the February collection at station 9.

*Psenes regulus* Poey. Two specimens, 121 and 116 mm SL, were taken in 92 ft. of water due west of Egmont Key on December 16, 1964. They were collected with a large mid-water trawl operated from the R/V *Hernan Cortez.*

*Bothus* sp. (unnamed). Two specimens were taken during our study. One, 92 mm SL, was taken in January at station 6; and one, 80 mm SL, was taken at station 7 in April.

*Bothus ocellatus* (Agassiz). Two specimens were taken during our study. One, 51 mm SL, was taken at station 6 in December; and one, 97 mm SL, was taken at station 9 in June.

*Cyclopsetta fimbriata* (Goode and Bean). One individual, 216 mm SL, was taken at station 8 in February.

*Etropus rimosus* Goode and Bean. This species is discussed in the text of this paper.

*Syacium papillosum* (Linnaeus). This species is also discussed in the text of this paper.

*Symphurus diomedianus* (Goode and Bean). Three individuals, 153 to 154 mm SL, were taken in the June collection at station 9.

*Symphurus minor* Ginsburg. One specimen, 45 mm SL, was taken in 80 ft. of water due west of Egmont Key on December 17, 1964. It was collected in a dredge sample from the R/V *Hernan Cortez.*

*Symphurus urospilus* Ginsburg. One specimen, 160 mm TL, was taken in the same haul as the previously listed *Mullus auratus* and the same data apply to this fish.

*Alutera heudelotii* Hollard. Three individuals, 174, 187 and 195 mm SL, were taken in 22 fathoms at 27°37′N, 83°43′W on May 23, 1965 with a 40-foot fish trawl during operations of R/V *Hernan Cortez.*

*Lactophrys triqueter* (Linnaeus). One specimen, 36 mm TL, was taken in a frame trawl on February 9, 1965 by Mr. Tom Stokel in 4 ft. of water on the Bay side of Egmont Key.

*Halieutichthys aculeatus* (Mitchill). Seven specimens were taken at station 9 in the June collection. One individual measured 80 mm TL and 49 mm disk width. All fish were about the same size.

## Summary

1. From November, 1962 to June, 1963 fishes taken during a study of adult pink shrimp offshore of Pinellas County, Florida, were retained for monthly biological analysis. These fishes were taken by a 16-foot trynet at monthly intervals from nine stations. Gear was selective for the smaller, slow-moving bottom fishes. Few very young or relatively large fish were taken.

2. The stations have been grouped in general depth ranges. These are: stations 2 and 3, shallow, 15 to 18 feet; stations 1, 4, 6, and 7, mid-depth, 25 to 45 feet; and stations 8 and 9, deep, 75 to 105 feet. Station 5 was discontinued before the detailed analysis of fishes was begun. Stations 2, 3, 4, and 6 produced 90.1 percent of the total catch. Data from the other stations are supplementary to these basic collections.

3. A total of 2,317 fishes representing 34 families and 72 species was collected at these stations. Twelve species composed 89.4 percent of the total catch and are discussed in detail. The occurrence of the other species is presented in tabular form.

4. A difference of only 6 ‰ between the highest and lowest salinity reading was recorded during our study; thus, salinity is not considered a significant factor. Temperatures ranged from 12.4°C in December to 28.4°C in June.

5. The largest individuals of each species were generally found at the deeper stations.

6. The depth relationships of the 12 species most numerous in the catch are analyzed. Definite depth preferences were found in most species within the depth range of the study, 3 to 18 fathoms.

7. Fifteen of the 72 species taken had not previously been reported from the Tampa Bay area. These 15 species, along with 27 other species taken in incidental collections, are listed with data as new additions to the ichthyofauna of the Tampa Bay area. A total of 312 species of fish are now reported from this area.

## Acknowledgments

It is our pleasure to acknowledge the following individuals for their contributions toward the completion of this paper. Mr. Vernon Senterfitt aided in the field work and in compilation of data and Mr. Phillip Heemstra assisted with the sorting and identification of specimens. Doctors C. Richard Robins, Donald P. deSylva, and Victor G. Springer graciously reviewed the manuscript and offered valuable criticisms and suggestions toward improvement. Mr. Robert M. Ingle, Director of Research of the Salt Water Fisheries Division of the Florida Board of Conservation critically reviewed the manuscript and offered encouragement throughout the study.

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October 11, 1965

# ERRATA

Fishes taken in monthly trawl samples offshore of Pinellas County, Florida, with new additions to the fish fauna of the Tampa Bay area.

Martin A. Moe, Jr. and George T. Martin

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Cover. The asterisk should be removed from "George T. Martin*"

Page 129. An asterisk should be inserted after "George T. Martin"

The designation Florida Board of Conservation Marine Laboratory, St. Petersburg, Florida, should follow "Contribution No. 93"

Table 2. "Bothus OcellatusO" should read Bothus ocellatus*
"Bothus Ocellatus*" should read Bothus sp. (unnamed)*
the portion of the legend..."study, but recorded by them"...should read,...study, but may have been recorded by them...

Figure 2. The word "..dis- tributions..." in the legend should read, distributions.

Figure 3. The name "Bairdiella chryssura" in the legend should read, Bairdiella chrysura.

Figure 5. The name "Prionotus scitul us latifrons" in the legend should read Prionotus scitulus latifrons.

The following misprints occur in the Literature Cited section:

under Gunter, G. 1938. The fourth line is not indented.

under Gunter, G. 1950. The second line is not indented.

under Hildebrand, S. F. and L. E. Cable. 1930. "(1931" should read (1931)

under Miles, R. M. 1951. The fourth line is not indented and two commas appear after the word Thesis.

Smith, F. G. Walton. 1953. Two commas appear after the name Smith.