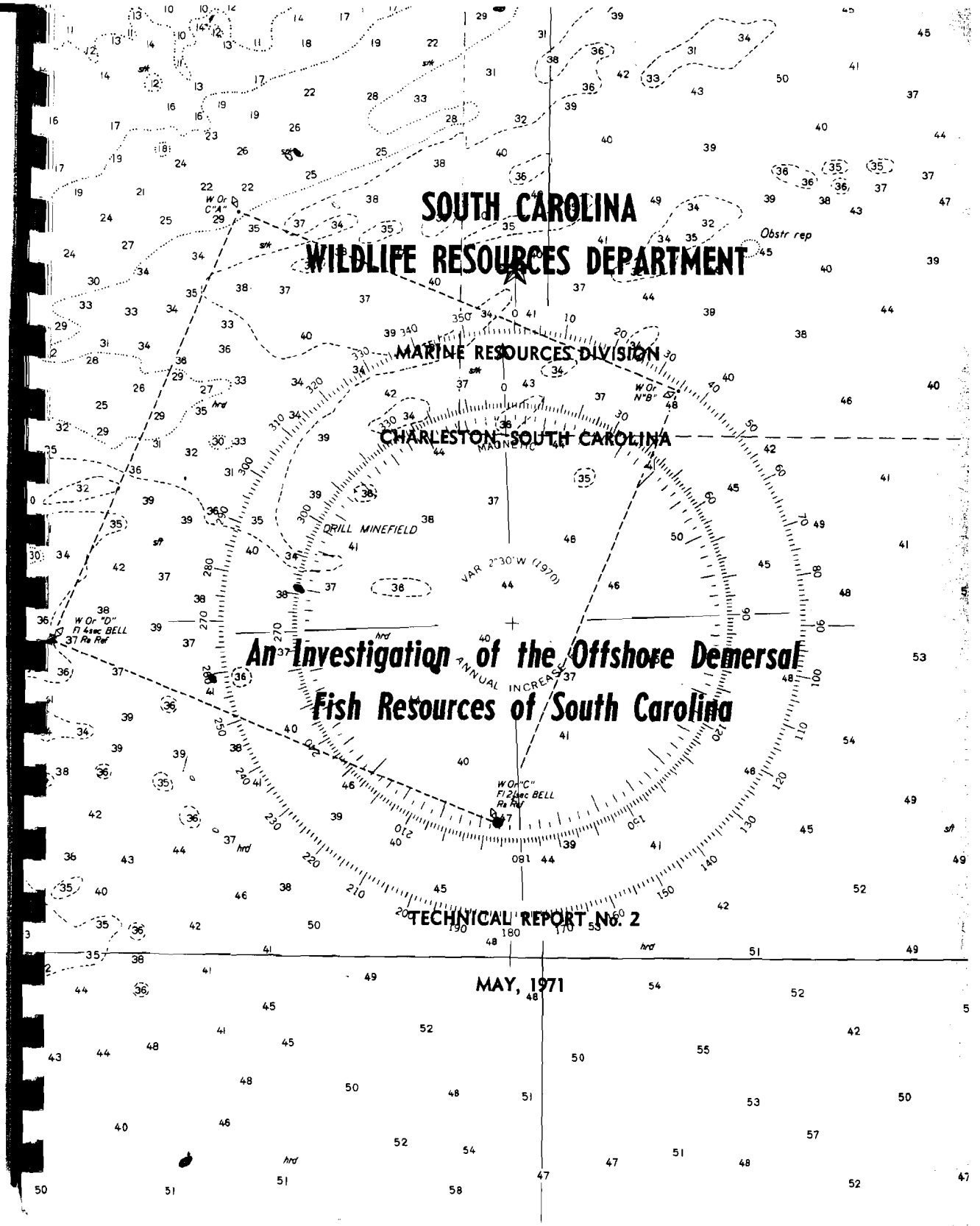
SOUTH CAROLINA
WILDLIFE RESOURCES DEPARTMENT
MARINE RESOURCES DIVISION
CHARLESTON, SOUTH CAROLINA
An Investigation of the Offshore Demersal Fish Resources of South Carolina
TECHNICAL REPORT No. 2
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# An Investigation of the Offshore Demersal Fish Resources of South Carolina

## Introduction

It is well documented that the live bottom and continental shelf-edge habitats of South Carolina support large concentrations of bottom fish. During recent years, the potential economic value of these resources has been recognized by commercial fishermen and related fisheries interests. Consequently, a number of exploratory fishery surveys have been conducted by federal, state and local agencies. Considerable knowledge was gained through exploratory fishing for bottom fish by the National Marine Fisheries Services and the U. S. Fish and Wildlife Service. Struhsaker (1969) gives a comprehensive account of the demersal fish resources of the Continental Shelf off the Southeastern U. S. Cummings, Rivers and Struhsaker (1962) present pertinent information on trawl-caught snapper, grouper, and ecologically-related species off the Carolinas. Rivers (1966) reported on the gear and methods used in the black sea bass fishery off the Carolinas. Previous fishery explorations off the South Carolina coast have also been described by Lunz (1957).

Contrary to the apparent potential for the development of an offshore bottom fishery, these resources have not been significantly exploited to date. The major limiting factors in development of this fishery in past years have been:

(1) The reluctance of fishermen to expand operations to the offshore area due to increased expenses and unfamiliarity of fishing grounds.

(2) Economic factors, including market instability and absence of on-shore processing facilities.

(3) Insufficient knowledge on the part of commercial interests related to availability and harvesting techniques.

The first significant commercial landings in S. C. appeared in the late 1950's and early 1960's. Since then, the fishery has been mostly seasonal, with annual fluctuations in total landings ranging from 38,142 pounds to approximately 1.1 million pounds during 1960-1970 (Table 1). Black sea bass (*Centropristis striata*) has consistently been the most abundant species caught, comprising 70 to 99.9 percent of the total bottom fish landings during the past decade. Snapper, grouper, grunts and porgy make up the remainder of the offshore bottom fish catch. In 1970 only about six commerical vessels fished regularly for demersal fishes off South Carolina. A few shrimp trawlers fished for sea bass during the off-season winter months using traps. Some of these fishermen occasionally employ hand lines for snapper, grouper, etc. Pink porgy (*Pagrus sedecim*) and other porgies have recently entered the fishery with almost 300,000 pounds being landed in 1970 by only a few fishermen. An abundance of these fish and other dominant species, as well as their increasing national market value, indicates a latent fishery resource with considerable potential.

In March 1970, the Marine Resources Division of the South Carolina Wildlife Resources Department entered into a cooperative project agreement with the National Marine Fisheries Service to study the offshore demersal fish resources of South Carolina. The project, as authorized under Public Law 88-309, was planned in an effort to provide practical information to commercial and scientific interests on the demersal fish resources of South Carolina. Specific objectives were as follows:

(1) To accumulate and evaluate existing data on the species composition, distribution and availability of commercially valuable demersal fishes found on the Continental Shelf, especially sea basses, snappers, groupers, porgies, and grunts.

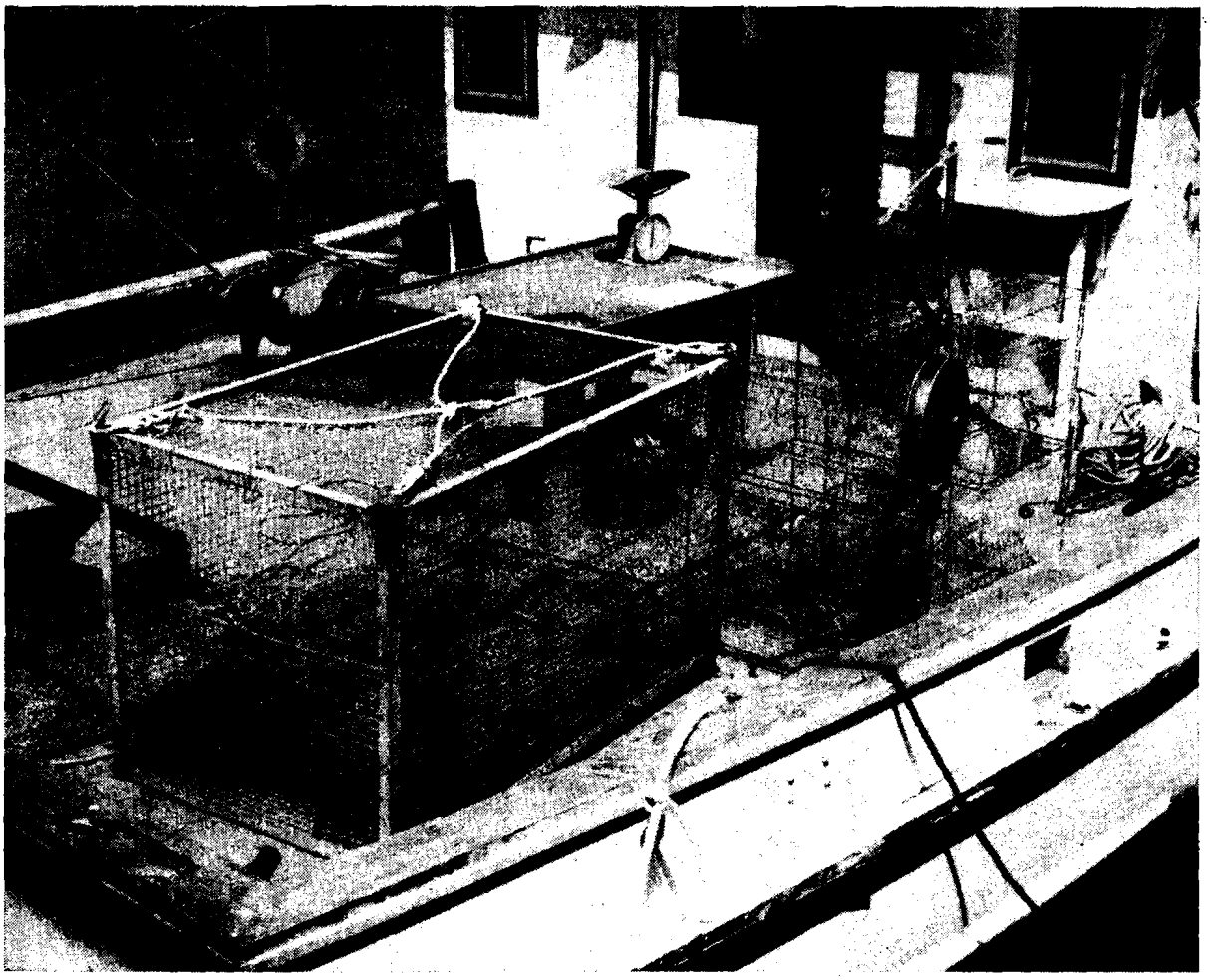

FIGURE 1.—Sampling gear consisted of fish traps and snapper reels.

A total of 47 individual stations were occupied during the survey period. Sampling duration and methods varied considerably, depending largely upon catch results at each station. In many instances, sampling was limited to manual snapper reel gear, and other times both reels and fish traps were used. Concentrations of fish were located within each area of exploration using the white line depth recorder. Potential fish schools were then sampled using hook and line. If indications were promising, the location was fished more intensively with snapper reel gear and traps. Often, exceptionally productive locations were temporarily marked with flag type buoys at convenient locations. At each station the position was recorded, using LORAN; other information, including hydrographic conditions, depth, etc., was also noted.

Fishes were measured individually (except in the case of very large catches) using standard length, fork length and total length, where applicable. Individual and total weights for individual species caught at each station were also recorded. Numerous specimens were preserved in formalin for later analyses in the laboratory. Other incidental data collected included stomach analyses of selected individuals.

## Results

As indicated earlier in this report, the primary objective of the current study was to summarize existing information on demersal fish resources off South Carolina and to provide additional information on the potentials of an offshore demersal fishery, especially as related to the use of trap and handline gear. Extensive data concerning the availability of demersal fishes to roller rigged trawls on the Continental Shelf area off South Carolina has been accumulated in past years by the National Marine Fisheries Service. A summary of the more productive trawl stations with representative catches of commercially important species is presented in Table 2.

Table 1.—South Carolina demersal fish landings (1960-1970) by species and in pounds.

| Year | Sea Bass | Snapper | Grouper | Porgy | Total |
|---|---|---|---|---|---|
| 1960 | 29,142 | 2,000 | 7,000 | — | 38,142 |
| 1961 | 324,161 | 138,000 | 6,000 | — | 468,161 |
| 1962 | 267,495 | 7,000 | — | 17,881 | 292,376 |
| 1963 | 264,591 | 500 | — | 4,100 | 269,191 |
| 1964 | 233,798 | 8,000 | 200 | 14,915 | 256,913 |
| 1965 | 82,788 | 16,000 | 51,042 | — | 149,830 |
| 1966 | 136,255 | — | 72 | — | 136,327 |
| 1967 | 66,000 | 3,000 | — | — | 69,000 |
| 1968 | 204,415 | 36,835 | 63,430 | 560 | 305,240 |
| 1969 | 722,455 | 16,518 | 10,442 | 12,465 | 761,680 |
| 1970 | 773,066 | 11,750 | 13,973 | 289,983 | 1,088,772 |

(2) To compile additional data on the commercial potentials of offshore fishery resources through exploratory fishing in selected areas using fish traps and handlines.

(3) To supplement existing biological knowledge of the offshore demersal fish populations

It is hoped that this report, in addition to providing a synopsis of current information on demersal fishery resources, will serve as a guide for future surveys and commercial fishing operations off the South Carolina coast.

## Methods and Procedures

On March 1, 1970, the Marine Resources Division initiated an investigation of the offshore demersal fisheries resources of South Carolina. Phase one of this study consisted of collecting and compiling published and unpublished data on the species composition, distribution and availability of commercially significant demersal fish species on the Continental Shelf area off South Carolina. A considerable amount of information was obtained from notes and publications of the National Marine Fisheries Service, the South Carolina Marine Resources Division, and Bears Bluff Laboratories. Knowledgeable sport and commercial fishermen were interviewed during 1970, and accurate data on fishing areas, catch, and general observations were recorded.

In May of 1970, the second phase of the study was initiated. This consisted of an exploratory fishing survey to provide supplemental information on the demersal fish resources off the South Carolina coast. The survey was focused on the Continental Shelf area lying between 32° 48.5′ N, 78° 51.5′ W and 31° 54.8′ N, 79° 30.5′ W, at a depth range of 12 to 50 fathoms.

Exploratory fishing was conducted aboard the 50-foot Marine Resources Division Research Vessel based at Charleston, South Carolina. This vessel was equipped with a Raytheon model DE - 727 white line depth recorder, LORAN A, and other navigational equipment. Sampling gear as shown in figure 1 included standard sea bass traps (modified crab pots), a large fish trap measuring 3′ x 3′ x 5′, and four manual commercial snapper reels, rigged similarly to those described by Moe (1963). Additional collecting equipment for incidental sampling included dip nets, shark rigs and trolling gear.

A total of ten exploratory cruises of 1 to 3 days each were made during the period from May 1970 to March 1971. Three general areas, located SSE, ESE and E of Charleston, known to be potentially productive fishing grounds, were chosen as primary collection sites. A number of other locations were also sampled to provide additional data.

A significant amount of information on fishing locations and the availability of various demersal fish species was obtained during this study from commercial and sport fishermen along the South Carolina coast. During 1970-71, the Marine Resources Division survey was conducted to provide supplemental information on demersal fish resources using handline and fish trap gear. The most promising fishing areas located from the above sources are shown in Figure 2.

The Continental Shelf area off South Carolina is characterized by a wide diversity of bottom habitat types and ecological conditions. Struhsaker (1969) presented an ecological description of the Continental Shelf along the Southeastern U. S., including the South Carolina subregion. He described five general types of bottom habitat between the shoreline and the 100 fathom curve: coastal; open shelf, live bottom; shelf edge; and lower shelf. Off South Carolina, the coastal habitat extends from the estuarine zone out to approximately the 10 fathom curve. Although scattered rock and live bottom areas are found throughout, most of the coastal habitat consists of smooth sand, mud, and shell mixtures. A number of ship

TABLE 2.—Selected Locations where Commercial quantities of fish were taken during National Marine Fisheries Service bottom fish Explorations off South Carolina 1958-64 (Mostly trawl drags of 60-90 minutes duration).

| Date | Position Lat.N. | Long.W. | Loran 1H6 | 1H7 | Depth FMS | Catch Tot.lbs. | Predominant Comm. Spp. (1000 Pounds) Vermilion Snapper | Pink Porgy | Blk. Sea Bass | Groupers | Grunts | Red, Gray & Mutton Snapper | Other | Species and Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/20/59 | 32°51′ | 78°32′ | 3498 | 4840 | 21 | 1715 | .1 | — | — | .1 | — | — | .9 | Scup |
| 12/ 4/60 | 32°55′ | 78°31′ | 3468 | 4860 | 21 | 767 | .3 | — | — | — | — | — | .2 | Triggerfish |
| 12/ 5/60 | 33°08′ | 77°46′ | 3000 | 4757 | 30 | 2200 | .4 | — | — | — | .9 | — | — | |
| 8/11/61 | 32°53′ | 78°44′ | 3588 | 4903 | 14 | 2100 | .3 | — | — | — | — | — | .15 | Scup |
| 8/13/61 | 33°15′ | 77°50′ | 2982 | 4808 | 17 | 1000 | .1 | — | — | .1 | — | .1 | .6 | Scup, Triggerfish |
| 8/17/61 | 33°20′ | 77°40′ | — | — | 13 | 1600 | .1 | — | — | .1 | — | .04 | — | |
| 12/11/61 | 33°17′ | 77°40′ | 2948 | 4795 | 18 | 1028 | .3 | — | — | .1 | — | .04 | — | |
| 12/12/61 | 33°15′ | 77°51′ | 3000 | 4806 | 18 | 1477 | .6 | — | — | .03 | — | — | .2 | Triggerfish |
| 12/13/61 | 33°18′ | 78°27′ | 3283 | 4937 | 14.5 | 2195 | — | — | — | — | .8 | — | — | |
| 8/11/61 | 32°53.5′ | 78°44′ | — | — | 14 | 2100 | — | — | — | — | — | — | — | Poundage by spp. not recorded |
| 8/11/61 | 32°48.5′ | 78°30′ | — | — | 14 | 275 | — | — | — | — | — | — | — | |
| 7/28/62 | 33°21′ | 77°40′ | 2872 | — | 14 | 900 | .6 | — | — | — | .8 | — | — | Croaker & |
| 1/17/63 | 32°52′ | 78°38′ | 3548 | 4905 | 17/18 | 7500 | .7 | — | — | — | — | — | .75 | Triggerfish |
| 1/25/63 | 33°15′ | 77°51′ | 3000 | 4837 | 17 | 2100 | .4 | — | — | — | .4 | — | .7 | Scup |
| 1/25/63 | 33°12′ | 77°50′ | 3010 | 4820 | 17 | 560 | .5 | — | — | — | — | — | — | |
| 1/26/63 | 33°00′ | 78°08′ | 3238 | 4830 | 18 | 2300 | .00 | — | — | — | — | — | 2.0 | Scup |
| 1/27/63 | 32°45′ | 78°33′ | 3543 | 4844 | 18/19 | 1275 | .7 | — | — | — | — | — | .4 | Scup 4 trawl hauls |
| 1/17/63 | 32°52.5′ | 78°38.5′ | — | — | 17/18 | 17,900 | 2.86 | — | — | — | 1.53 | — | 1.60 | Scup 90 min. each |
| 1/25/63 | 33°15.5′ | 77°51.5′ | — | — | 17 | 2000 | — | — | — | — | — | — | 1.8 | Scup Hogfish 9 trawl hauls |
| 1/28/63 | 33°45′ | 76°33.5′ | — | — | 20/24 | 15,396 | .52 | 4.9 | — | 4.7 | .2 | .41 | 4.7 | Scup in same area |
| 1/30/63 | 32°22′ | 79°12.5′ | — | — | 23/24 | 1190 | — | — | .04 | .04 | — | — | 1 | Scup |
| 1/14/64 | 32°53′ | 78°46′ | 3615 | 4940 | 15 | 2040 | .5 | — | — | — | — | — | 1.2 | Scup |
| 1/16/64 | 32°58′ | 78°36′ | 3490 | 4923 | 16 | 3075 | .2 | .1 | — | — | — | — | 2 | Scup |
| 1/21/64 | 32°21′ | 79°07′ | 3918 | 4817 | 25/27 | 2730 | — | — | — | — | — | — | 2 | Scup Hogfish & |
| 4/12/64 | 33°11′ | 77°30′ | 2850 | 4745 | 29 | 1225 | — | — | — | .4 | — | .1 | .4 | Triggerfish |
| 1/21/64 | 32°21′ | 79°07.5′ | — | — | 25/27 | 2730 | — | — | — | — | — | — | 2.6 | Scup |
| 1/21/64 | 32°20.5′ | 79°07.5′ | — | — | 25/27 | 2120 | — | — | — | — | — | — | 1 | Spadefish Amberjack 3 hand- |
| 5/17/64 | 32°21′ | 79°02′ | — | — | 31/34 | 1476 | — | .02 | — | .92 | — | .34 | .17 | Lines, 3 hrs. |

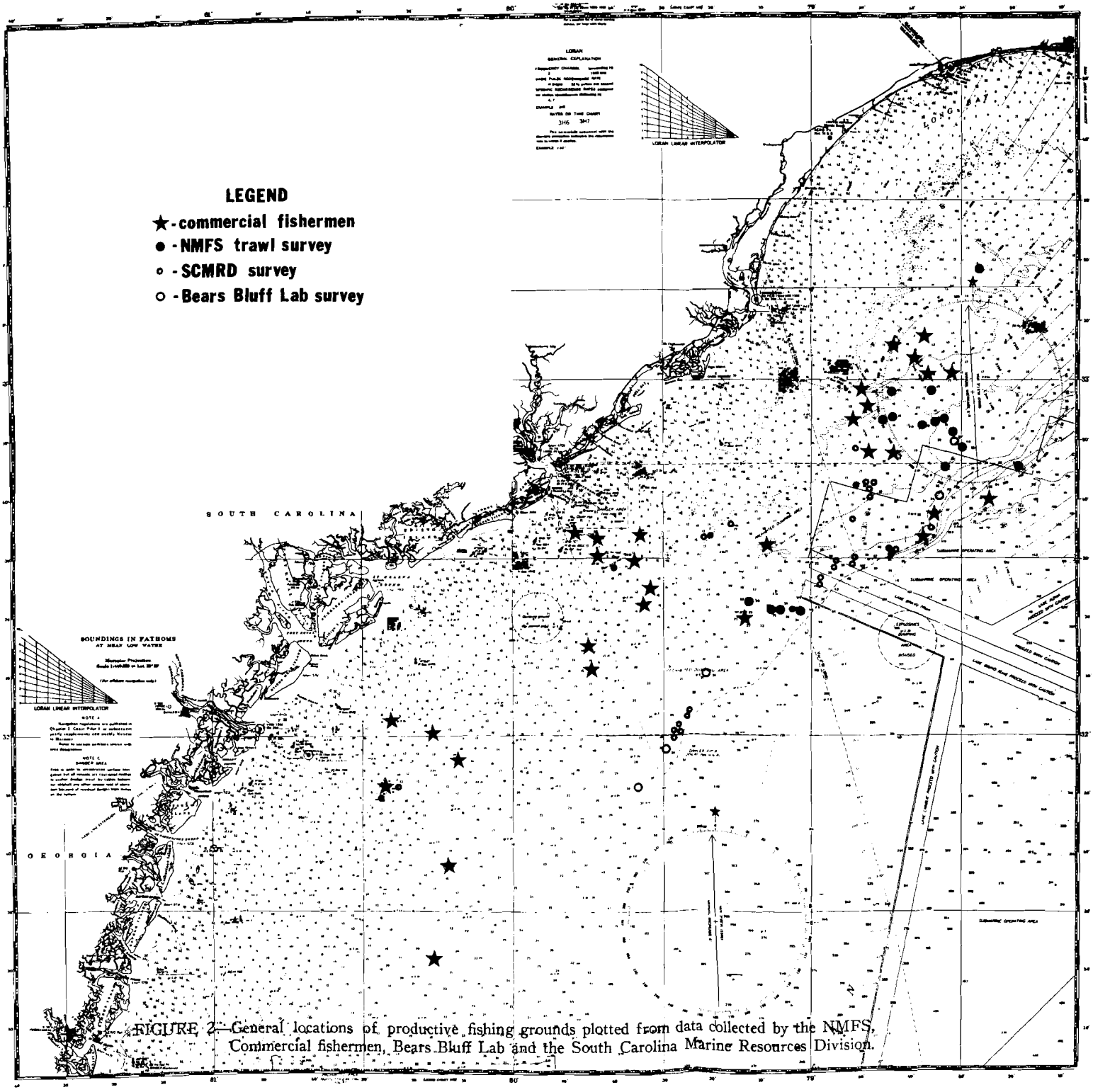


FIGURE 2—General locations of productive fishing grounds plotted from data collected by the NMFS, Commercial fishermen, Bears Bluff Lab and the South Carolina Marine Resources Division.

wrecks and artificial reefs are present in the coastal area, and provide additional habitat for demersal fish species. Large concentrations of sea bass are found around the artificial fishing reefs and wrecks, and utilization by fishermen has been heavy in recent years.

The open shelf habitat generally extends from the 10 fathom curve offshore to a depth of 25-30 fathoms. Between 10 and 18 fathoms, considerable rough bottom having coral, limestone and invertebrate growth is present and this area is commonly known as the "Blackfish Banks", Beyond 18 fathoms broken or live bottom areas are generally more scattered, and out to 25-30 fathoms the shelf contour is relatively smooth and has a very gradual slope. On the smooth bottom areas of the open shelf habitat, predominant fishes include sea robins, filefishes, porgies, lizard fishes and a variety of flatfishes. On the live bottom areas of the open shelf, sea bass and porgies are predominant, but snappers, groupers, and grunts also occur on these areas, especially in the 15-30 fathom depth range.

The shelf edge habitat off South Carolina (25-60 fathoms) is characterized by a wide variety of bottom types. The dominant feature of this area is the remains of an ancient reef which runs approximately parallel to the coastline at depths of 25-35 fathoms. This reef is more or less continuous along the entire Continental Shelf area off South Carolina, although its relief varies considerably from place to place. This is the best known and most readily located natural formation of the shelf edge habitat, and is fished extensively by both sport and commercial fishermen. Figure 3 is a white line recorder tracing across this reef indicating the steep relief commonly associated with this formation. The shoreward or upper portions of the reef are characterized by extensive invertebrate growth, including sponges and coral.

As pointed out by Struhsaker (1969), the live bottom areas are interspersed at various localities along the Continental Shelf. These areas are characterized by outcrops of rock with attachments of sessile organisms, sponges, etc., and are populated largely by tropical fishes. Due to the proximity of the Florida current, water temperatures in this area are much more constant than in the open shelf and coastal zone habitats. Fishes commonly occurring in the shelf edge live bottom habitat are grunts, cardinal fishes, scorpion fishes, groupers, amberjacks, snappers, porgies, triggerfishes, squirrel fishes and sea bass.

Fish movements on the Continental Shelf area off South Carolina are generally speculated to be inshore-offshore, depending largely upon water temperatures, as was concluded for Florida waters by Moe (1963). However, little is known concerning the coast-wise migrations of demersal fishes off South Carolina at this time. Although the species composition of the demersal fish fauna off South Carolina has been fairly well described, much remains to be learned concerning their biology and ecological relationships.

During the 1970-71 survey by the Marine Resources Division, 47 individual stations were sampled on the Continental Shelf area off South Carolina. The majority of these stations were located in three general areas of the open shelf edge habitats at compass headings of 160°, 105-120° and 95-100° off the Charleston sea buoy (2C). The specific stations sampled, and the catches of commerically important bottom fishes taken by fish traps and snapper reels are summarized in Table 3.

TABLE 3.—Catch Results at Offshore Bottom Fishing Stations, South Carolina Continental Shelf, 1970-71.

| Date | Position Lat.N. | Position Long.W. | Loran 3H6 | Loran 3H7 | Gear 1 | Depth FMS | Time Fished Min. | Total Catch Lbs. | PREDOMINANT Spp. CAUGHT IN POUNDS: Vermilion Snapper | Pink Porgy | Black Sea Bass | Grouper | Grunt | Red and Black-fin Snapper | Other Species & Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/ 1/70 | 31°58.5′ | 79°28.0′ | 4071 | 4641 | SR | 26.30 | 220 | 78.6 | 22.5 | 37.0 | — | 4.5 | 7.3 | — | 3.6 Triggerfish Amberjack |
| 5/ 1/70 | 32°00.8′ | 79°28.0′ | 4071 | 4659 | SR | 26/30 | 115 | 63.6 | 17.9 | 21.8 | — | 10.3 | — | — | 13.6 Triggerfish |
| 5/ 1/70 | 32°07.5′ | 79°12.0′ | 3965 | 4699 | SR | 42 | 60 | 21.8 | — | 3.0 | — | 14.5 | — | — | 4.3 |
| 5/ 1/70 | 32°14.0′ | 79°11.5′ | 3959 | 4761 | SR | 27 | 60 | 12.3 | 2.0 | 7.8 | — | 2.5 | — | — | — |
| 6/ 4/70 | 32°28.0′ | 78°55.5′ | 3800 | 4822 | SR | 27/28 | 120 | 83.9 | 12.8 | 38.4 | — | 32.3 | — | — | — |
| 6/ 4/70 | 32°28.1′ | 78°51.7′ | 3768 | 4808 | SR | 36/37½ | 110 | 212.9 | — | 149.6 | — | 41.3 | — | — | 22 Blk. Line Tilefish |
| 6/ 4/70 | 32°31.4′ | 78°48.0′ | 3724 | 4818 | SR | 25/27 | 15 | 11.4 | — | 1.6 | — | 9.8 | — | — | — |
| 6/ 4/70 | 32°29.7′ | 78°51.8′ | 3763 | 4823 | SR | 22½/24 | 40 | 53.3 | — | 38.8 | — | 1.4 | — | — | 13.1 Banded Rudderfish |
| 6/ 4/70 | 32°26.7′ | 78°58.2′ | 3827 | 4823 | SR | 27 | 30 | 33.8 | — | 23.1 | — | 10.7 | — | — | — |
| 6/ 5/70 | 32°26.0′ | 78°58.2′ | 3830 | 4820 | SR | 26 | 90 | 126.3 | — | 91.3 | — | 25.0 | — | — | — |
| 6/ 5/70 | 32°20.2′ | 79°03.3′ | 3884 | 4788 | SR | 28 | 15 | 6.6 | — | — | — | — | — | — | 6.6 Blk. Line Tilefish |
| 7/ 1/70 | 32°25.7′ | 78°58.3′ | 3831 | 4815 | SR | 23/28 | 180 | 93.4 | — | 80.5 | 12.9 | — | — | — | — |
| 7/ 1/70 | 32°25.7′ | 78°58.3′ | 3831 | 4815 | SR | 24 | 100 | 131.6 | — | 76.4 | — | 24.3 | — | — | 31 Blk. Line Tilefish Triggerfish |
| 7/ 2/70 | 32°29.7′ | 79°11.0′ | 3931 | 4899 | SR | 18/19 | 66 | 3.0 | — | — | 1.2 | — | — | — | 1.8 Sand Perch |
| 7/ 2/70 | 32°31.7′ | 79°14.7′ | 3960 | 4930 | SR | 17 | 25 | 0.4 | — | — | — | — | — | — | 0.4 Sand Perch |
| 8/ 6/70 | 32°48.5′ | 78°51.4′ | 3683 | 4938 | SR | 17 | 90 | 37.2 | — | 1.5 | 34.3 | — | 0.4 | — | 1.0 Scup |
| 8/ 6/70 | 32°42.5′ | 78°48.8′ | 3691 | 4893 | SR | 18 | 85 | 86.9 | 1.1 | 15.5 | 45.3 | — | — | 25.0 | — |
| 8/ 6/70 | 32°40.2′ | 78°48.3′ | 3694 | 4877 | SR | 19 | 60 | 101.8 | — | 66.3 | 35.5 | — | — | — | — |
| 8/ 6/70 | 32°31.3′ | 78°44.0′ | 3689 | 4800 | SR | 32/35 | 35 | 35.9 | — | 11.3 | — | — | — | — | 24.6 Blk. Line Tilefish Silky Shark |
| 8/ 6/70 | 32°34.7′ | 78°36.3′ | 3608 | 4793 | SR | 25/30 | 180 | 123.4 | — | 33.4 | — | 33.5 | — | 47.5 | — |
| 8/ 7/70 | 32°34.7′ | 78°36.3′ | 3608 | 4793 | SR | 26 | 85 | 46.5 | — | 2.2 | — | 19.8 | — | 24.5 | — |
| 8/ 7/70 | 32°34.7′ | 78°36.3′ | 3608 | 4793 | SR | 29½ | 37 | 7.3 | — | — | — | 7.3 | — | — | — |

TABLE 3—(Continued)

| Date | Position | | Loran | | Gear | FMS | Min. fish | Total Catch | VS | PREDOMINANT Spp. PP | BSB | G | G | R&B Snap. | Other | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/ 3/70 | 32°42.0′ | 78°49.0′ | 3690 | 4891 | SR,FT | 18 | 132(90) | 142.0 | — | 53.0 | 83.3 | — | 4.2 | — | 1.5 | Sand Perch |
| 9/ 3/70 | 32°35.5′ | 78°35.6′ | 3598 | 4797 | SR | 25 | 20 | 34.9 | — | 23.5 | — | 11.4 | — | — | — | |
| 9/ 3/70 | 32°34.8′ | 78°35.2′ | 3599 | 4788 | SR | 27/37 | 40 | 16.4 | — | 8.9 | — | 7.5 | — | — | — | |
| 9/ 3/70 | 32°34.7′ | 78°35.1′ | 3595 | 4783 | SR | 26/30 | 50 | 27.3 | — | 21.8 | — | 5.5 | — | — | — | |
| 9/ 3/70 | 32°36.4′ | 78°52.0′ | 3744 | 4872 | SR,FT | 20 | 70(50)2 | 143.8 | — | — | 141.6 | — | — | — | 2.2 | Porgy |
| 9/ 4/70 | 32°42.0′ | 78°49.5′ | 3700 | 4893 | SR,FT | 18 | 275(190) | 436.4 | — | 55.9 | 379.3 | — | — | — | 1.5 | Sand Perch Sea Bass |
| 10/ 1/71 | 32°02.8′ | 79°24.8′ | 4054 | 4679 | SR | 25/30 | 80 | 87.3 | 21.8 | 28.9 | — | 12.8 | 7.3 | 5.1 | 11.3 | Amberjack |
| 10/ 1/70 | 32°01.0′ | 79°27.0′ | 4063 | 4659 | SR | 26 | 80 | 170.4 | 26.3 | 26.2 | — | 13.3 | 13.3 | — | 91.1 | Spotted Scorpionfish, Amberj., Triggerfish |
| 10/ 1/70 | 31°58.2′ | 79°29.2′ | 4077 | 4633 | SR | 26/31 | 30 | 9.5 | — | 9.5 | — | — | — | — | — | |
| 10/ 1/70 | 31°54.8′ | 79°30.5′ | 4077 | 4596 | SR | 33 | 20 | 12.1 | — | 4.3 | — | — | — | — | 7.8 | Triggerfish |
| 10/ 1/70 | 31°57.0′ | 79°22.7′ | 4038 | 4605 | SR | 35 | 10 | 8.8 | — | — | — | — | — | — | 8.8 | Blk. Line Tilefish |
| 10/ 1/70 | 31°59.4′ | 79°24.9′ | 4050 | 4639 | SR | 32 | 12 | 23.8 | — | 6.3 | — | 17.5 | — | — | — | |
| 10/ 1/70 | 32°01.9′ | 79°26.0′ | 4958 | 4668 | SR | 25/28 | 70 | 13.3 | 8.1 | — | — | — | 5.2 | — | — | |
| 10/1-2/70 | 32°08.5′ | 79°17.8′ | 4006 | 4722 | SR,FT | 28 | 135(875) | 103.4 | 21.7 | 10.8 | — | 41.3 | 6.1 | — | 21.2 | Amberjack, Triggerfish |
| 10/ 2/70 | 32°09.4′ | 79°18.5′ | 4012 | 4736 | SR | 24 | 25 | 12.9 | — | — | 12.9 | — | — | — | — | |
| 11/19/70 | 32°25.5′ | 78°56.2′ | 4820 | 4820 | SR | 25 | 10 | 9.3 | 1.1 | 7.9 | — | — | 0.2 | — | — | |
| 11/19/70 | 32°28.4′ | 78°55.2′ | 3795 | 4820 | SR | 25/27 | 105 | 129.4 | 12.3 | 13.1 | — | 33.0 | — | — | 70.9 | Cobia, Amberj. |
| 11/19/70 | 32°25.0′ | 78°58.8′ | 3835 | 4811 | SR | 24 | 15 | 20.9 | — | 11.6 | — | 9.3 | — | — | — | |
| 11/19/70 | 32°20.5′ | 79°03.0′ | 3880 | 4790 | SR | 25/28 | 40 | 56.1 | — | 24.1 | — | 32.0 | — | — | — | |
| 11/19/70 | | | | | | | | | | | | | | | | |
| 11/20/70 | 32°20.9′ | 79°03.7′ | 3884 | 4794 | SR,FT | 24 | 265(900) | 125.6 | 4.8 | 54.0 | 0.2 | 25.6 | 6.8 | 20.0 | 11.1 | Squirrelfish, Triggerfish |
| 12/22/70 | 32°33.8′ | 79°21.5′ | 4016 | 4972 | SR,FT | 13 | 165(435) | 1174.2 | — | 46.8 | 1082.0 | — | — | — | 44.5 | Triggerfish, |
| 1/13/71 | 32°29.5′ | 79°33.0′ | 4125 | 4990 | SR | 15 | ? | 0 | — | — | — | — | — | — | — | |
| 1/13/71 | 32°34.5′ | 79°31.8′ | 4105 | 5030 | SR | 10/15 | ? | 0 | — | — | — | — | — | — | — | |
| 1/13/71 | 32°32.3′ | 79°27.7′ | 4075 | 4922 | SR | 10/15 | ? | 0 | — | — | — | — | — | — | — | |
| 2/23/71 | 32°29.8′ | 78°51.5′ | 3760 | 4820 | SR | 24/28 | 210 | 52.0 | — | 43.6 | — | 5.6 | — | — | 2.8 | Amberjack |
| | | | | | | | TOTAL WT. | 4179.7 | 152.4 | 1149.6 | 1828.5 | 462.0 | 50.8 | 122.1 | | |

1. SR = Snapper Reels
   FT = Fish Traps
2. ( ) = Time fish traps were overboard, all other times indicate snapper reel fishing.

The total catch of commercial species at individual stations varied considerably, from less than one pound to as high as 1,174.2 pounds. Average time fished per station was 121 minutes, and the average catch per station was 92.8 pounds of marketable fish. Approximately 20 of the stations sampled by fish trap and/or snapper reel gear produced catch rate indications of commercial magnitude. The general areas sampled having the best commercial potentials were situated between 90° and 100° from Charleston at a depth range of 16-20 fathoms and at 105° from Charleston at a depth range of 13-14 fathoms. Figure 4 is a white line recorder tracing in the former area, indicating large concentrations of sea bass near the bottom. A tracing in the latter area, also indicating sea bass and pink porgy concentrations, is shown in Figure 5.

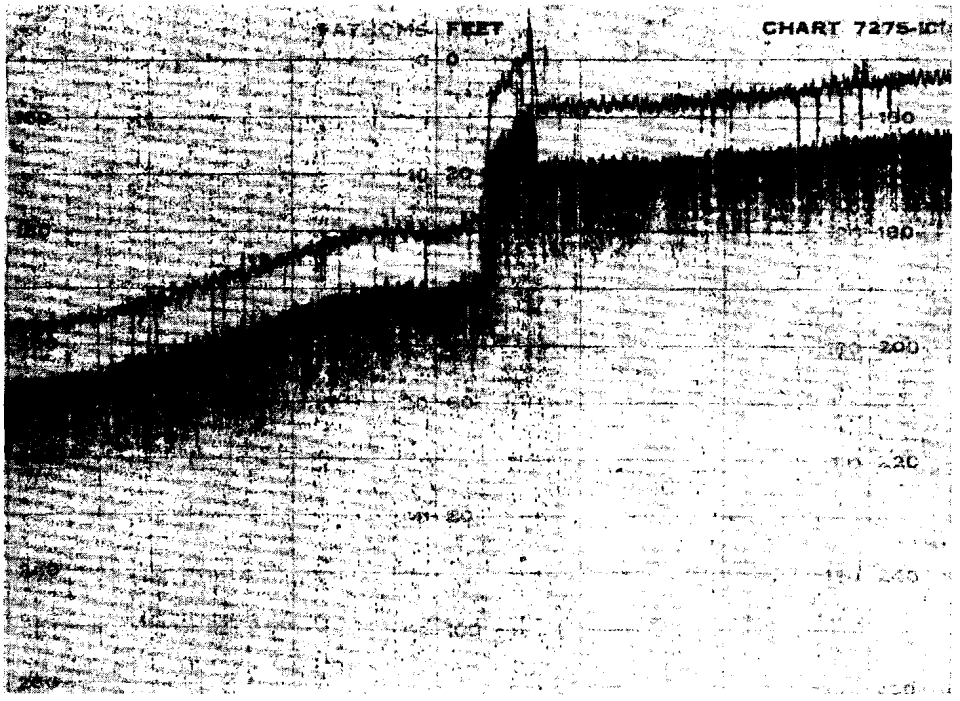


FIGURE 3—White line recorder tracing of Continental Shelf edge habitat.

At the shallowest depth range sampled during the project (13-20 fathoms), black sea bass (*Centropristis striata*) predominated the total catch, both in numbers and pounds, of fish caught. At the deeper depth range sampled (22-42 fathoms), pink porgy (*Pagrus sedecim*) was the dominant species taken (Tables 4 and 5). The above two species comprised over 70% of the total weight of the fishes taken at all locations. (Grouper (*Mycteroperca phenax, M. microlepis, Epinephelus drummondhayi, E. niveatus*); vermilion snapper (*Rhomboplites aurorubens*); red and blackfin snapper (*Lutjanus campechanus* and *L. buccanella*); triggerfish (*Balistes capriscus*); grunts (*Haemulon aurolineatum* and *H. plumieri*); and blackline tilefish (*Caulolatilus cyanops*) made up the remaining catch of marketable species.

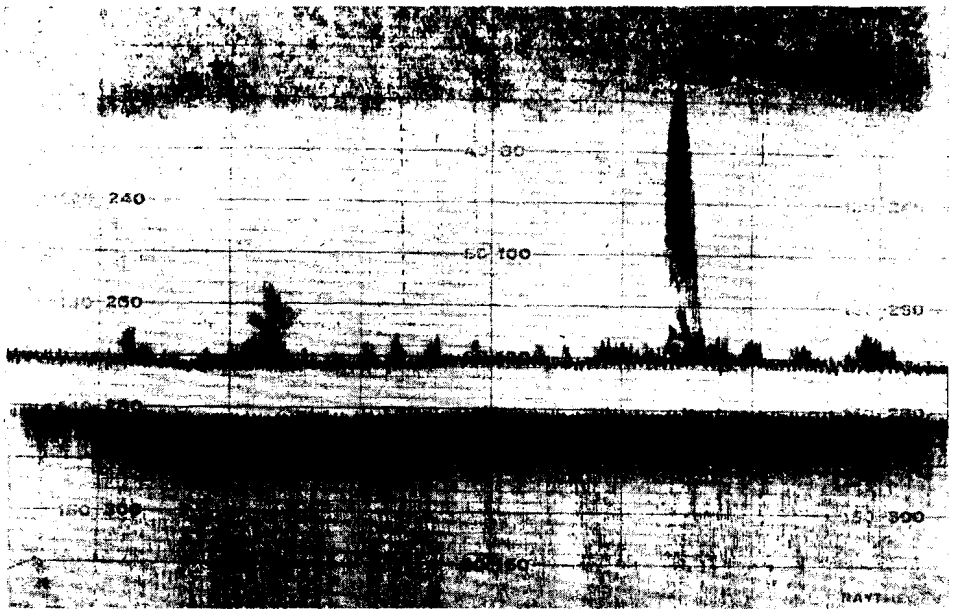


FIGURE 4—White line recorder tracing of sea bass located between 90 and 100° off Charleston at 16-20 fms.

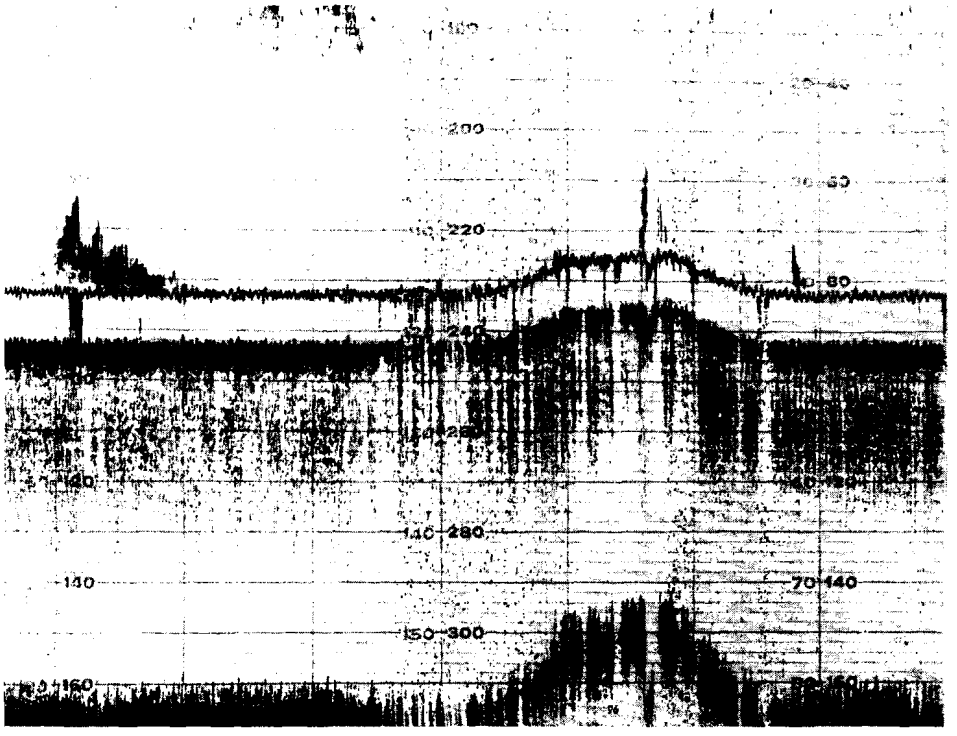


FIGURE 5—White line recorder tracing of sea bass and pink porgy located 105° off Charleston at 13-14 fms.

TABLE 4.—Species Composition of commercially important bottom fishes taken at selected depth ranges off S. C. — 1970-71

| SPECIES | Weight of species x100% Weight of all species | | % By weight of each species caught | | Catch per hour of each species in lbs. | |
|---|---|---|---|---|---|---|
| | Shallow 13-20 FMS | Deep 22.5-42 FMS | Shallow 13-20 FMS | Deep 22.5-42 FMS | Shallow 13-20 FMS | Deep 22.5-42 FMS |
| Black sea bass | 84.9% | 0.1% | 98.6% | 1.4% | 87.4 | 0.4 |
| Pink porgy | 11.3 | 44.3 | 20.8 | 79.2 | 11.6 | 13.5 |
| Groupers | — | 22.5 | 0 | 100 | — | 6.8 |
| Vermilion snapper | 0.5 | 7.4 | 0.8 | 99.2 | 0.05 | 2.2 |
| Red and blackfin snapper | 1.1 | 4.7 | 20.5 | 79.5 | 1.2 | 1.4 |
| Triggerfish | 2.0 | 2.0 | 51.0 | 49.0 | 2.1 | 0.6 |
| Grunts | 0.2 | 2.2 | 9.1 | 90.9 | 0.2 | 0.7 |
| Blackline tilefish | — | 3.7 | 0 | 100 | — | 1.1 |
| Amberjacks | — | 5.7 | 0 | 100 | — | 1.7 |

TABLE 5.—Rank by number and weight of commercially important bottom fishes at selected depth ranges off S. C. — 1970-71.

| SPECIES | Shallow 1 13-20 Fathoms | | | | Deep 2 22.5-42 Fathoms | | | | All Stations 13-42 Fathoms | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number Weighed | Rank By Number | Weight | Rank By Weight | Number Weighed | Rank By Weight | Weight | Rank By Weight | Number Weighed | Rank By Number | Weight | Rank By Weight |
| Black sea bass | 759 | 1 | 1802.5 | 1 | 19 | 5 | 26.0 | 9 | 778 | 1 | 1828.5 | 1 |
| Pink porgy | 102 | 2 | 238.0 | 2 | 360 | 1 | 911.7 | 1 | 462 | 2 | 1149.7 | 2 |
| Groupers | 0 | — | 0 | — | 48 | 3 | 462.0 | 2 | 48 | 4 | 462.0 | 3 |
| Vermilion snapper | 1 | 5 | 1.1 | 6 | 91 | 2 | 151.3 | 3 | 92 | 3 | 152.4 | 4 |
| Red and blackfin snapper | 2 | 6 | 25.0 | 4 | 11 | 7 | 97.1 | 5 | 13 | 7 | 122.1 | 5 |
| Triggerfish | 6 | 3 | 43.5 | 3 | 11 | 7 | 41.8 | 8 | 17 | 6 | 85.3 | 6 |
| Grunts | 2 | 4 | 4.6 | 5 | 38 | 4 | 46.2 | 7 | 40 | 5 | 50.8 | 8 |
| Amberjacks | 0 | — | 0 | — | 12 | 6 | 122.1 | 4 | 12 | 8 | 122.1 | 5 |
| Blackline tilefish | 0 | — | 0 | — | 9 | 8 | 75.1 | 6 | 9 | 9 | 75.1 | 7 |

1. 9 Shallow Stations = 20.63 hrs. fishing time
2. 35 Deep Stations = 67.73 hrs. fishing time

A total of 48 species of fishes, representing 26 families, was collected during the 1970-71 survey. A listing of all species taken, depths of collection, and size ranges is presented in Table 6. A total of 1594 individuals of various species were both measured and weighed during the course of the project. The combined weight of all species taken was 4938.1 pounds.

TABLE 6.—Species composition, depth range and size of bottom fishes taken off S. C., 1970-71.

| FAMILY AND SPP. | Range of Depth of Capture FMS | Number of Specimens[1] | Length Range SL (mm) | Weight Range in Pounds[2] | Total Weight in Pounds | Average We per Specim |
|---|---|---|---|---|---|---|
| CARCHARHINIDAE | | | | | | |
| Carcharhinus falciformis | Surface-35 | 3 | 990-1280 | 14.3-21.5 | 53.8 | 17.9 |
| Carcharhinus milberti | Surface | 3 (1) | 1620-2090TL | | ca:170 | ca 170 |
| Carcharhinus obscurus | Surface | 1 | 3280 TL | Not Weighed | Not Weighed | — |
| Galeocerdo cuvieri | Surface | 3 | 2325-2620TL | Not Weighed | Not Weighed | — |

| | | | | | | |
|---|---|---|---|---|---|---|
| SPHYRNIDAE | | | | | | |
| Sphyrna zygaena | Surface | 1 | 2050 TL | Not Weighed | Not Weighed | — |
| MURAENIDAE | | | | | | |
| Gymnothorax sp. | 26 | 1 | 990 TL | 3.9 | 3.9 | 3.9 |
| CLUPEIDAE | | | | | | |
| Sardinella anchovia | | 1 | 151.8 | Not Weighed | Not Weighed | — |
| BATRACHOIDIDAE | | | | | | |
| Opsanus tau | 13-24 | 2 | 225-373 | 1-2.9 | 3.9 | 1.95 |
| GADIDAE | | | | | | |
| Urophycis floridanus | 26 | 1 | 378 | 2.0 | 2.0 | 2.0 |
| EXOCOETIDAE | | | | | | |
| Cypselurus heterurus | Surface | 6 | 185-227 | 0.3-0.4 | 1.7 | 0.3 |
| Parexocoetus brachypterus | Surface | 3 | 99.3-122.7 | both = 0.1 | 0.2 | 0.07 |
| HOLOCENTRIDAE | | | | | | |
| Holocentrus ascensionis | 24 | 7 | 240-293 | 0.6-1.3 | 7.5 | 1.06 |
| SERRANIDAE | | | | | | |
| Centropristis ocyurus | 13-30 | 10 | 143-204 | 0.2-0.9 | 3.5 | 0.35 |
| Centropristis striata | 13-28 | (652) | 147-405 | 0.2-3.9 | 1828.4 | 1.27 |
| Diplectrum formosum | 17-19 | 10 | 189-230 | .3-.8 | 4.5 | 0.45 |
| Epinephelus drummondhayi | 22.5-37.5 | 33 | 279-840 | .5-32.0 | 269.2 | |
| Epinephelus niveatus | 27-42 | 5 | 420-506 | 4.5-9.3 | 36.8 | 7.26 |
| Mycteroperca microlepis | 24-26 | 3 | 763-920 | 19.5-38.0 | 75.5 | 25.17 |
| Mycteroperca phenax | 24-30 | 7 | 552-710 | 8.8-16.3 | 80.3 | 11.48 |
| GRAMMISTIDAE | | | | | | |
| Rypticus maculatus | 24 | 1 | 162 | 0.2 | 0.2 | 0.2 |
| BRANCHIOSTEGIDAE | | | | | | |
| Caulolatilus cyanops | 24-42 | 9 | 406-660 | 2.8-12.0 | 75.0 | 8.33 |
| RACHYCENTRIDAE | | | | | | |
| Rachycentron canadum | 25 | 1 | 830 | 16.5 | 16.5 | 16.50 |
| ECHENEIDAE | From sharks at | | | | | |
| Echeneis naucrates | Surface | 1 | 70.5 | Negligible | Negligible | — |
| Remora remora | From sharks at Surface | 1 | 80.2 | Negligible | Negligible | — |
| CARANGIDAE | | | | | | |
| Decapterus punctatus | Surface | 2 | 29.4-30.0 | Negligible | Negligible | — |
| Seriola dumerili | 24-30 | 8(7) | 398SL-1120FL | 2.8-41.0 | 133.9 | 19.12 |
| Seriola rivoliana | 25-30 | 5 | 325-750 | 1.8-13.5 | 37.3 | 7.46 |
| Seriola zonata | 22.5-24 | 3 | 465-480 | 4.1-4.6 | 13.1 | 4.36 |
| CORYPHAENIDAE | | | | | | |
| Coryphaena hippurus | Surface | 22 | 656-1005 | 6.5-19.0 | 288.3 | 13.10 |
| LUTJANIDAE | | | | | | |
| Lutjanus buccanella | 25-30 | 8 | 407-552 | 5.5-10.5 | 72.02 | 9.00 |
| Lutjanus campechanus | 18-30 | 5 | 322-715 | 2.3-20.0 | 50.1 | 10.02 |
| Rhomboplites aurorubens | 18-30 | 92 | 133-448 | 0.3-4.8 | 152.2 | 1.65 |
| POMADASYIDAE | | | | | | |
| Haemulon aurolineatum | 17-26 | 29 | 130-211 | 0.1-0.5 | 9.3 | 0.32 |
| Haemulon plumieri | 18-30 | 11 | 310-415 | 2.0-5.4 | 41.6 | 41.60 |
| SPARIDAE | | | | | | |
| Calamus sp. | 20 | 4 | 163-259 | 0.3-1.4 | 2.2 | 0.55 |
| Pagrus sedecim | 13-24 | 473 | 193-446 | 0.4-5.6 | 1149.5 | 2.48 |
| Stenotomus chrysops | 17 | 3 | 165-192 | 0.3-0.4 | 1.1 | 0.36 |
| MUGILIDAE | | | | | | |
| Mullus auratus | Surface | 6 | 37.0-39.0 | Negligible | Negligible | — |
| LABRIDAE | | | | | | |
| Halichoeres caudalis | | 1 | 65.9 | Negligible | Negligible | — |
| MULGILIDAE | | | | | | |
| Mugil curema | Surface | 1 | 22.0 | Negligible | Negligible | — |
| SPHYRAENIDAE | | | | | | |
| Sphyraena barracuda | Surface | 1 | Not Measured | Not Weighed | Not Weighed | — |

| | | | | | | |
|---|---|---|---|---|---|---|
| SCOMBRIDAE | | | 1120 FL | | | |
| Acanthocybium solanderi | Surface | 2 | 1330 SL | 24.0-29.0 | 53.0 | — |
| Euthynnus alletteratus | Surface | 6 | 367-705 | 2.3-11.5 | 43.6 | 26.50 |
| Scomberomorus cavalla | Surface | 4 (3) | 447-795FL | 1.8-9.0 | 14.5 | 7.26 |
| Thunnus atlanticus | Surface | 6 | 4.83 | 8.5-16.8 | 69.5 | 536-660 |
| SCORPAENIDAE | | | | | | |
| Scorpaena plumieri | 26 | 1 | 343 | 4.3 | 4.3 | 11.58 |
| TRIGLIDAE | | | | | | |
| Prionotus evolans | 14 | 1 | 259 | 0.8 | 0.8 | 4.3 |
| BALISTIDAE | | | | | | |
| Balistes capriscus | 13-33 | 18(17) | 312-471 | 2.3-8.5 | 85.2 | 0.8 |
| Monacanthus hispidus | Surface | 7 | 9.5-23.5 | Negligible | Negligible | 5.01 |

1. Total no. specimens weighed and measured = 1,594.
2. Total wt. all species = 4,938.1 Lbs.

Length-frequency data were compiled for black sea bass and pink porgy caught by fish traps and snapper reels during the survey period. This information is presented in Figures 6 and 7. Black sea bass specimens ranged from 147-405 mm in standard length and ranged in weight from 0.2-3.9 pounds (average 1.27 pounds per fish). Specimens taken by handlines were significantly larger than those caught in fish traps. Pink porgy specimens ranged from 193-446 mm in standard length and 0.4-5.6 pounds in weight (averaging 2.48 pounds each).

Subsamples of black sea bass and pink porgy were examined for stomach contents. Both species were found to feed on a wide variety of small fishes and invertebrates. Decapods (Portunid crabs, etc.) and fish remains were predominant in the stomachs of sea bass. Pink porgy stomachs contained a mixture of decapods (Majidae, Xanthidae and Portunidae), polychaetes, and molluscs. Both species appeared to be influenced more by the availability of food organisms rather than food preference.

The results of this 1970-71 survey and findings from previous exploratory fishing surveys have indicated the depth distribution and general areas of availability for the major commercial species of demersal fishes found off the South Carolina coast, excluding the deeper lower shelf habitat. A list of the more important bottom fishes occuring in this area, along with the known depth ranges of populations of commercial size, is presented in Table 7.

Present knowledge indicates that the greatest potential commercial concentrations of demersal fishes off South Carolina are found between latitudes 32° 40′ N and 33° 50′ N. at a depth range of 16-24 fathoms. Although numerous other locations having commercial potential are known, this general area appears to have the most consistent concentrations of demersal fishes available to a variety of fishing methods and gear.

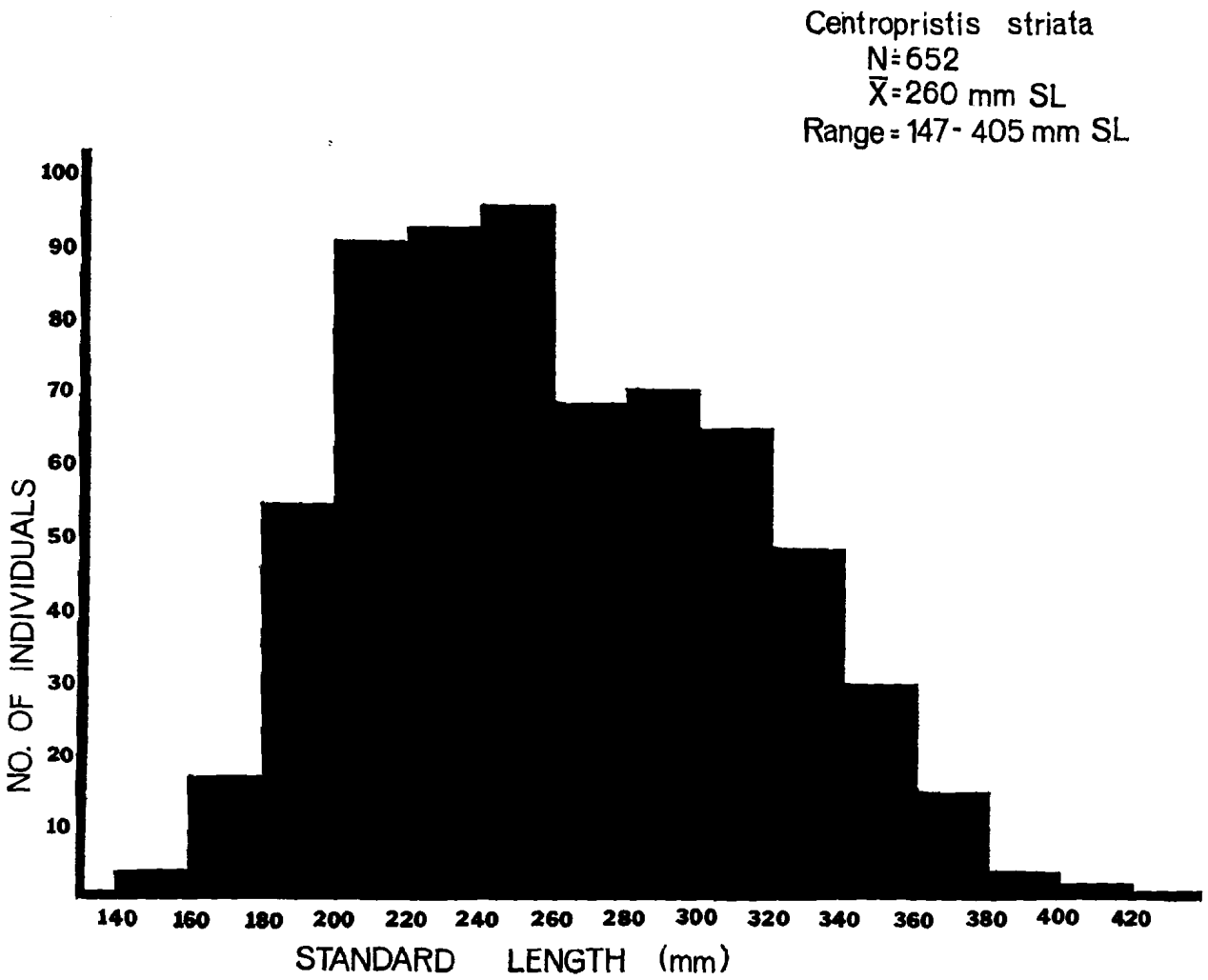


FIGURE 6—Length-frequency data for black sea bass (*Centropristis striata*).

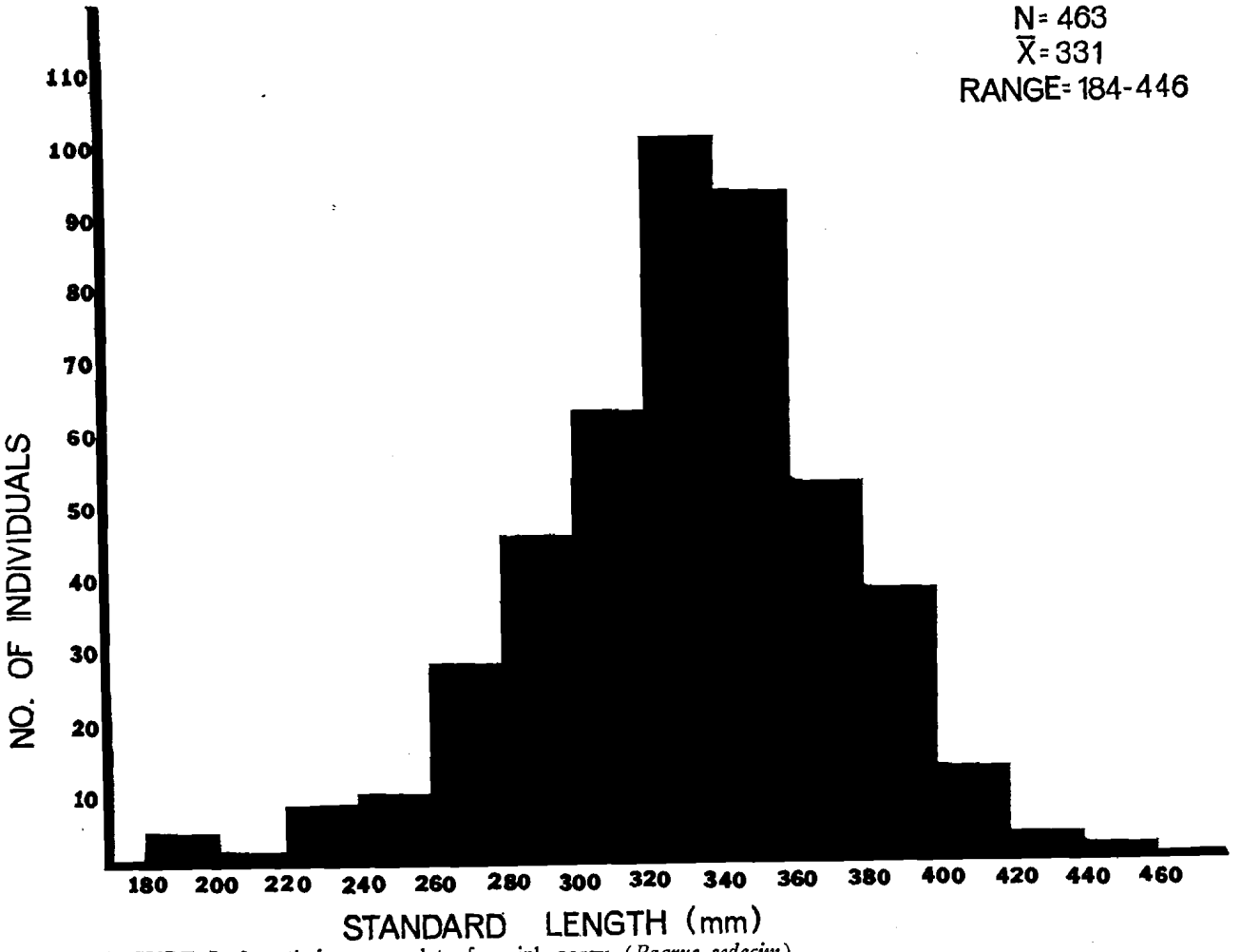


FIGURE 7—Length-frequency data for pink porgy (*Pagrus sedecim*).

TABLE 7—Depth distribution of commerical concentrations of demersal fishes off South Carolina.

| Species | Known Depth Range Comm. Conc. | Depth Range of Major Comm. Conc. Found on Survey |
|---|---|---|
| Black Sea Bass | 5- 28 fathoms | 10-18 fathoms |
| Pink Porgy | 13- 50 fathoms | 18-30 fathoms |
| Vermilion Snapper | 15- 35 fathoms | 16-30 fathoms |
| Groupers | 16-100 fathoms | 30-50 fathoms |
| Red and Blackfin Snapper | 15- 50 fathoms | 20-40 fathoms |
| Scup | 5- 20 fathoms | 10-18 fathoms |
| Grunts | 10- 30 fathoms | 10-30 fathoms |

## Discussion & Recommendations

Results of this study and previous surveys on the Continental Shelf off South Carolina indicate a considerable potential for the development of demersal fishery resources in this area. This seems particularly true of the live bottom and shelf edge habitats lying at depths of 10 to 50 fathoms.

Three general types of fishing gear appear to be most suitable for commercial bottom fishing operations off South Carolina—fish traps, roller-rigged trawls and handlines (manual or powered commercial reels). Although further exploratory trawling off the South Carolina coast is desirable, the basic gear and methods, as well as the areas of bottom fish availability to this type of operation are fairly well known. The techniques of handline and trap fishing off the South Carolina coast are reasonably well developed at this time. However, most of these operations are conducted on a part-time or seasonal basis by fishermen whose primary interests lie in other fisheries such as shrimping.

At the present level of knowledge, it appears that fishing for demersal species off the South Carolina coast utilizing only handline gear (manual or powered snapper reels) is the least feasible method for a full scale commercial venture. Results of this study indicate that higher priced species, such as red snappers, fluctuate in availability considerably from year to year in various areas; these fish are not usually abundant enough to warrant full scale commercial handline fishing. Handline fishing for pink porgy, snapper, grouper, etc., as a supplement to the use of fish traps, does appear to have some potentials for a full time sea bass operation.

Commercial fishing with traps for sea bass has become well established off South Carolina. After much experimentation most fishermen have found that the modified crab trap similar to that described by Rivers (1966) is the most efficient gear for this type of fishing. In recent years, some minor innovations—such as the use of steel reinforcing rod around the edges of the traps—have evolved.

As pointed out by Struhsaker (1969), trawling with roller rigged fish trawls on the live bottom and shelf edge habitats off South Carolina, has considerable potential. Further exploratory trawling is needed to determine the availability of black sea bass to trawling. It has been established that commercial quantities of vermilion snapper, pink porgy and grouper are available to this type of operation. During the course of this study, a large area of comparatively even bottom was located east of Charleston in 17-18 fathoms and was fished during August and September of 1970. Large concentrations of sea bass mixed with pink porgy were found in this area and from all indications, trawling with roller rigged gear would be possible. Successful trawlingoperations of this type require a high degree of skill and experience as well as sophisticated gear and electronic equipment. In addition, the handling and marketing problems involved in such an operation would tend to discourage full scale trawling for demersal fishes on the Continental Shelf. Currently, it appears that exploitation of demersal fishery resources off this coast may be primarily limited to trap and trap/handline combinations both on a part-time and full-time basis.

A major need at this time is for commercial scale pilot projects to determine the economic feasibility of: (1) fish trap or fish trap/handline combinations for sea bass and incidental species occurring in the 10-20 fathom depth range; and (2) fish trawling operations for sea bass, vermilion snapper, pink porgy and other species in the 10-40 fathom depth range. The Marine Resources Division is currently working with several commercial fishermen along these lines. Technical advice will be provided and, if possible, financial assistance from various sources will be sought to aid in these attempts on year round commercial fishing operations.

In addition to the problems and needs associated with gear and methods of fishing, the availability of demersal fishes on the Continental Shelf area appears to fluctuate considerably on a seasonal and yearly basis. During January of 1971 large concentrations of bottom fishes were indicated on the white line recorder during an exploratory cruise. However, the fish would not take to baited hooks or enter traps. Commercial and sport fishermen along the South Carolina coast reported similar incidents throughout January-April of 1971. The reasons for such occurrences are not known. Sport fishermen along the South Carolina coast have reported a decline over the past three years in catches of snapper and grouper in the 20-40 fathom depth areas, and many have expressed concern that the natural reefs are being overfished. It appears more likely that such changes may be due to fluctuations in environmental conditions or to other natural factors, rather than over-fishing by commercial and sport fishermen.

As indicated previously, other major problems regarding the feasibility of full scale year around bottom fishing operations are related to marketing. Although red and vermilion snapper normally bring consistently high prices (1.00-$1.25/lb.), the market for sea bass has fluctuated widely in past years, and no well established market exists for pink porgy at this time. Scup and northern porgy consistenly bring prices of around 75-80 cents/lb. If pink porgy, which is as fine a quality if not better, could be marketed under this category—a tremendous fishery could be developed in South Carolina. Prices on the northern markets for grouper have averaged 35-40 cents per pound year-round. The sea bass market easily becomes flooded with higher production even though whole fish of this species brought prices of $.90-$1.00 per pound (for large sizes) during 1970 on major northern markets. The sea bass market has been excellent during the spring through fall in recent years. However, during the winter months, when South Carolina shrimpers enter the fishery on a seasonal basis, prices have often dropped to 20-30 cents per pound or less. In the past, catches of 2,000-6,000 pounds of sea bass per boat for a two day trip by a crew using 15-20 traps have been common. The fishermen have been, however, entirely dependent on the existing market conditions. Most fishermen either sell their catch to a local fish dealer at dockside for comparatively low prices, or ship their fish to larger markets in New York or Baltimore. There is little doubt that fishermen need better market information and more reliable sources for disposing of their catch at fair prices. In spite of the problems associated with marketing and demand, it is felt that the potentials for full scale bottom fishing operations off the South Carolina coast are good. A basic requirement for future commercial ventures of this type is that they be given primary consideration, rather than secondary effort to shrimping or other fishing operations. At present there are a number of large shrimp trawlers which are idle after the shrimp season. If a suitable trawl net or trap/handline fishery were developed, it could mean year-round fishing for these boats. This, in turn, would offer better employment opportunities for the crew members and enable the fishery to keep trained men. Once the problems associated with fishing techniques, handling and marketing are overcome, both year-round and seasonal operations should become more feasible.

In conclusion, the results of this study and previous surveys leave little doubt that the live bottom and shelf edge habitats on the Continental Shelf off South Carolina have commercially valuable demersal fish resources. Further exploratory fishing and biological studies are needed to gain additional knowledge concerning seasonal and spatial distribution, availability, population dynamics and life histories of the more important commercial species. Commercial feasibility operations by knowledgeable fishermen with financial assistance from governmental or private interests would be highly desirable, and the problems and potentials related to marketing need thorough investigation.

It appears that the greatest immediate potentials for commercial fisheries development is for the live bottom and shelf edge habitats lying between 10 and 40 fathoms off South Carolina. Further investigation of the open shelf, coastal, and lower shelf (60-150 fathoms) areas should also be conducted, as was pointed out by Struhsaker (1969). Definite potentials for the development of an industrial fishery for species such as filefish, sea robins, scup, etc., exist in the coastal and open shelf areas having smooth bottom. The deeper lower shelf area has not been adequately surveyed at this time.

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