

SOUTH CAROLINA MARINE FISHERIES, 1977-1986

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PREFACE

This report is an information summary of important developments in South Carolina's marine fisheries since 1977. It is written from the layman's perspective and assumes only superficial knowledge of the subject. The report identifies the principal components of the fisheries and documents the developments and trends in each. Discussion has been limited to the harvesting sector and emphasis has been placed on landed products rather than semi-processed or finished items. Economic consideration has been confined to trends in landed (ex-vessel) value. The accounts are descriptive and have been prepared using simple, standard presentation methods, at the risk of occasional oversimplification. Subjective interpretation has been minimized, particularly in instances where there has been substantial scientific debate about the data and what they mean. Current status evaluations have been based on consensus opinions. Numerous sources of information were used and, rather than cite these according to scientific practice, a bibliography has been included after each section.

Most of the landings statistics have been abstracted from official reports prepared by the Fisheries Statistics Section of the Marine Resources Division. In some cases, these have been supplemented by unpublished figures from port sampling reports or data contained in fisheries publications. These sources are included in the bibliographies or cited in footnotes. All production units are in pounds whole landed weight (pounds of meat for molluscan shellfish). Value figures are based on ex-vessel prices in contemporary dollars (i.e., those in the year of landing). In some cases, these values have been adjusted using the Consumer Price Index figures for the appropriate years in order to facilitate trend analysis.

INTRODUCTION

The commercial fishing industry in South Carolina has traditionally consisted of inshore, small-boat fisheries directed primarily at shrimp, blue crab, and oysters. The typical industry infrastructure has been comprised of independently owned boats, owner-operated with assistance from one or two share-paid crew members, that have landed their catches at numerous small wholesale docks. Most boats have worked from single locations, based on longstanding agreements with the dock owners. The buyers have usually marketed product through self-owned retail outlets, sold to other local retailers, or shipped to out-of-state large regional wholesalers or processors. Most of the state's production, particularly of offshore fish, has been shipped out-of-state as it came off the boats. In a few cases, notably the blue crab and oyster fisheries, fishermen have sold most of their catch to a few local packers, who have then distributed processed products to regional markets.

The state's seafood industry has been characteristically fragmented at these various levels, with a predominance of small, family-controlled businesses operating more or less independently. There have been few examples of large, company-owned fleets or fishermen's cooperatives. This personal (and private), independent aspect of South Carolina's fishing business has contributed to a traditional reluctance to maintain detailed production records for government agencies. A historical respect for personal independence and property rights has tended to limit legislative attempts to obtain such information on a mandatory basis. A similar attitude has also contributed to minimal regulation of commercial fishing activities, in the absence of obvious conservation requirements. South Carolina's fishing industry also has been typical of that in the southeastern U.S. in its conservative approach to technological change.

The ten-year period (1977-1986) covered in this report is therefore significant in that there were major divergences from these traditional modes of operation. Principal among these were:

- 1) the harvesting sector adopted new fishing gears and methods;
- 2) fishermen targeted untraditional species and directed effort into previously unfished areas;
- 3) reporting requirements for landings data increased, although the emphasis was placed on voluntary cooperation;
- 4) restrictive regulations became more numerous; and
- 5) some resources began to exhibit typical symptoms of overfishing.

At the start of the interval (1977), both total landed production (Fig. 1) and value (Fig. 2) were relatively low. Blue crab catches dominated the annual landings by weight (Fig. 3) and shrimp contributed about 60% of the total value (Fig. 4). Finfish landings were a minor component, representing only 20% of the total pounds landed and 11% of the ex-vessel value. The amount of coastal fish landed was about the same as that of shellfish (mostly oysters), although worth considerably less.

During the next ten years, the composition of annual landings changed in several major respects. In terms of landed weight, the relative contribution of blue crab declined considerably, to about 30% in recent years. In contrast, the percentage attributable to offshore fish increased gradually to about 20% and the total contributions of all finfish grew to over 30% before declining during 1985-1986. Shellfish landings also increased in relative importance, although less noticeably. Shrimp landings have fluctuated considerably, but have always represented a significant part of the overall annual production, even in extremely poor years (e.g. 1984).

Shrimp have maintained their dominance in landed value throughout the reporting period, rather consistently representing around 60% of the total annual ex-vessel value. An exception was 1984, in which shrimp landings declined to a modern historical low. The relative value of crab landings has edged downward. The most conspicuous change has been associated with the offshore fish category, where the relative percentage contribution to value quadrupled after a rather steady upward trend. Percentages attributable to other categories have either fluctuated with no directional trend (shellfish) or remained relatively stable (coastal and river fish).

As will be noted in the following categorical accounts, the present status of South Carolina's commercial marine fisheries is mixed. The annual report of the Wildlife and Marine Resources Department for FY 1977-1978 noted:

Two adverse winters in a row and the resultant damage to the shrimp resource have dramatically indicated the need to broaden the resource base on which our commercial fisheries have traditionally depended.

Ten years later, that diversification has been accomplished, yet the commercial fisheries are not in materially better condition; indeed, the total volume landed in 1986 was almost identical to that in 1977. Landed value, after adjustment for inflation, has fluctuated with no pronounced trend. Diversification alone has not been the answer. Most traditionally exploited resources have either achieved or surpassed

their level of optimal, long-term productivity. Some promising new fisheries have shown symptoms of a boom-and-bust development cycle. The overall impression is that more comprehensive and intensive management may be required to maintain our commercial fisheries at their present levels of economic productivity.

One aspect of the commercial fishery sector has not changed appreciably during the reporting period. South Carolina receives relatively little in additional benefits from its commercial harvest. Processing seafood adds value to the resource in the form of additional jobs and the creation of a stronger tax base. Mississippi receives \$8 in processing for every ex-vessel dollar of seafood landed, Alabama \$5, and even Louisiana receives \$1.70. In South Carolina, research by Clemson University indicated that \$1 of 1984 output by the fishing industry had a total economic impact on the state economy of only \$1.67.

Very little mention in this report is made of the state's marine recreational fisheries. Compared to the commercial fisheries, virtually nothing is known about historical levels of catch and effort, or even of participation. The recreational fisheries are at least as diverse as are the commercial ones, but there are no reporting requirements and very few licensing provisions. A few Division surveys have been conducted during the last decade, but nearly all have been short-term efforts addressed at specific areas and/or fisheries. The only source of annual estimates of recreational catch, effort, and participation is the National Marine Fisheries Service survey, which has been conducted yearly since 1979. These figures have limited descriptive value and are admittedly very rough estimates. What is known with reasonable certainty is that the population of recreational users, including anglers, shellfishermen, crabbers, and shrimpers, is increasing as the state's coastal population expands. The economic contribution from such recreational fisheries activities is also increasing and exceeds that from the commercial sector by a substantial margin. In 1983, Division personnel estimated the total economic impact of recreational fishing at \$187 million. In the same year, the estimated total impact of commercial fisheries was about \$42 million.

Prior to the reporting period, the commercial and recreational sectors coexisted with relatively few conflicts, largely because the resources were capable of providing for the needs of both groups. As events of the past ten years should clearly indicate, the capability has been strained, if not exceeded. Although restrictions on operations, participation, and harvest are unpopular with nearly all users, it seems inevitable that increasingly stringent measures will be needed for both commercial and recreational fishermen. Almost as inevitable will be competition between these factions, as well as within each. In the

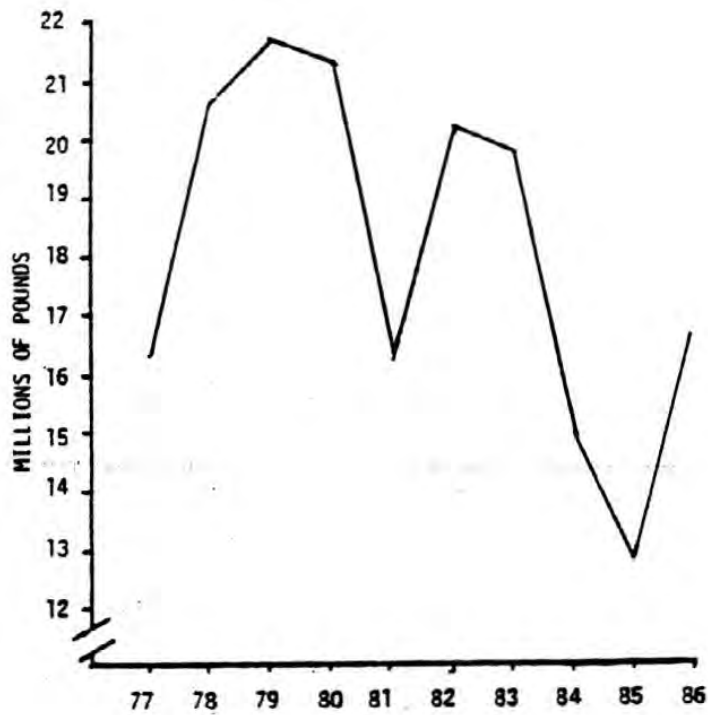


Fig. 1. Total landed weight of commercial marine fisheries products in South Carolina.

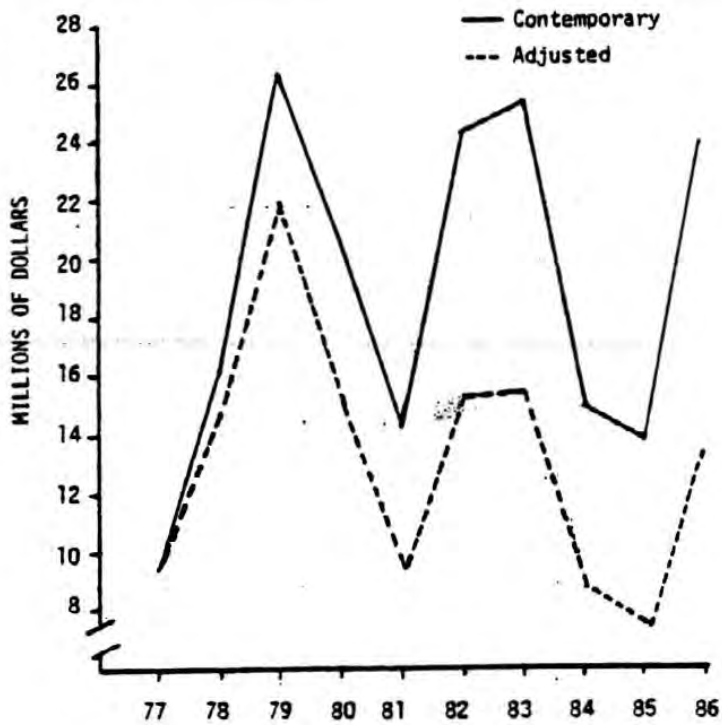


Fig. 2. Total ex-vessel value of products landed by South Carolina commercial fishermen.

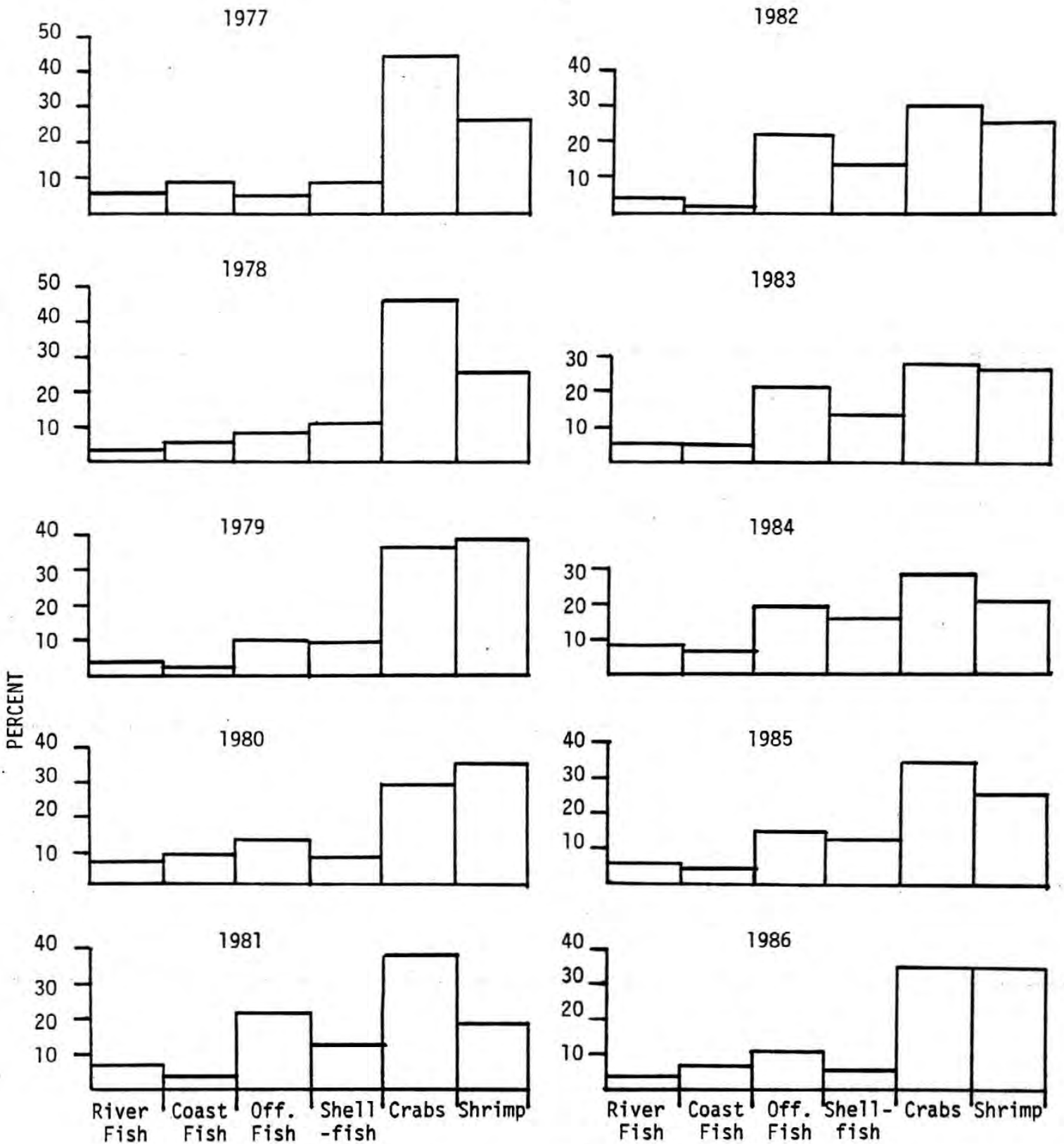


Fig. 3. Percentage weight composition of South Carolina commercial fisheries landings.

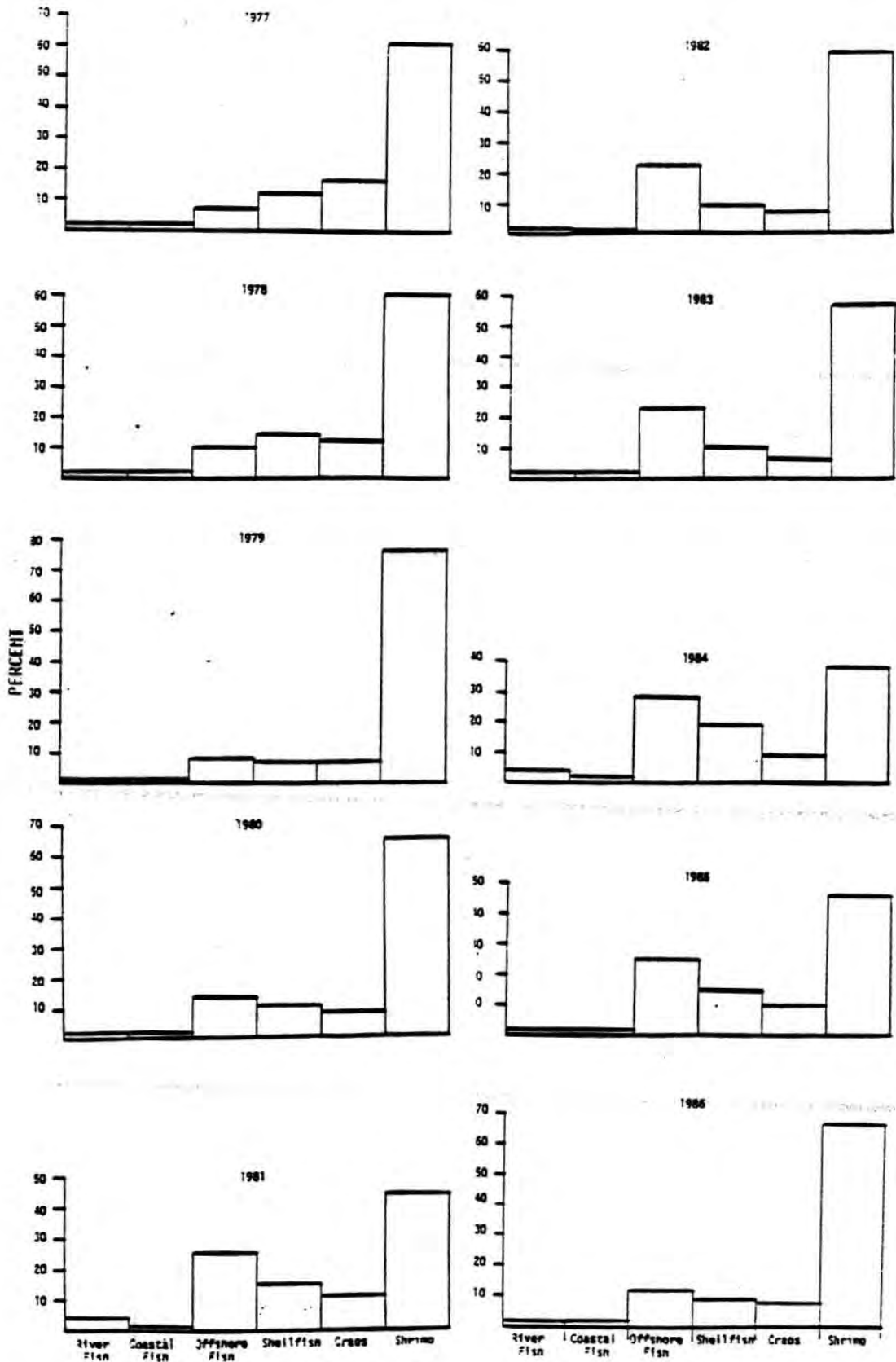


Fig. 4. Percentage ex-vessel value composition of South Carolina commercial fisheries landings.

welter of emotional, political, and economical arguments that will ensue, two considerations should be kept in mind. One is that the needs of the resources should receive the highest priority; without resources, there will be no resource users. The second is that the needs of the human users must also be given serious consideration; without users, there is no need for resources.

COMMERCIAL FISHERIES

SHRIMP

Following a sustained period of high production during the early and mid 1970's, the fishery experienced a disastrous year for white shrimp in 1977, with annual landings being among the lowest on record. The principal causative factor was the extremely cold water that prevailed during the winter of 1976-1977, which resulted in the total mortality of the overwintering population. This caused the complete absence of a spring fishery for the large and valuable roe white shrimp, which had been an important contributor to annual landings in the early 1970's. Extremely low numbers of spawning shrimp in the spring and a very dry summer contributed to greatly reduced fall landings of white shrimp as well. A large catch of brown shrimp partially compensated for the failure of the white shrimp fishery (Fig. 5).

Another severe winter in 1977-1978 caused heavy mortality of the overwintering stock and there was no spring fishery in 1978. Fall landings, however, were greatly improved over those of the previous year, perhaps because summer and fall rainfall was higher. Overall production increased moderately as a result, in spite of a drop in brown shrimp landings.

In 1979, the spring population of white shrimp was relatively small and the growth rate of brown shrimp was lower than normal, so the opening of the season was delayed until June 19. Both overall shrimp production and white shrimp landings reached a modern peak, although brown shrimp catches were down for the second consecutive year. In part because of the reduced abundance of brown shrimp, there was an increase in effort for rock shrimp that produced landings of over 700,000 pounds. The sound season opened several weeks later than usual because of Hurricane David, but the impact on the shrimp fishery was considered minimal. Very high prices prevailed during most of the year.

During the winter of 1979-1980, water temperatures remained above the problem level and the spring white shrimp population was larger than in the three previous years. The

season opened June 10 and the sound opening was in early September. Brown shrimp catches increased considerably, but white shrimp landings declined. There was no appreciable effort for rock shrimp. The combined result was a modest decrease in overall shrimp production for 1980.

Water temperature fell below the critical level (47°F) for several weeks in the winter of 1980-1981. This caused a large emigration of overwintering white shrimp into offshore waters during early January, while those remaining in the estuaries died. As a result, very few roe shrimp were available in the spring. There was industry support for an earlier opening than in the immediately preceding years and the season began on May 15. Bull, North Santee, and Winyah Bays were opened briefly in August to provide access to brown shrimp that were slow in moving into the ocean, but brown shrimp landings for the year dropped off considerably. The sounds and bays were opened on September 8. White shrimp production also dropped drastically in 1981 and overall shrimp landings were the lowest of the ten-year reporting period.

In 1982, landings of both brown and white shrimp improved and overall production was about the same as in 1978. Water temperatures during the winter were less severe than in 1980-1981, but the spring population of roe white shrimp was quite small. High prices and the industry's pressing need for revenue led to a relatively early opening on May 17. The sounds and bays opened in mid-September and closed on December 3.

The winter of 1982-1983 was mild and overwintering shrimp were abundant. Roe white shrimp grew and matured slowly, however, because of cool spring weather. The season again opened fairly early (May 16). Landings were very similar to those in 1982.

During the winters of 1983-1984 and 1984-1985, cold water temperatures appeared to kill nearly all of the overwintering white shrimp and the season openings were delayed to afford maximum protection to the reduced brood stock. Although brown shrimp landings remained stable in 1984, white shrimp production dropped to the lowest level in recent history. Only large landings of rock shrimp kept total shrimp production in 1984 above the dismal showing of 1981. In 1985, white shrimp landings remained very depressed, while production of brown shrimp increased moderately. Overall shrimp landings in 1985 were only slightly above the poor showing in 1984.

The 1986 production was the highest since 1980 and reflected good seasons for both brown and white shrimp. Brown shrimp landings, though slightly below the previous year's level, were above average and white shrimp landings in the fall registered a major increase from the depressed 1984-1985 harvests. Although the 1986 fall catch was composed of rather large shrimp, prices were

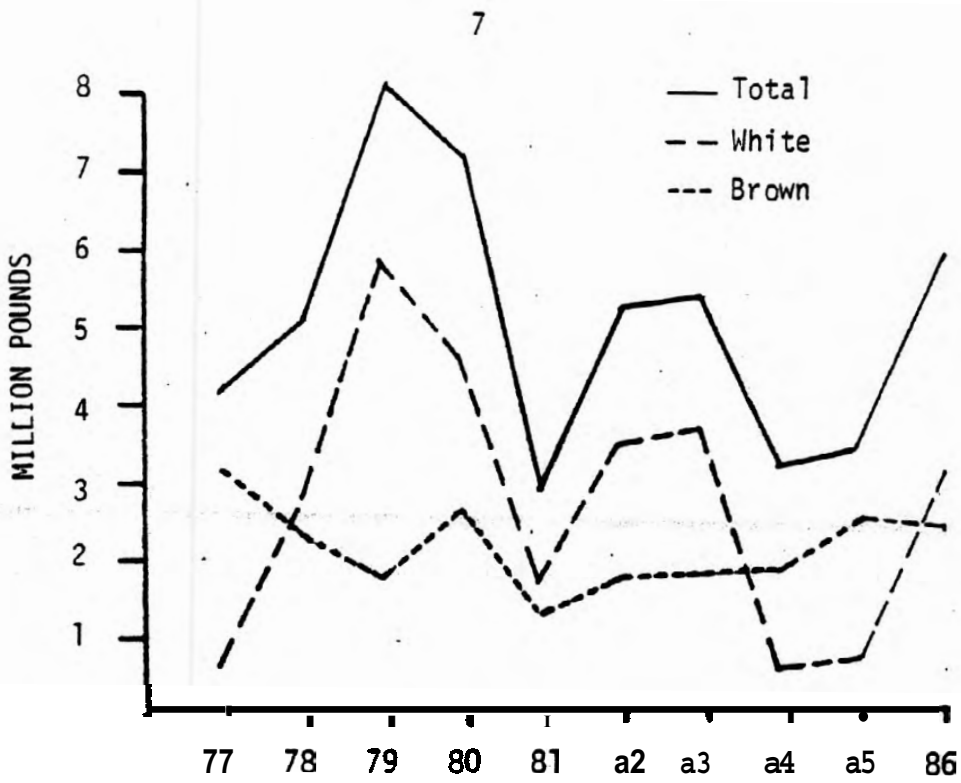


Fig. 5. Annual landings of shrimp in South Carolina.

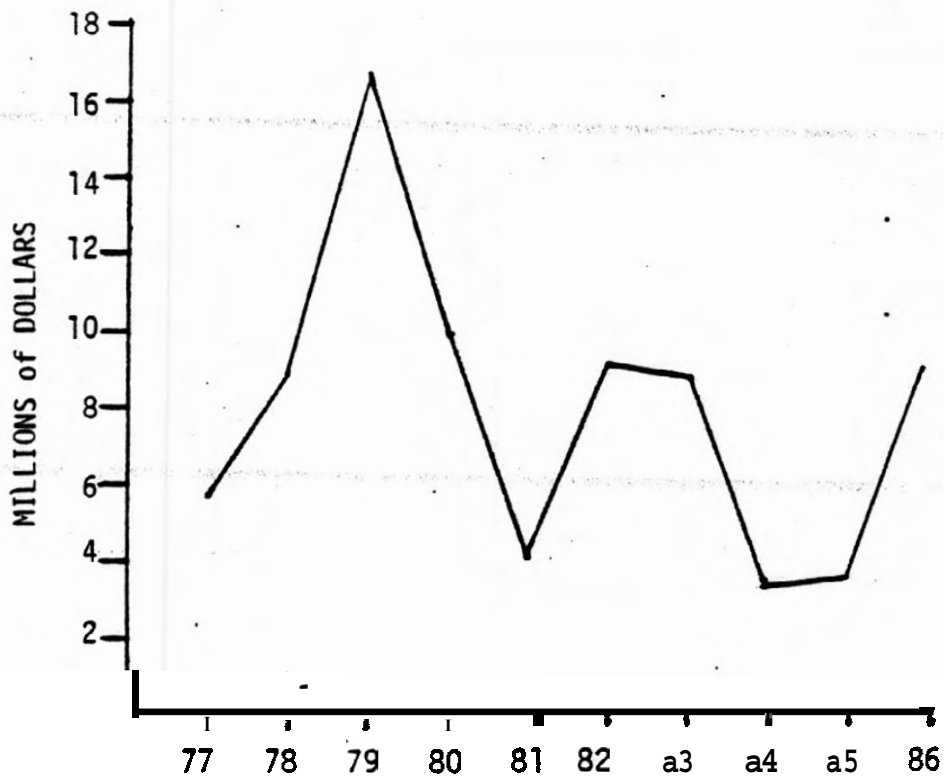


Fig. 5. Adjusted ex-vessel value of commercial shrimp landings in South Carolina.

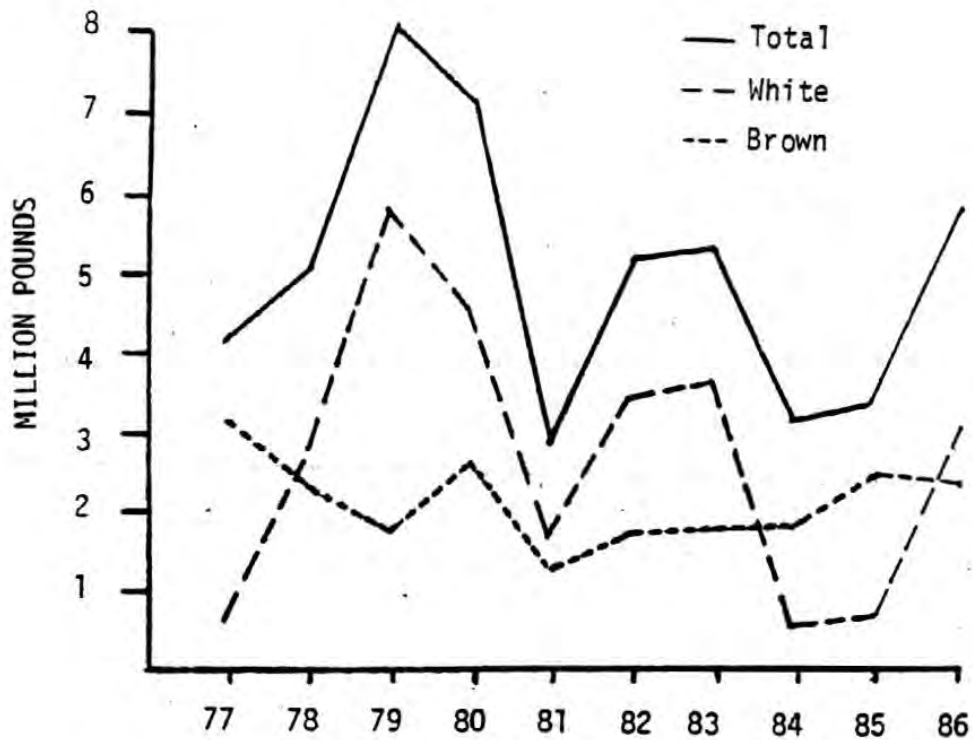


Fig. 5. Annual landings of shrimp in South Carolina.

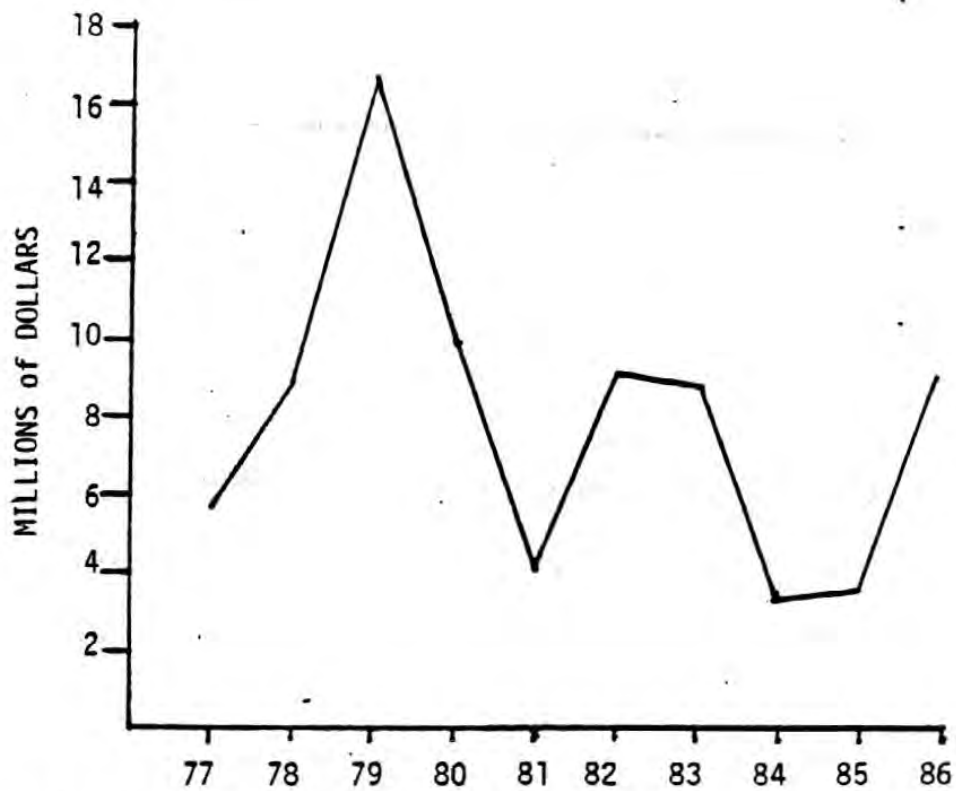


Fig. 6. Adjusted ex-vessel value of commercial shrimp landings in South Carolina.

somewhat below those typical for that size range compared to other counts. Still, the adjusted ex-vessel value was almost \$1 million above the 10-year average. The southern sounds and Bull Bay were closed to trawling during the 1986 season by legislative resolution, although the effect of this closure on commercial landings is not known.

During the reporting period, landings of brown shrimp have fluctuated around the 2 million pound (heads-on) level, with no obvious directional trend. Brown shrimp overwinter in offshore waters, where they are much less affected by climatic conditions. Juvenile movement into the estuaries begins in late winter and early spring and outmigration usually starts in late May and early June. Most brown shrimp have left inshore areas by mid-August. Because their residence in estuarine areas is short-term, they are less susceptible to large population fluctuations in response to environmental factors during their maturing stage. The brown shrimp stock therefore is likely to be more stable than the white shrimp population. Active management of the brown shrimp fishery has been based primarily on the size composition of the maturing inshore population, with fishing curtailed through openings and closures until the majority of the shrimp are of acceptable size.

The white shrimp population in South Carolina is at the northern limit of the species' range and is therefore highly susceptible to large fluctuations as a result of climatic conditions. Principal among these appear to be winter water temperature and summer-fall river discharge rates, which in turn are related to rainfall. Although enough is known about the effect of such conditions to permit qualitative projections of upcoming fishery success, accurate predicative capability has not yet been achieved. Short-term factors, such as hurricanes, can seriously disrupt the fishery, depending upon their timing and duration. Such adverse environmental events are believed to affect the annual stocks independently, rather than on a significant cumulative basis. As long as the carrying capacity, i.e., the ability of the habitat to support the population, of the inshore nursery areas remains stable, a large crop of white shrimp is probable if climatic conditions are conducive to juvenile survival and growth.

In recent years, the controversy over opening of the sounds and bays to commercial shrimping has intensified. A recently completed Division position paper concluded that the state's policy of controlled openings had neither increased nor decreased the overall physical and economic yield potential of the resource significantly, given the prevailing levels of recruitment. Effects of the current closure have not yet been determined.

The maximum production potential of South Carolina's shrimp fishery appears to have been reached in the 1950's. The lack of a significant increase in landings in recent years, in spite of the greatly increased fishing capacity of the fleet, indicates that the shrimp resource has been fully exploited. Overexploitation of mature shrimp is not believed to be a problem in the biological sense, because there is no apparent relationship between the population in one year and the level of fishing effort or catch during the previous one. One objective of the shrimp management program has been the protection of the entire resource, achieved through regulation of the commercial harvest (e.g. season opening dates) and preservation of critical habitat areas. The apparent rapid increase in recreational shrimping, which exploits predominantly small and medium shrimp in areas closed to commercial fishing, is a factor that must be addressed in future management planning. Successful management will depend on a greater variety of measures than was employed during the past ten years. These could include substantial restrictions on the recreational fishery.

The other objective of the shrimp management program has been the maximization of the gross economic yield from total shrimp landings by harvesting shrimp at the point of their maximum individual value. Although the prices paid for shrimp depend on many factors, the state's management policy has been based on the assumption that value of the landings is maximized when the individual size of the shrimp harvested is maximized. Thus, seasons have been set based largely upon the prevailing size composition of the shrimp available.

Although shrimp prices have increased over the past decade, the additional value has not been sufficient to offset effects of overcapitalization and increased operating costs. Until 1984, this factor, combined with the declining trend in annual landings per vessel (Fig. 7), had contributed to a significant decrease in net revenues for many individual vessel operators. License sales have since declined to the level of the late 1970's, perhaps reflecting the exit of the more marginal performers. Although the state has addressed economic performance only through the indirect effect of control over the size of shrimp caught, a more direct approach to the maximization of economic yield may eventually be warranted.

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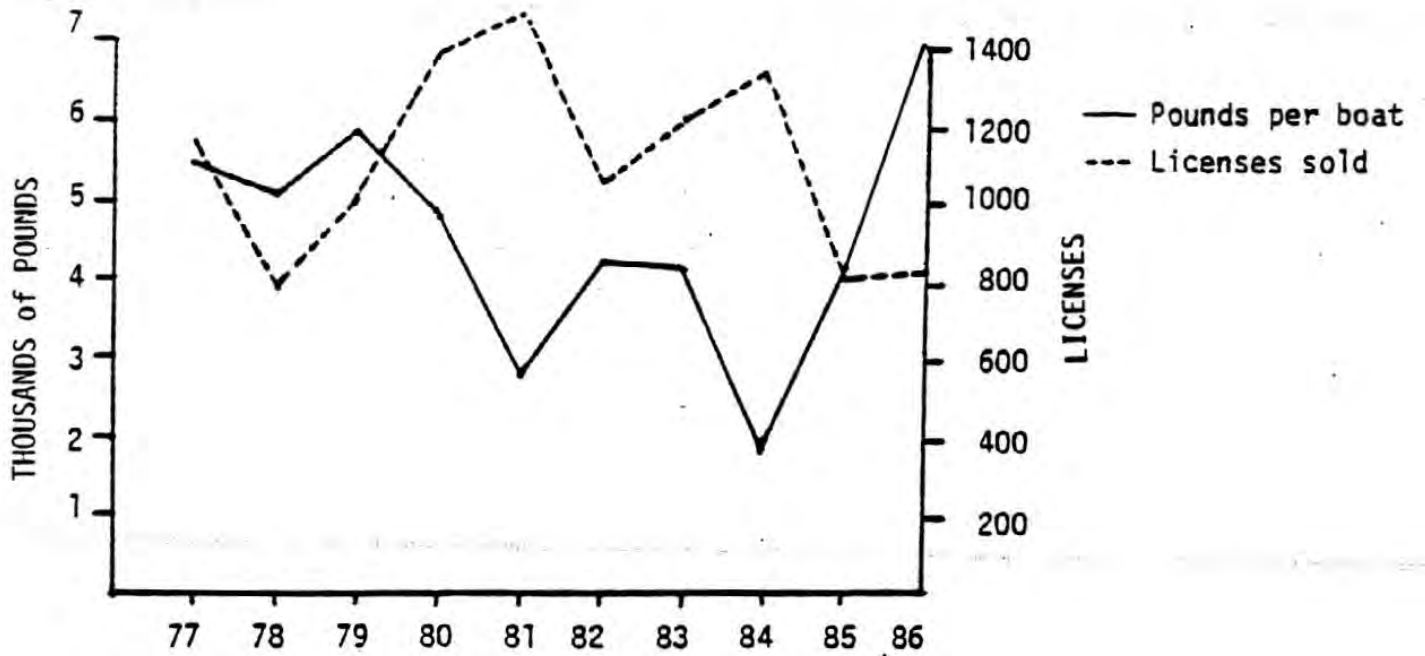


Fig. 7. Number of commercial shrimp trawl licenses sold and average pounds of shrimp landed annually per boat.

(Source: Fisheries Statistics Office)

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CRABS

The Division has recently completed A Profile of the Blue Crab and its Fishery in South Carolina, which provides a much more extensive discussion than the following account. Traditionally, the South Carolina fishery has harvested hard blue crab for picking and packing by local processors. Prior to 1959, most of the annual catch was taken with trotlines, although a winter fishery in the southern part of the state (primarily Port Royal and St. Helena Sounds) also contributed substantially during the 1950's. Pots were introduced during the mid-1950's and replaced trotlines as the principal gear after 1959. Trotline landings have been negligible since the mid-1960's. The trawl fishery also declined during the 1960's, with landings fluctuating about a very low level since 1964. By 1978-1979, as few as four boats were participating in the directed trawl fishery for crab. Blue crab, mostly mature females ("sooks"), have been an incidental catch in the whelk trawl fishery that developed during the late 1970's and early 1980's, but this production has been inconsequential. During the present reporting period, landings of hard blue crab have been almost entirely accounted for by

the pot fishery and have represented nearly all of South Carolina's total crab production.

At the beginning of the reporting period, state landings were recovering from a year (1976) of relatively low production. Landings (Fig. 8) peaked in 1978, when South Carolina, North Carolina, and Georgia all experienced significant increases in production.

During the first year (1979) of decline, Hurricane David struck the South Carolina coast in September. Although a significant portion of the annual catch, particularly of large male crab, is taken during the fall, the impact appeared to be minimal. No obvious effect on crab abundance was noted, although large numbers of pots were lost. Most fishermen resumed operation soon after the storm and the drop in annual landings does not appear to have been attributable to it.

The decline continued during 1980, leveled off for two years, then resumed at nearly the same rate observed in 1979-1980. Reported landings in 1984 were the lowest since 1968, when the "gray crab" disease was suspected as a possible factor in the decline of the stock. An outbreak of this condition was noted in both Georgia and the southern part of South Carolina in 1984. There have been other reports of "gray crab" disease in recent years, although such incidences have been relatively low and localized. Production in 1985 and 1986 recovered slightly, but remained at a low level compared to that prior to the reporting period. Adjusted landed value (Fig. 9) has trended steadily downward during the reporting period and that in 1985 was about 50% of the 1978 figure. There was a modest improvement reported for 1986.

It is uncertain whether trends in annual landings have been reflective of stock status. Since the 1978 regional peak, Georgia landings have shown a downward trend similar to that observed here. Production in North Carolina, however, has increased steadily through 1982 and remained at comparatively high levels during 1983 and 1984. Annual fluctuation in abundance of blue crab is believed to be largely associated with climatic factors. Mass mortalities have occasionally been reported, most recently in the 1960's. In the Chesapeake Bay area, extremely cold winters have been suspected, although the 1978 peak in South Atlantic production followed two such winters. The bulk of the mature female population moves to deeper, coastal (ocean) waters to overwinter and it is unlikely that the female brood stock has been significantly affected by cold winters here. Georgia research personnel have recently linked a trend in annual catch per landing there to river discharge rates during the juvenile stage and reductions in adult crab populations are most probably attributable to reduced rainfall. Fall (September-November) is a critical time in the development of young crab and recent years have experienced below-average river discharges then due to prolonged droughts. In

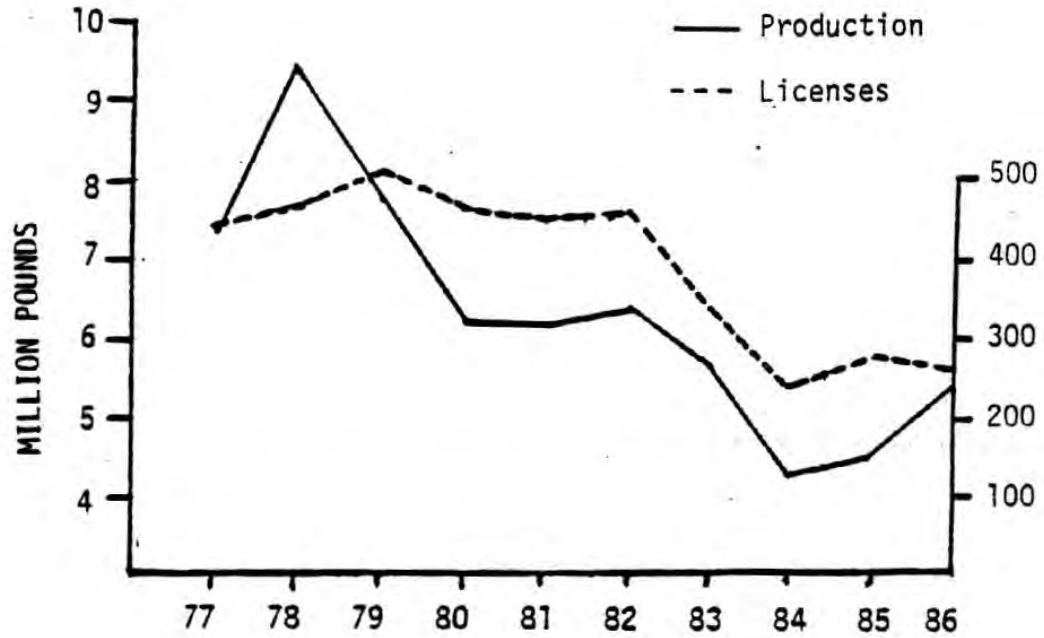


Fig. 8. Number of pot licenses sold and landed weight of blue crab produced by the South Carolina commercial fishery.

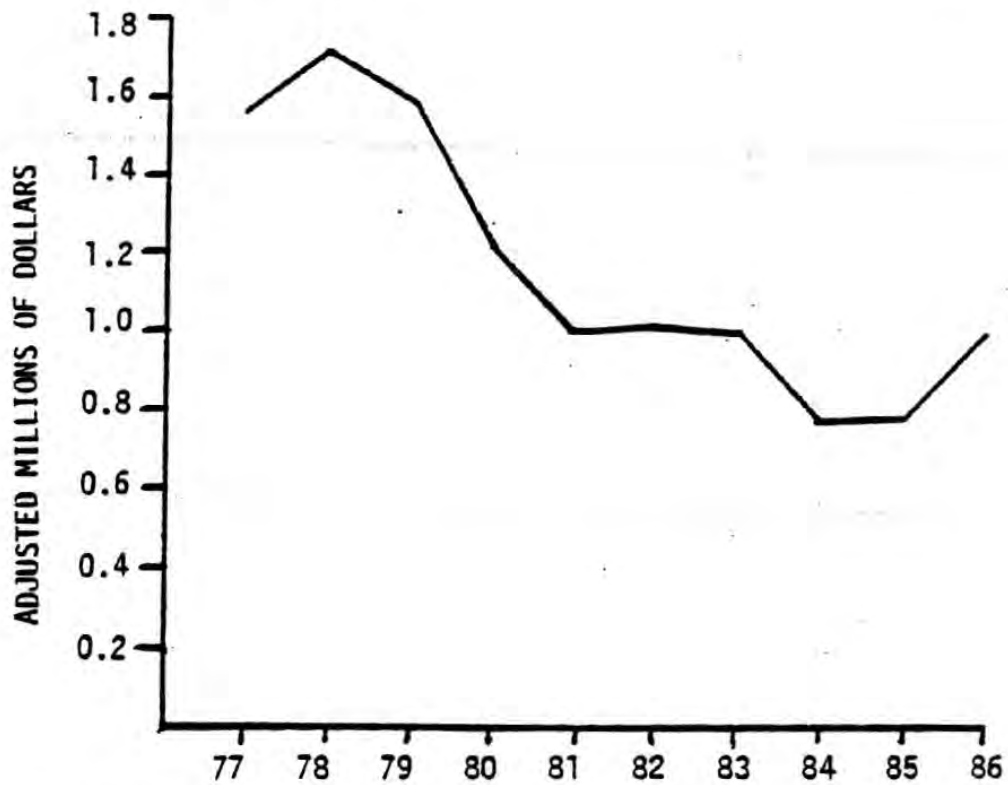


Fig. 9. Adjusted ex-vessel value of commercial landings of blue crab in South Carolina.

South Carolina, experimental catch rates by Division research vessels have declined in Port Royal and Calibogue Sounds, but remained stable in the central part of the state. The southern sounds are fed by rivers with small drainage areas, whereas the central region receives most of its input from large inland sources. Thus, any effect of the recent droughts would probably be more apparent in the southern area.

In addition to disease and climatic conditions, pollution has been frequently cited as a possible factor in the decline of blue crab production. Pesticides have received most of the blame, since several types are known to be highly toxic to juvenile crabs. The state has recently initiated a comprehensive survey of contaminant levels in coastal waters. Preliminary findings suggest that most systems are in good condition, probably more so than some years back. Although pesticides are an oft-mentioned factor, agricultural runoff has probably been reduced in recent years due to droughts.

The apparent recent decline in production could be partly due to numerous other factors not related to stock abundance. A lucrative "basket" trade has developed during the reporting period for select hard crabs that are shipped by the bushel to northern markets. These crabs do not go through the picking houses and much of this production, mostly during spring and late fall, may go unreported. Thus, part of the apparent decline may be attributable to these landings, which were not culled in earlier years and were reported.

Marketing conditions also impact landings, although the overall effect is difficult to evaluate. Prices during the summer are generally at a seasonal low. Increased supplies from the Middle Atlantic area lower the demand for southern basket crab, which also experiences high shipping mortality in warmer weather. Local picking houses sometimes reach capacity and place their suppliers on quotas, which suppresses production. Thus, the short-range influence of market factors on the level of effort (and production) can be considerable, but is hard to quantify over the course of one year or several.

One interesting observation is that the trend in overall production has rather closely followed that in the number of pot licenses issued annually, at least since 1979. Although the number of licenses sold may be a poor proxy for the amount of fishing effort expended, this does suggest that there is some relationship between annual production, annual participation, and the total amount of effort.

Production in other categories besides hard crab has been negligible. Although there has been a strong demand for soft crab in the Middle Atlantic region, South Carolina

peeler production has been sporadic and very low. Procurement of commercial quantities of shedders has been a major obstacle. This is one promising area of improved utilization that is currently being explored.

Stone crabs occur in South Carolina, but a recent Division survey found that the stock is small and incapable of supporting a significant directed fishery. Minor amounts of stone crab claws have been landed as incidental catches from the blue crab pot fishery.

The Division recently completed a two-year study of the commercial potential of golden crab, a large species found in deep (200 fathoms plus) offshore waters. Exploratory fishing suggested that commercial catch rates can be obtained in some areas, but that the overall productive capability of the resource is rather limited.

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SHELLFISH

The state's most abundant shellfish resource is the intertidal oyster. Of poorer quality than subtidal oysters, intertidal oysters line the banks of tidal waters in large clusters, typically composed of small oysters. South Carolina's historical shellfish fishery evolved as a steam canning industry that used these oysters. This

industry achieved its maximum development in conjunction with vegetable farming on the sea islands, where it offered winter employment to residents, for whom competitive alternatives were unavailable. Because intertidal oysters are typically picked by hand, the oyster industry has been highly labor-intensive.

South Carolina's oyster production dropped to the lowest level since World War II during the early and mid-1970's. The overall value of the state's shellfish landings (Fig. 10) was depressed at the start of the reporting period, because practically all of the production and most of the landed value (Fig. 11) was attributable to intertidal oysters. Higher priced (in unit value) shellfish, such as hard clams and calico scallops, were harvested in very limited amounts in 1977.

In 1978, landings of shellfish increased sharply. Landed value rose very dramatically, due to the exploitation of a large bed of calico scallops discovered (as juveniles) the previous year. The fishery began in January, with seven Florida boats. By March, about 45 vessels from Florida, North Carolina, and South Carolina were fishing the area, located off the Georgia-South Carolina border. Scallops represented 35% of the total ex-vessel value of shellfish landed in the state in 1978. A second nontraditional fishery, for whelks (conchs), also began in this year, with two boats. The oyster harvest improved substantially in value and landings of clams also posted a small gain.

In 1979, the scallop survey continued, but no commercially viable beds were located and there were no landings. Six permits were issued for the harvesting of whelks. Most of the trawling occurred in the Charleston area during the winter and spring. Nearly all of the limited catch (Fig. 12) was sent to the ethnic markets in the northeast. Oyster production (Fig. 13) continued to improve, while landings of clams (Fig. 14) remained stable, due to a decline in hydraulic escalator production. The significant decrease in adjusted landed value for the year was due largely to the lack of scallop landings.

The most notable feature of 1980's shellfish production was a sharp decline in oyster landings. Clam catches were up, as a result of increased escalator harvests. Landings of clams taken with hand-operated gear continued a gradual, but steady, upward trend. Whelk production declined slightly. The scallop survey continued, but again no commercially harvestable concentrations were located. Results did indicate an exceptional potential for scallop recruitment off South Carolina, due to large quantities of dead shell available on the shelf for larval attachment. A special legislative Shellfish Study Committee was created to investigate: 1) the shellfish leasing system, 2) existing

laws relating to management, and 3) the performance of agencies charged with management responsibilities. The Division also initiated a multi-year, comprehensive inventory of the state's shellfish growing areas. A moratorium was imposed on shellfish leases.

In 1981, overall production increased slightly, although adjusted landed value continued a slight decline. Two small scallop beds were located in October, although there were no commercial landings because of small individual size. The number of whelk permits increased and landings were up sharply. Winter water temperatures were very cold and catches might have been higher but for this. Charleston fishermen had noted that whelks were less available during very cold weather. Total landings of whelks nearly equalled those of clams in volume. Clam landings declined, while oyster production increased slightly.

Total shellfish production increased greatly in 1982 and adjusted landed value increased for the first time in four years. Landings were up in each major category. During January, three nonresident boats fished the scallop beds that had been located the previous fall and additional boats harvested another bed during April. These landings were far below the level of 1979, however, and contributed only 2% of the total shellfish value. Participation in the February-May whelk fishery increased substantially and landings reached the highest point of the reporting period. Whelks surpassed clams as the number two volume contributor. Total production of clams also peaked in 1982, as landings by hand pickers doubled. As a result, the landed value of clams exceeded that of oysters for the first time, even though oyster production also increased substantially. Overall shellfish production reached the highest level of the reporting period in 1982.

Total production declined slightly during 1983, due primarily to a substantial decline in clam landings. Although both escalator and hand production were down, total value again exceeded that of oysters. Oyster landings reached the highest point of the reporting period, at slightly below 1.8 million pounds. Whelk landings declined slightly. A limited scallop harvest during July again contributed about 2% of the total value of shellfish.

Adjusted landed value of shellfish in 1984 reached the highest level since 1978.

The major contributor was clam production, which exceeded that of oysters in value for the third consecutive year. Clams were also the only category in which an increase in landings was achieved. Whelk catches declined significantly, oyster production decreased, and there were no reported scallop landings.

The year 1985 was a dismal one for the shellfish industry in virtually all respects. There were two brief fisheries for scallops, with the bulk of the catches being taken by

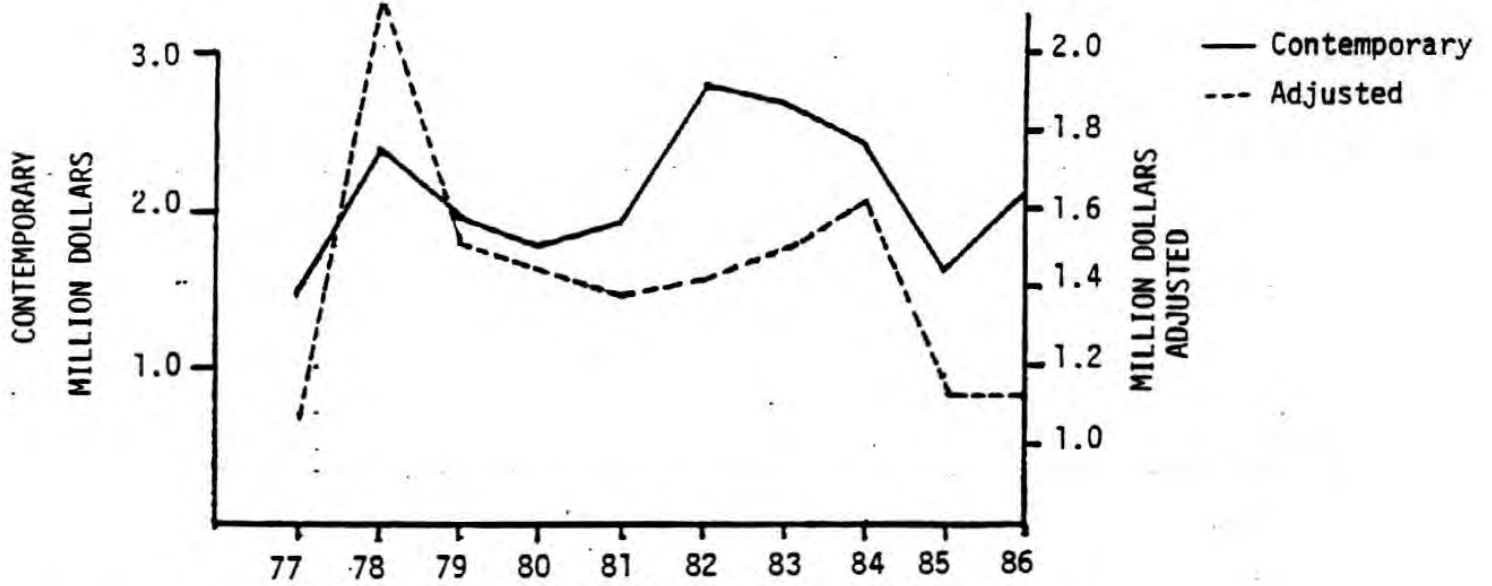


Fig. 10. Landed ex-vessel value of shellfish in South Carolina.

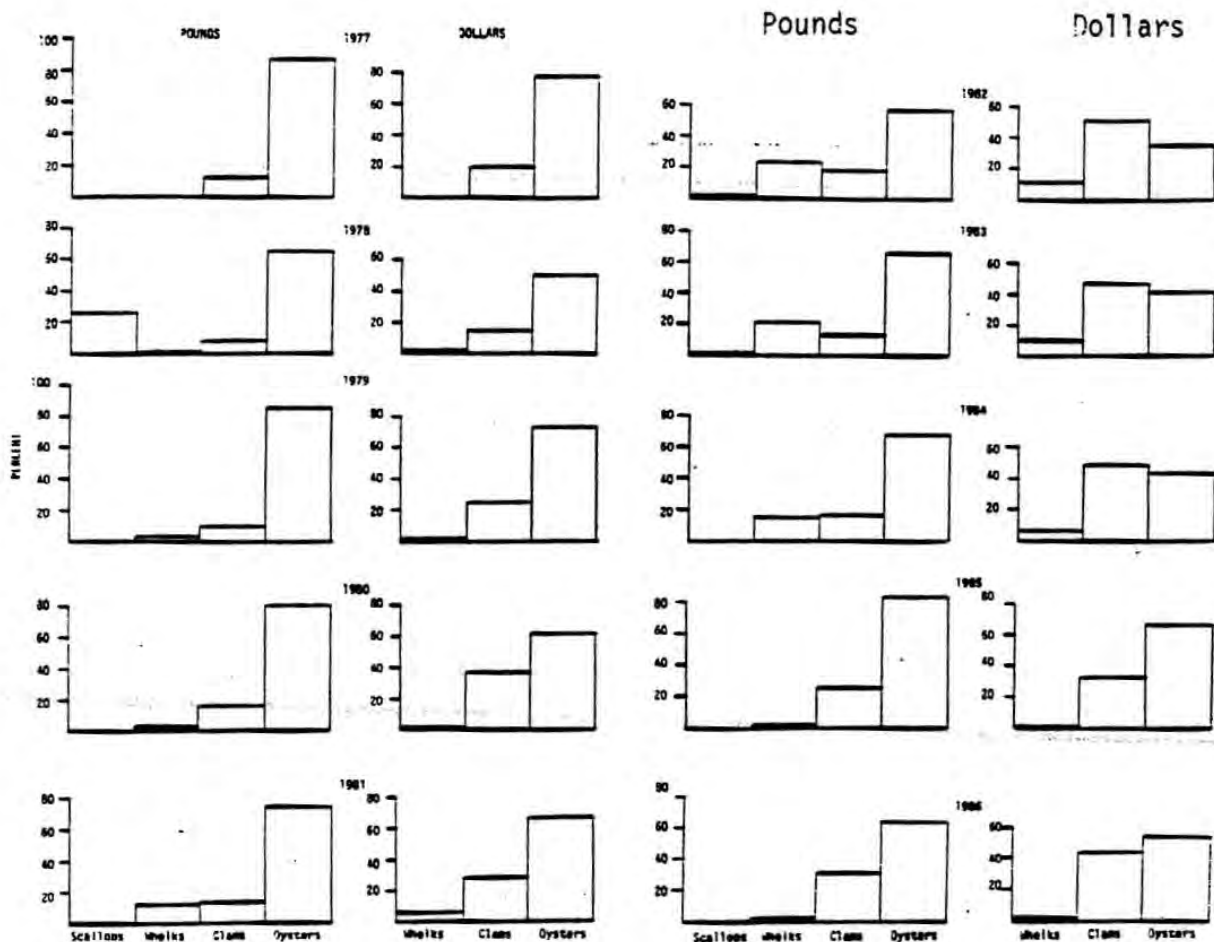


Fig. 11. Composition of commercial landings and contribution to landed value of shellfish in South Carolina.

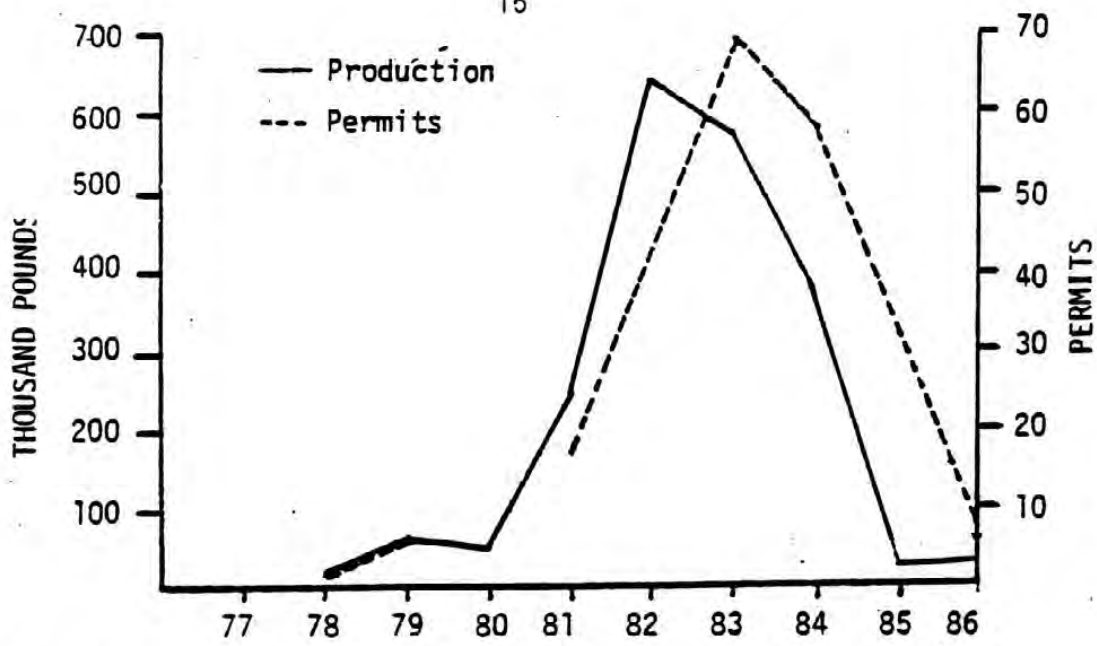


Fig. 12. Permits issued and landed weight of whelks in the South Carolina commercial fishery.

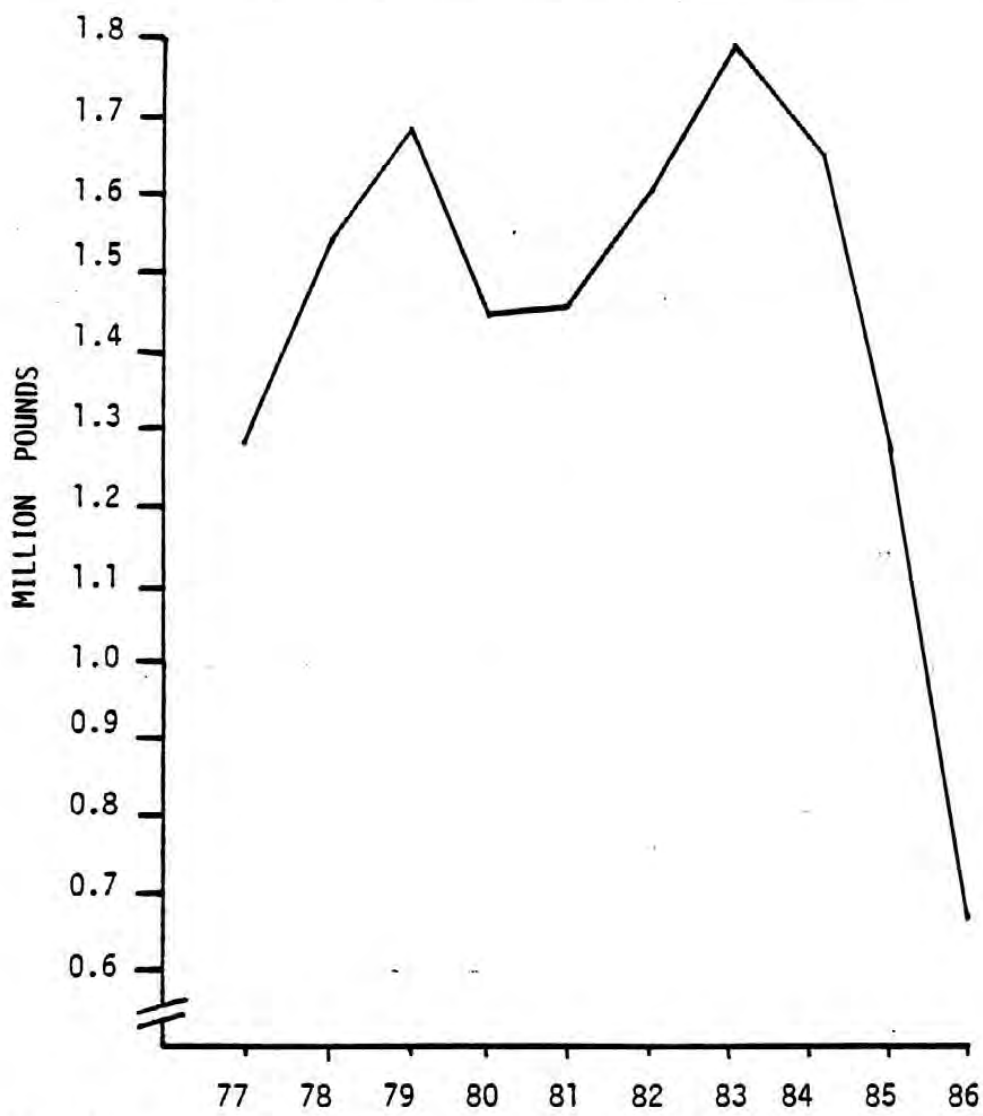


Fig. 13. Landed weight of oysters (meats) produced by the South Carolina commercial fishery.

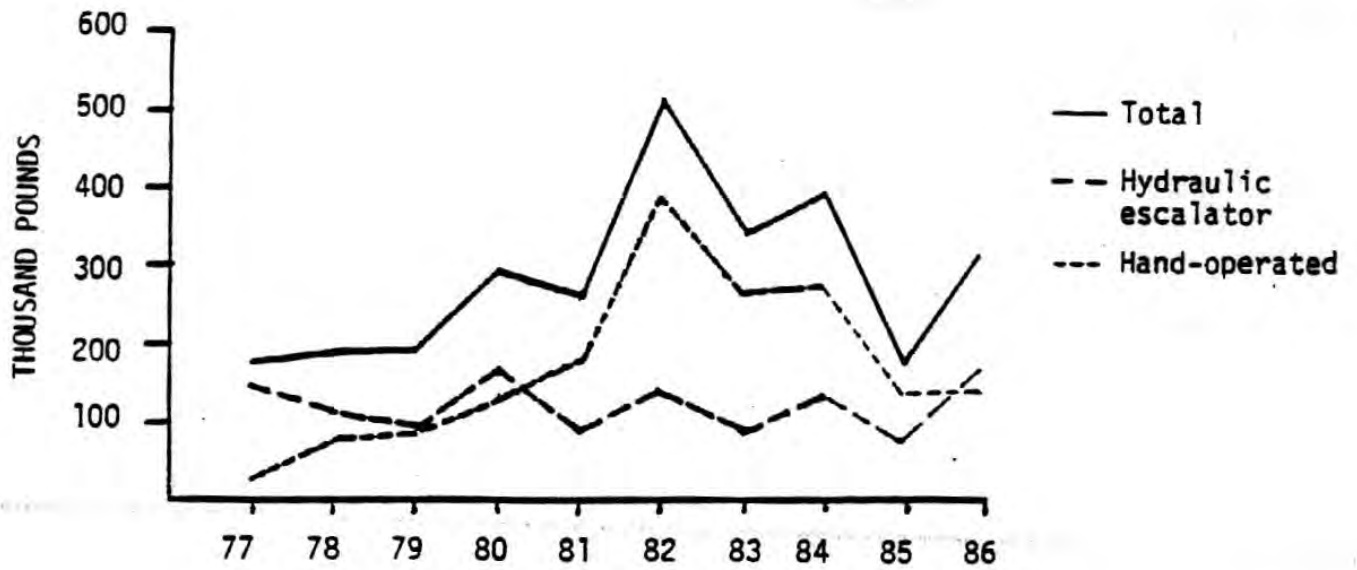


Fig. 14. Landed weight of clams (meats) produced by the South Carolina commercial fishery.

Florida boats. The whelk catch plummeted to a very low point and oyster landings were the worst since 1977. A prolonged drought apparently weakened oysters and an outbreak of "dermo" caused mortalities as high as 80% in densely crowded intertidal beds. The southern half of the state was particularly hard hit. The Santee-Cooper redirection was accomplished, with the expected elimination of shellfish resources in the lower Santee delta, one of only two areas in the state known to have a large subtidal oyster resource. An influx of clams from the Indian River (Florida) flooded the eastern market and reduced both demand and prices for South Carolina clams during the first half of 1985. Effort was down as a result.

Perhaps the most notable development in 1986 was the successful completion of a year-long investigation of the illegal sale and interstate transport of South Carolina clams. Receipts for about \$775,000 worth of black market clams were confiscated, reflecting the sale (90% out of state) of about 5.2 million clams between December 1983 and August 1986. Officials concluded that this represented only a small part of the total black market in hard clams. The total harvest of clams for commercial purposes in recent years is therefore greatly underestimated in official landings statistics.

During 1986, clams were the only category in which an increase in shellfish production was reported. Oyster stocks continued to be affected by "dermo" and landings declined drastically. Production of whelks continued at a minimal level, with continued low effort, and there were no reported scallop catches. The adjusted ex-vessel value of overall shellfish landings was the lowest since 1977.

The most important developments in the shellfish fishery during the reporting period were increased species diversity, improved harvesting methods, and restructuring of the traditional leasing system. At the start of the interval, the state's shellfish production was dominated by oysters, which contributed more than 80% of the volume and about 80% of the landed value. Multi-year surveys indicated a potential for offshore scallop fisheries in some years, although on a limited, opportunistic basis. A significant fishery for whelks developed and provided much-needed off-season employment for shrimp trawlers. Expansion of the clam fishery was facilitated by the increased use of hydraulic escalators on leased grounds and in polluted waters, with treatment of polluted clams in depuration plants. Favorable market conditions also prompted a substantial increase in effort by pickers using hand-operated gear. Although the oyster industry continued to rely on intertidal oysters for more than 90% of its production, interest in higher quality subtidal oysters for the lucrative shell stock trade led to increased effort on these

stocks. Drag dredges were introduced for this purpose, with 37 permits being issued in the 1984-1985 season for use of this gear in the South Santee River. The comprehensive reorganization of the shellfish lease system, initiated after five years of intensive study and based on a detailed inventory of the state's shellfish growing areas, should result in much improved management and more optimal utilization of the productive capacity of these grounds.

The current status of the state's shellfish fisheries is mixed, depending on the category examined. Despite a latent potential, a fishery for calico scallops has occurred infrequently. Exploitation has typically been very short-lived and characterized by intensive fishing in very small areas. There is probably little that can be done to alter this situation and the scallop fishery will likely continue to be a very occasional one of short-term, limited opportunity. Whelk stocks appear to have been overexploited, judging from the rapid decline in production and drastically reduced catch rates. Division research has shown that whelks are nonmigratory and slow-growing, which renders them very susceptible to overfishing. Significant sustained production of whelks in the future will likely require catch restrictions, which may need to be very limiting at first to allow the stock to rebuild. Location of previously unfished whelk populations appears unlikely.

The increase in clam landings that began in the mid-1970's resulted from the discovery of commercial quantities of subtidal clams in the lower Santee River and introduction of hydraulic escalators. The use of these devices in polluted areas of Little River, Dunn Sound, Winyah Bay, and Charleston Harbor has maintained production. Depuration of clams from these areas in five plants in Georgetown and Horry Counties has allowed production of wild clams to expand in spite of a relatively limited resource. With approximately 50,000 of the 182,975 acres classified as shellfish growing areas closed to pollution as of 1984, depuration will remain an important factor in the continued utilization of wild clams. Illegal harvest and sale of polluted clams has a detrimental effect on demand because of product credibility and must be strictly controlled for the good of the industry, as well as the health of the consumer. A major producing area has been lost to the Santee-Cooper redirection and discovery of significant quantities of unpolluted wild clams elsewhere is unlikely. The success of mariculture operations suggests that this source may play an important role in the state's future clam production.

South Carolina's oyster industry has always been labor-intensive and achieved peak production at a time when competitive employment was not readily available. Cannery operations experienced increased economic difficulty, due partly to steadily declining

demand for their product. In recent years, only one cannery has operated in South Carolina and significant expansion of canned production is rather unlikely. Part of the long-term decline of the state's oyster industry has been due to a parallel decline in the demand for its major product.

On the production side of the equation, then, the industry has needed alternatives for labor and product for some time. Refinement of the mechanical oyster harvester has helped to remedy the first problem. Whereas an experienced oysterman can pick about 75 bushels in a tidal cycle, the harvester can harvest 1,500. Relocation of cluster oysters to less crowded areas, where better growth can be achieved, is one solution to the more efficient utilization of intertidal oyster stocks. The mechanical harvester has demonstrated its effectiveness in this application. Both the commercial industry and recreational users have suffered as a result of limited planting capability and the employment of the harvester(s) for this purpose can help to rectify this.

Product alternatives are sorely needed. Large cluster oysters can be used in the raw shuck (container) trade, while high quality single oysters can be sold as shell stock (half-shell oysters). Although both types have a much higher unit value than do smaller cluster oysters, the latter dominate the available stock. Most of the more productive intertidal grounds are under permit to commercial firms, with the holders being responsible for management and cultivation. Under the new permit system, there is greater incentive for these operators to intensively manage oysters, in order to obtain a higher economic yield. One way this can be accomplished is by periodically culling and redistributing stock to promote better growth and increased production of single and large cluster oysters.

The other part of the equation concerns the resource. Man-induced environmental changes are steadily encroaching upon the available habitat, both directly due to land development and indirectly due to pollution. Beyond a certain point, even the most intensive management of the stocks cannot compensate for the loss of productive growing areas. For this reason, physical elimination of shellfish grounds for marinas, housing, and other coastal development must be balanced against the loss of the area's long-term productivity. Reduction of productive capacity due to indirect sources, most notably pollution by domestic sewage, must also be taken into account. In addition to these stresses, the direct removal by recreational users is becoming an increasingly important factor. As coastal populations expand and people have more leisure time to devote to consumptive outdoor activities, exploitation of oyster stocks will continue to increase, particularly in those areas that are readily accessible. It was conservatively estimated that over 200

commercial and 10,000 recreational shellfish harvesters were using public and state grounds as of 1985. The state's response in the past has been to increase oyster stock on state shellfish grounds by replanting, but this is an expensive operation that has finite limits to its applicability.

The final aspect relevant to the status of the shellfish industry is the prospective availability of additional resources that have previously been unexploited or underutilized. Foreign demand for squid and the development of viable fisheries elsewhere have prompted local interest, but exploratory fishing surveys have not indicated the presence of economically harvestable stocks in South Carolina's offshore waters. Division fishing trials have found commercially exploitable stocks of octopus, but these would be sufficient only for limited, alternative fisheries. Prospects offered by other species, e.g. arks, seem very limited.

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OFFSHORE FISH

Prior to 1976, offshore commercial fishing in South Carolina was very limited. Some shrimpers occasionally trapped black sea bass during the closed shrimp season and a few fishermen used handlines and powered

snapper reels to land groupers, snappers, and other bottomfish on a sporadic basis. Few local fishermen had equipment or expertise for offshore fishing, area wholesalers knew little about handling or marketing offshore species, and there was little incentive for either group to expand their activities in this direction. Most commercial fishing offshore of South Carolina in the early 1970's was conducted by snapper boat fishermen operating from northeastern Florida.

In 1976, a Charleston company with good dockage, packing, and shipping facilities offered competitive prices for offshore fish and several Florida boats landed catches regularly there. An experienced local fishermen working with the Sea Grant Marine Advisory Program made a number of successful trips offshore, using a newly designed trawl. The winter of 1976-1977 was unusually cold and white shrimp abundance was much reduced in 1977. At the urging of the Marine Resources Division, some local fishermen began to consider alternative fishing opportunities and continued profitable landings by the Florida handliners indicated the viability of offshore bottomfishing. Additional Florida boats continued to move to several South Carolina docks. Several owners of large South Carolina shrimp boats outfitted for trawling, while other fishermen with smaller boats set up for handline (snapper reel) fishing. As the participation in offshore fishing increased and substantial landings were brought in, the Division began routine port sampling of offshore finfish catches (Fig. 15). During this year, practically all of the offshore effort was directed at bottomfish (Fig. 16). Nearly half of the total catch by weight consisted of mid-depth groupers (gag and scamp) caught by handline boats. Most of the remaining catch consisted of snapper and porgies, also landed primarily by handliners. The most valuable component was the snapper complex (Fig. 17), which represented slightly less than half of the total landed value of offshore finfish.

In 1978, the most notable development was the introduction of swordfish landings at South Carolina ports by surface longliners from Florida. Swordfish was by far the most important individual fish species in the South Carolina commercial fishery that year, accounting for about 35% of the total weight of offshore fish landed and 50% of the value. Grouper landings (Fig.18) increased

appreciably, while snapper landings (Fig.19) remained steady. Total landings of offshore fish doubled in weight and nearly tripled in adjusted value.

During 1979 and 1980, swordfish remained the leading species in both landed weight and value (Fig.20), as total landings continued to increase. Grouper catches declined slightly. Significant expansion of the trawl fishery produced large increases in the landings of porgies (Fig. 21) and snappers that offset declines in handline catches. Catches of black sea bass (Fig. 22) and king mackerel (Fig.23) also increased substantially. A developing fishery for deep-water species contributed substantial quantities of tilefish (Fig. 24). Offshore fish landings grew by 30% in 1979 and 23% in 1980 and the increase in unadjusted landed value averaged about \$0.5 million per year.

In 1981, the gradual trend toward species diversification evident in previous years intensified and there were four species groups with landings between 600,000 and 700,000 pounds. Swordfish remained the most important species, while groupers, porgies, and black sea bass each contributed about 18% of the total landed weight. Grouper landings increased appreciably, due to the expanded deep-water fishery, while catches of porgies and black sea bass reached their peak of the ten-year period. Tilefish landings continued to increase substantially, while catches of king mackerel dropped sharply. Total landed weight increased about 27% and adjusted value grew by nearly \$1.0 million from 1980.

Total landings peaked in 1982, while retaining the diversity achieved in 1981. The major responsible factor was the catch of swordfish, which almost doubled in weight. Landings for groupers and snappers increased significantly, while catches of porgies and black sea bass declined. There was a major increase in the tilefish catch, attributable to the rapid expansion of the bottom longline fishery. King mackerel landings recovered to nearly the peak level of 1980. Total landed weight matched the 27% increase of the previous year and overall unadjusted value improved by nearly 49%, due largely to the swordfish catch.

After five years of growth averaging 25% annually, total landed weight declined slightly in 1983. Landed unadjusted value, however, peaked at slightly less than \$6.0 million, due primarily to another substantial increase in swordfish landings. The grouper and tilefish catches also peaked in 1983, due to a large increase in bottom longline landings of deep-water species. Snapper landings also reached a peak, slightly above the 1982 level, due to a continued increase in handline catches. The main causes of the decline in total landed weight were major reductions in the catches of porgies and black sea bass. During 1977-1983, the total landed weight of offshore fish increased by a factor

¹ Snapper boats have electric or hydraulic reels, from which single lines are fished. The only substantive difference from handlines is that the lines are retrieved with powered reel rather than by hand. In official statistics, "handline" landings refer to both handline and snapper reel catches, although nearly all are made with powered snapper reels.

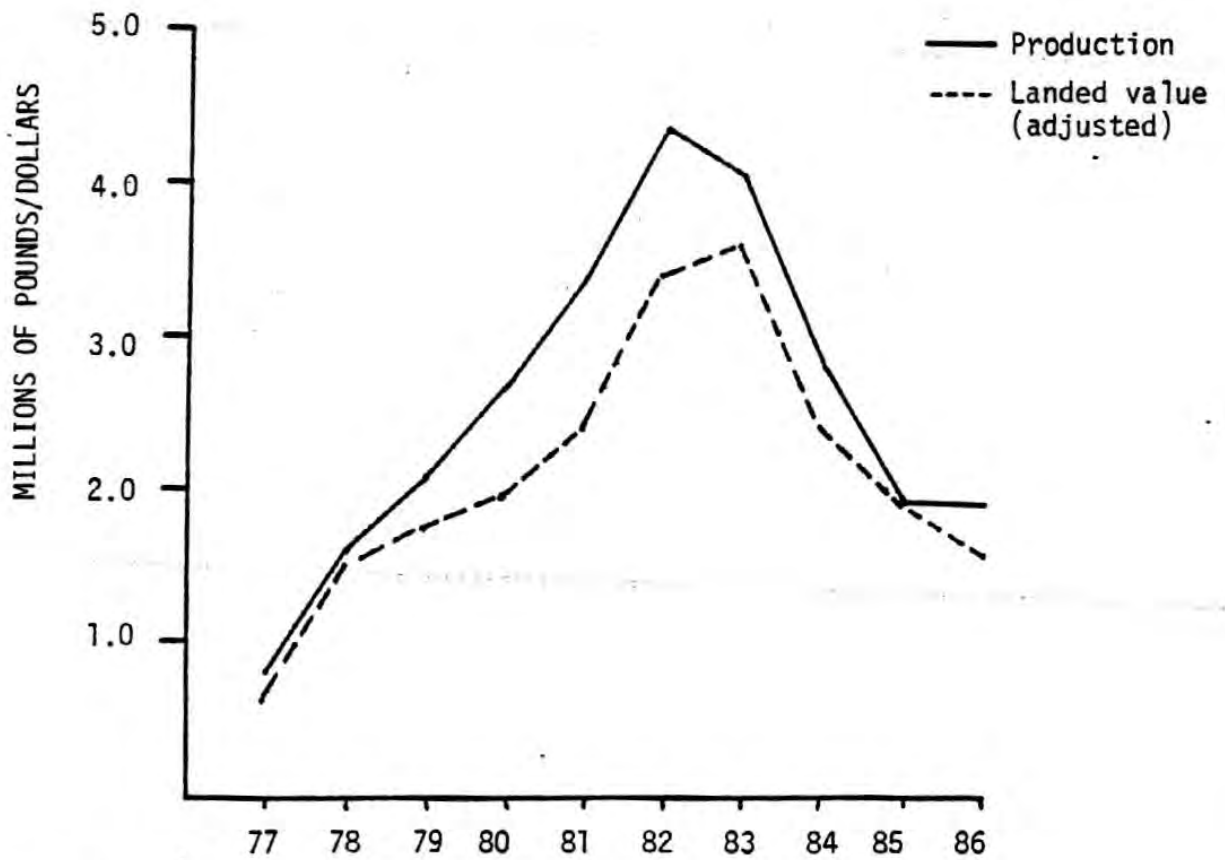


Fig. 15. Landed weight and value of offshore fish landed by South Carolina commercial fishermen.

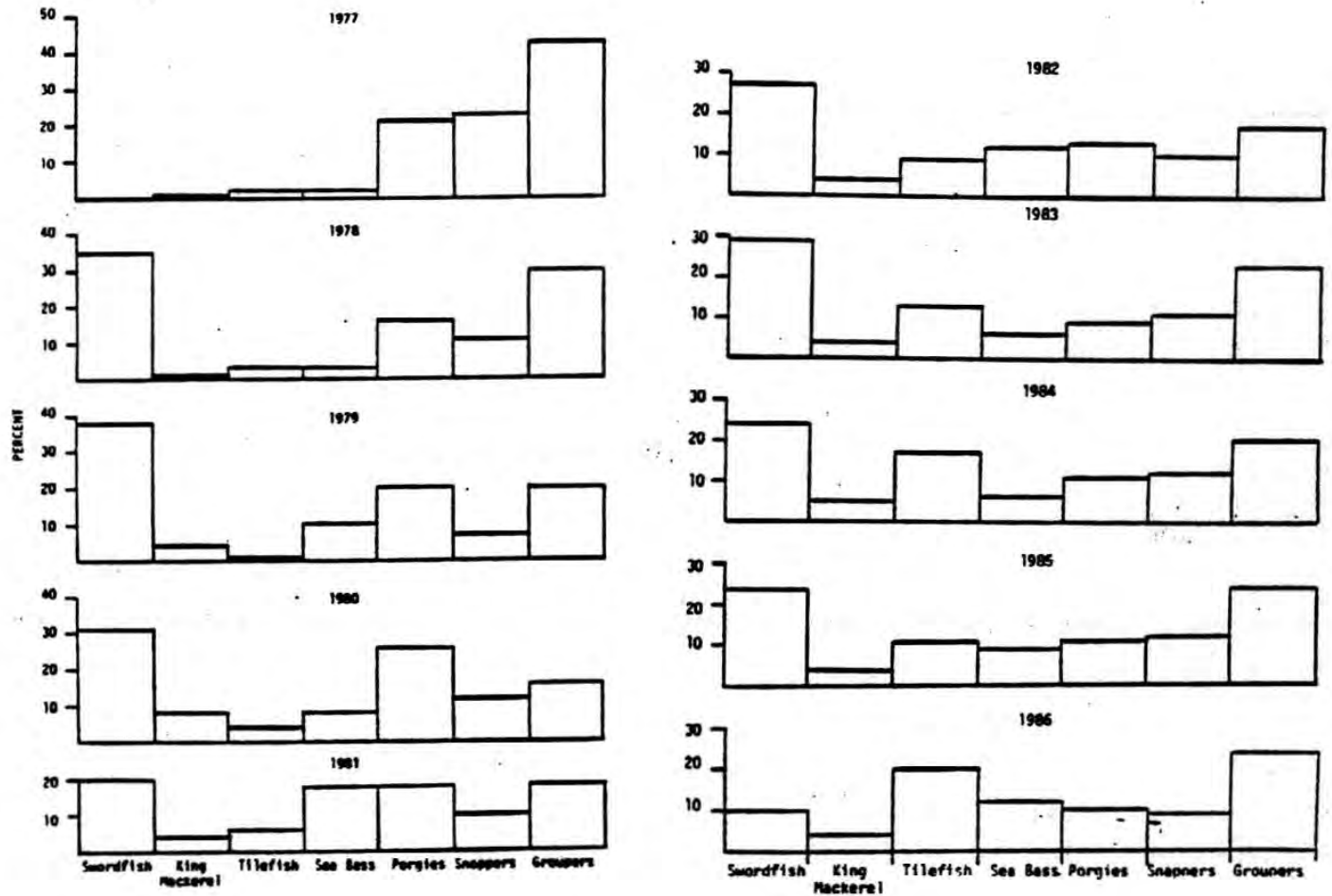


Fig. 16. Composition of the landed weight of offshore fish caught by South Carolina commercial fishermen.

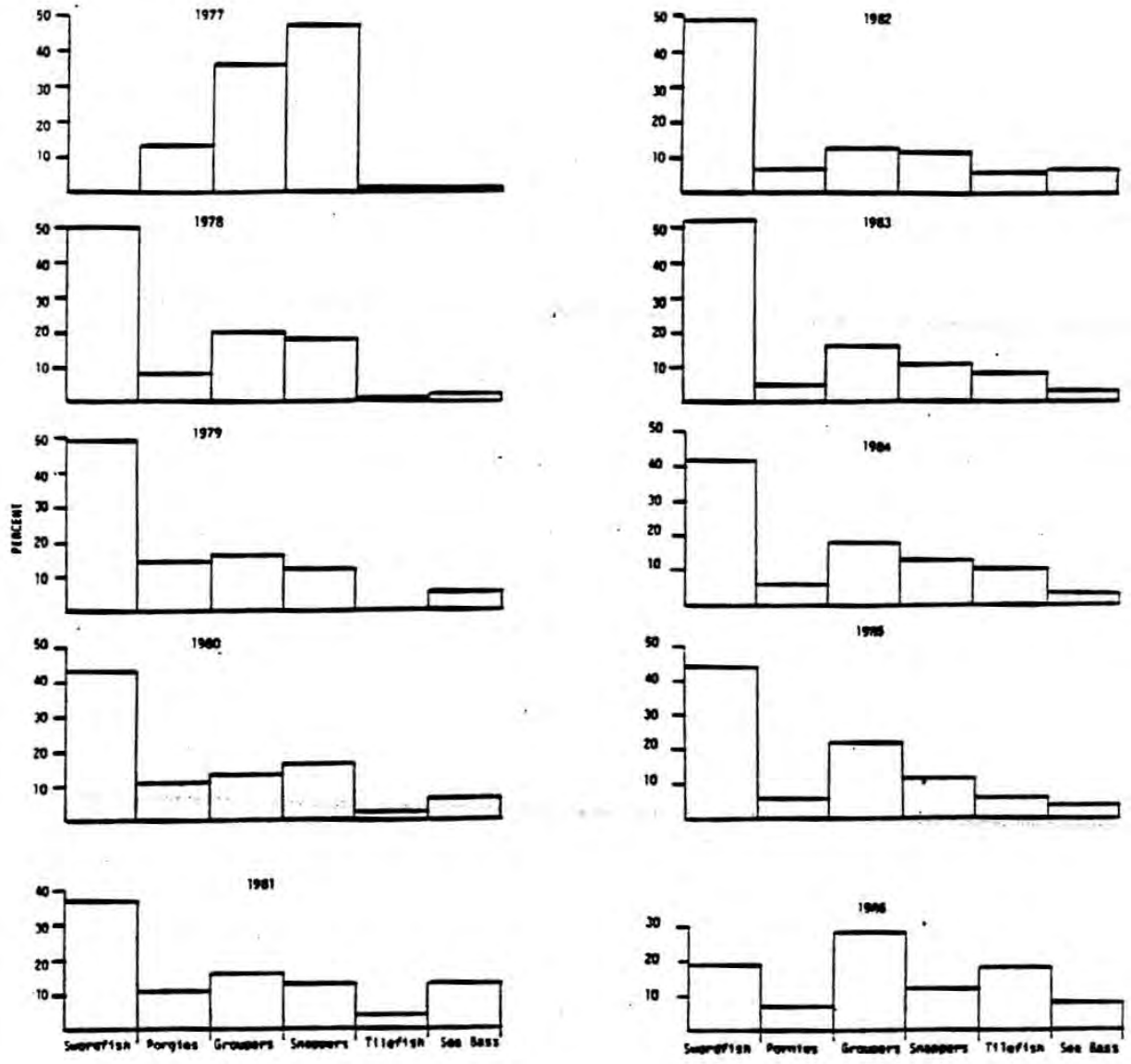


Fig. 17. Contribution to landed value of offshore fish caught by South Carolina commercial fishermen.

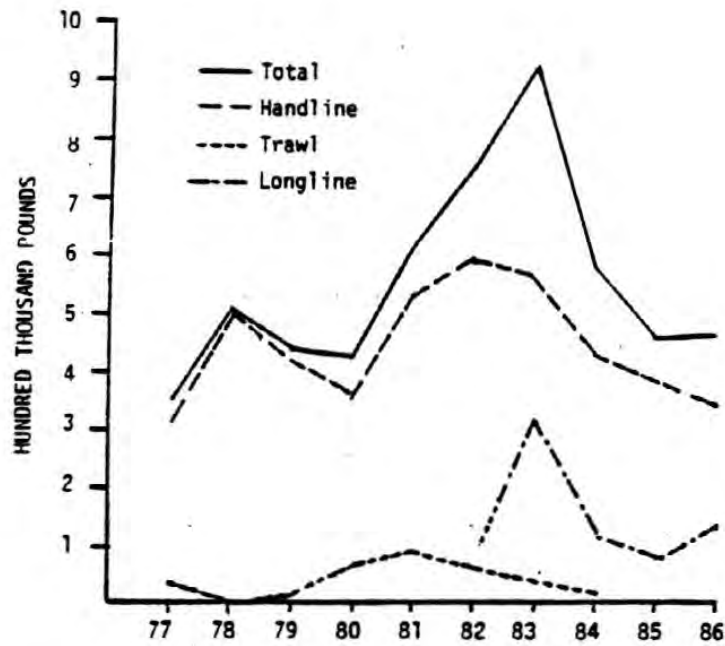


Fig. 18. Landed weight of groupers produced by South Carolina commercial fishermen. The 1985-1986 trawl landings and 1981-1982 longline landings are subject to confidentiality.

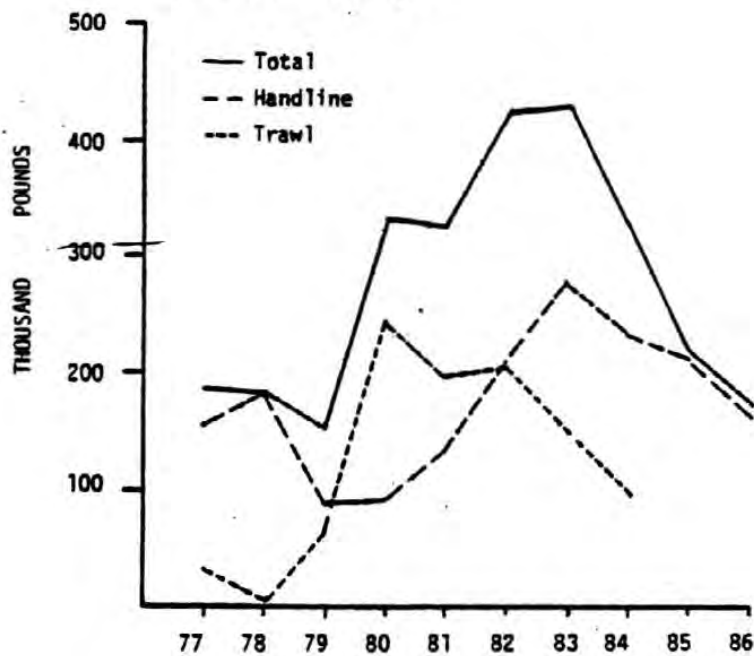


Fig. 19. Landed weight of snappers produced by South Carolina commercial fishermen. The 1985-1986 trawl landings are subject to confidentiality.

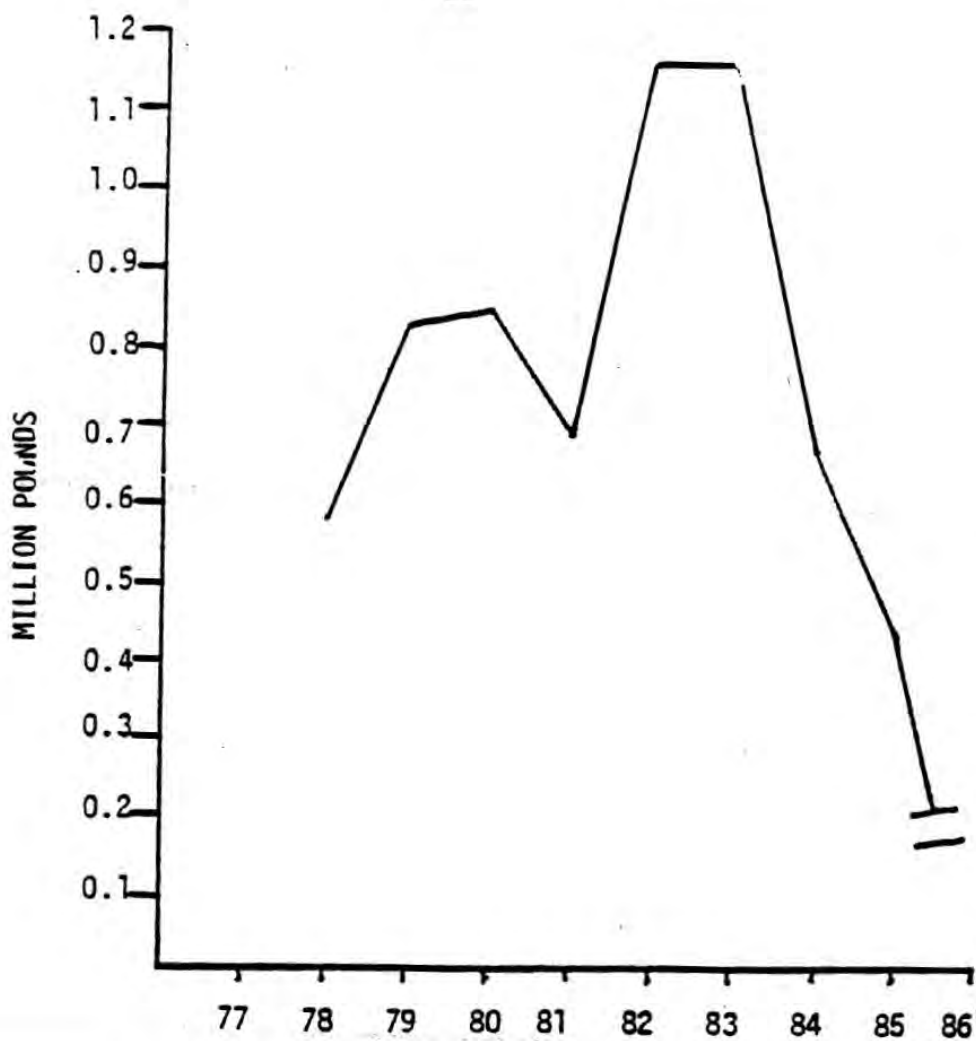


Fig. 20. Landed weight of swordfish produced by South Carolina commercial fishermen.

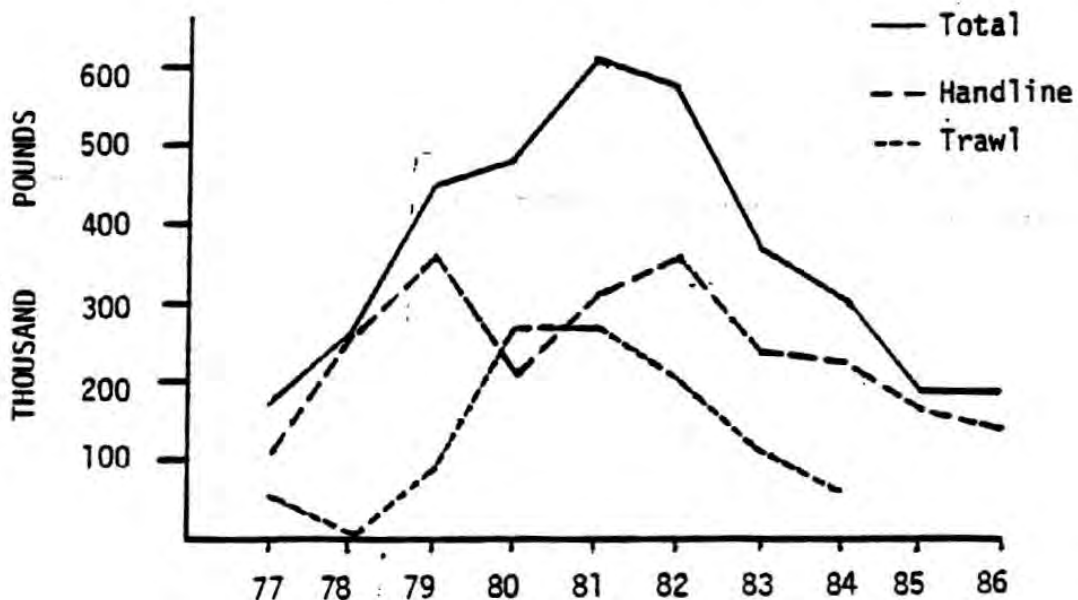


Fig. 21. Landed weight of porgies produced by South Carolina commercial fishermen.

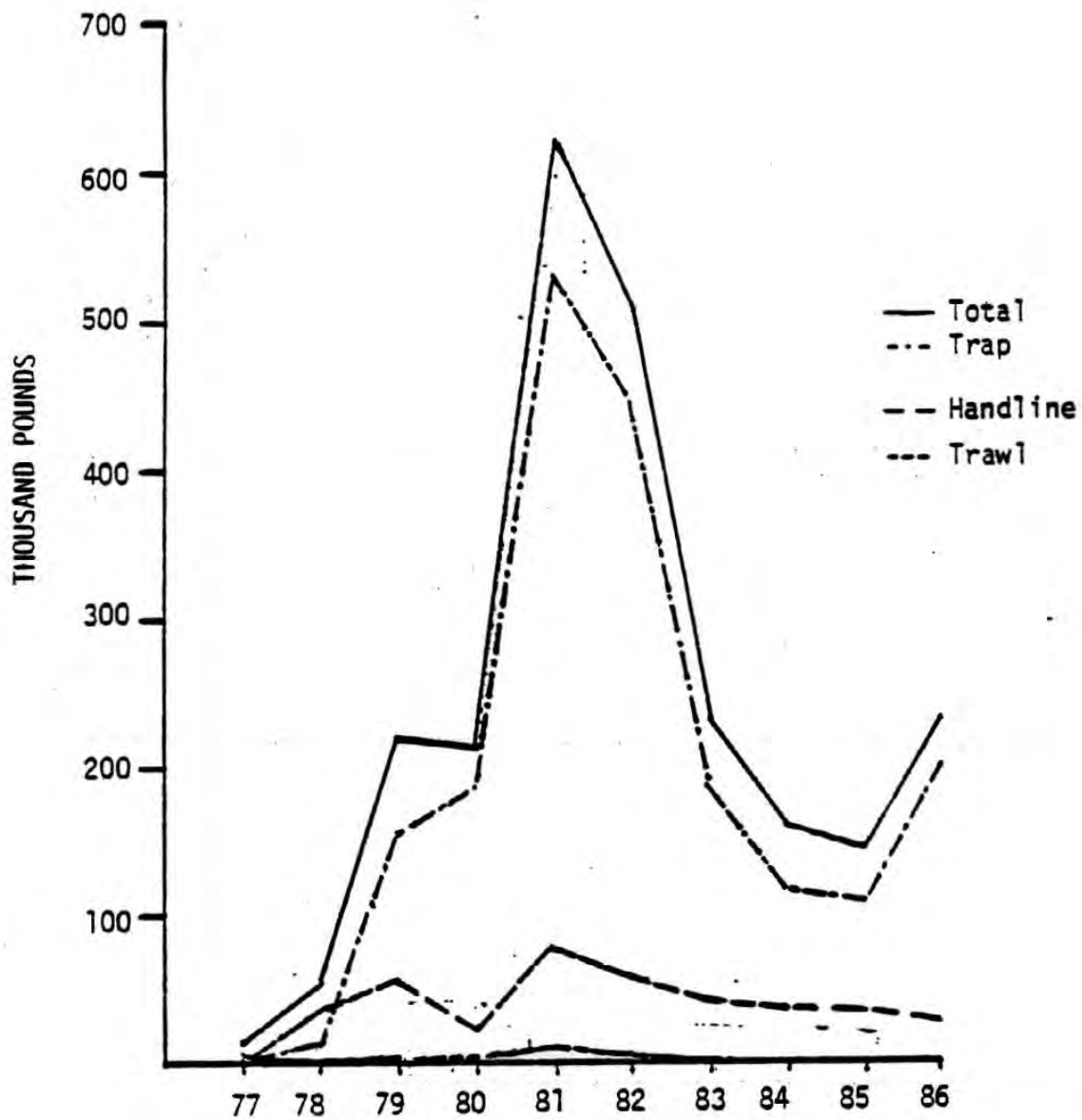


Fig. 22. Landed weight of black sea bass produced by South Carolina commercial fishermen.

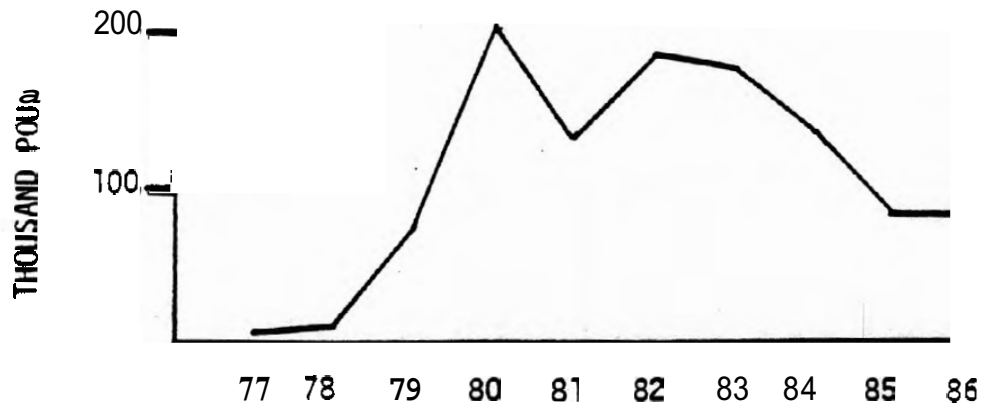


Fig. 23. Landed weight of king mackerel produced by South Carolina commercial fishermen.

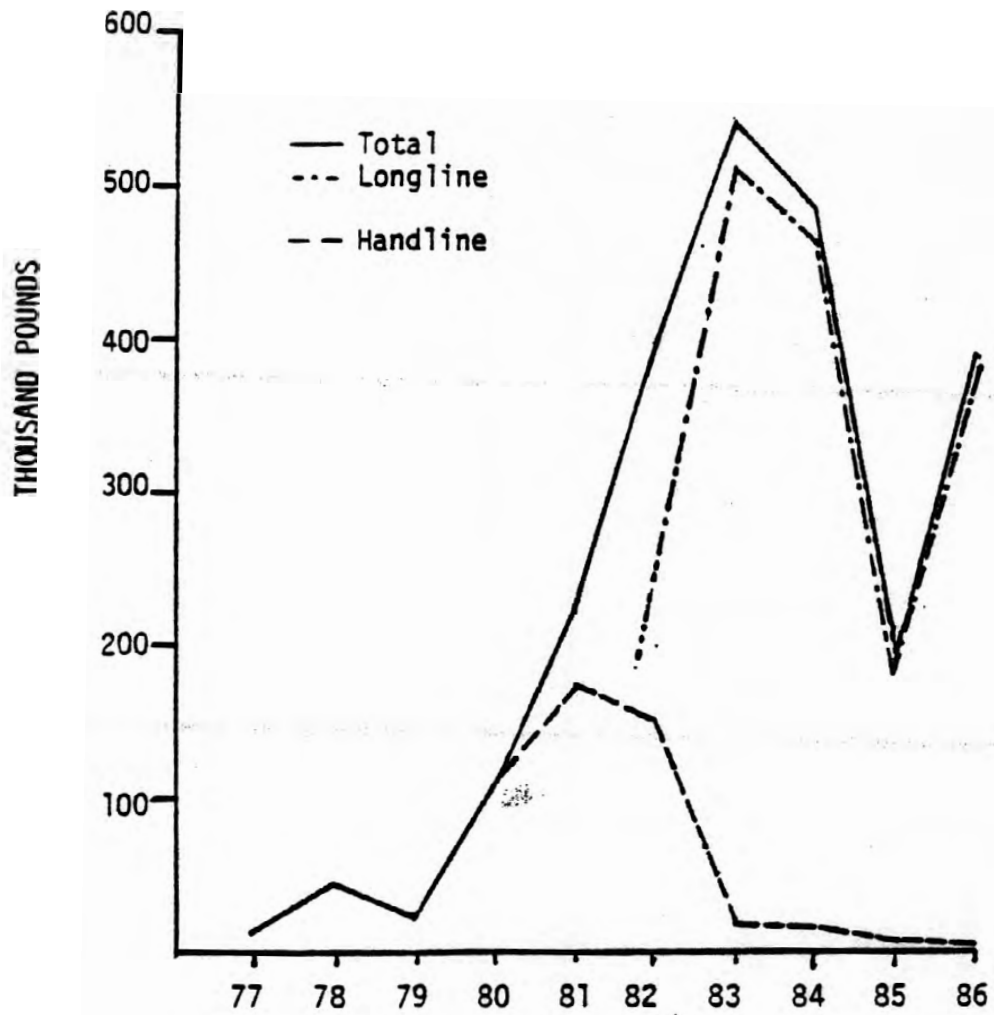


Fig. 24. Landed weight of tilefishes produced by South Carolina commercial fishermen.

of 4 and the 1983 landed value, after adjustment for inflation, was about 5.7 times the 1977 figure.

In 1984, total landings declined at a greater rate, with decreased catches reported for every major species group. Swordfish landings were 58% of those the previous year and down about \$1.3 million in unadjusted ex-vessel value. Grouper and snapper catches also dropped considerably, with corresponding reductions in unadjusted value of 21% and 16%, respectively. Landings by weight were also down appreciably for tilefish (-11%), porgies (-16%), king mackerel (-23%), and black sea bass (-32%). The one positive aspect was that the overall catch continued to reflect a wide species diversity, which tended to minimize the negative effects of sharp declines in individual major categories.

Total landings continued to decline in 1985, with significant reductions in every major category. Percentage species composition remained similar to that in 1984. The most conspicuous change was a decline in the relative contribution of tilefishes. Relative contributions to total landed value remained similar to those in 1984. After adjustment for inflation, overall landed value decreased about 27%.

Production increased slightly in 1986, although adjusted landed value declined to the lowest level since 1978. A sharp reduction in swordfish landings was a major causative factor. Landings in most other categories remained stable or increased. A substantial improvement was reported for black sea bass and tilefish production doubled. Groupers were the leading contributor to landed value, as swordfish dropped into second place after eight years of dominance. The relative contribution of tilefishes increased to the highest point of the reporting period.

Swordfish

The rapid expansion of this fishery off South Carolina coincided with its phenomenal growth off the east coast of Florida and in the Gulf of Mexico. Swordfish appear to be a migratory stock within a wide area of the western Atlantic and the fishery off South Carolina exploits only a small and variable fraction of this stock. Trends in South Carolina landings therefore are largely dependent on a complex series of interacting events. These trends, however, do appear consistent with what is believed to be happening to the swordfish stock and the wide-ranging fishery dependent on it.

As with many species of offshore fish, the unit value (price per pound) of swordfish increases with the individual size of the fish. The larger fish are almost all females. These large fish are vital to the stock because they represent the brood stock and they are important to the fishermen

because of their greater unit value. Swordfish in the South Atlantic are captured with surface longlines. In the early years of the fishery, large fish were abundant and relatively less gear was required to catch a given total weight of fish. As the number of large fish decreased, fishermen were required to catch more smaller fish to attain the same total weight. Since the smaller fish were worth less per pound, a disproportionately greater number had to be caught in order to attain the same total value as before. In longline fishing, as the density of fish decreases, more hooks must be fished in order to maintain production rates. Furthermore, these hooks must be spread farther apart in order to cover more fishing area, thus the length of the mainline must also be increased. Because of the additional gear required (and the bait), the expense of fishing, as measured per fish caught, increases as the number of fish decreases. If the fish caught are getting smaller (and less valuable per pound) as well, then the net return per pound of fish taken declines. Thus, a continued decline in the size of swordfish, in addition to a drop in their total number, has ominous implications for both the biological status of the stock and the economic viability of the fishery.

From 1978-1983, the Marine Resources Division received reports of carcass weights of over 40,000 swordfish landed in South Carolina. From 1980 to 1983, the average size declined from 73 to 66 pounds dressed weight. Although this seems minor, it was due to a marked decrease in the percentage of large fish and a large increase in the number of small fish landed. Since 1979, the smallest size at which fish were likely to be captured decreased from the 40-50 pound dressed weight class to the 20-30 pound class. When this was combined with the increasing total catch (in weight) observed during 1978-1983, it meant that substantially more small fish (under 50 pounds) were being caught each succeeding year.

The principal biological feature of the increased swordfish landings during this period in South Carolina (as in most of the South Atlantic) was the large increase in the percentage of small, predominantly male fish landed. The large females became relatively uncommon in the landings during most of the year. The increased landings of swordfish overall apparently were obtained through disproportionately greater effort, when considered in terms of the miles of gear and numbers of hooks being fished. The large increase in trip expenses and lower trip gross returns posed economic problems for many fishermen. The overall indications were typical of a fishery headed for trouble due to overfishing of the stock and overcapitalization of the harvesting sector.

The trend in South Carolina swordfish landings since 1983 supports the argument that overfishing is occurring. Landings have

declined sharply in each year and the average dressed (carcass) weight in 1985 was about 49 pounds.

The fishery management plan developed by the regional fishery management councils is designed to deal with the overfishing aspect and does not directly address the economic concerns. The principal feature, a geographically variable seasonal closure intended to reduce the landings of small fish, was not implemented by federal officials and its authorization expires at the end of 1987. The swordfish fishery at present is practically free of restrictions.

Groupers

At the start of expansion of the offshore fishery in 1977, groupers represented about 43% of the total landed weight and 36% of the value. From 1979-1985, this group consistently accounted for 20-25% of the total annual catch by weight and 15-20% of the adjusted value, usually ranking second to swordfish in both categories. In 1986, groupers moved into first place in both landed weight and value.

Handline boats have accounted for most of the grouper production, with landings of mid-depth species (primarily gag) predominating. In 1977-1978, handline fishermen spent substantial effort in deep water and snowy grouper represented about half of the total handline grouper catch. During 1978, average trip production of deep-water groupers declined drastically (Fig. 25), then remained at a low level during 1979-1982. Since then, deep-water groupers have comprised a minor portion (less than 10%) of the overall annual handline catch. Gag was the dominant species of grouper landed by trawlers, although these catches were very small relative to the handline landings. Average catch rates of gags by handliners have fluctuated between 750 and 1200 pounds per trip during most of the reporting period (Fig. 26a).

In contrast to the handline fishery, the bottom longline fishery has been directed primarily at deep-water species and snowy groupers have represented a significant portion of the bottom longline landings since 1982. Landings of deep-water groupers peaked in 1983, with 87% coming from the longliners. Catches have fluctuated since then, due to variable longline effort; the handline landings have stayed in the 15,000-20,000 pounds range. The longline catch in 1986 was nearly the same as that in 1984, but represented only about 50% of the 1983 figure.

Snappers

In 1977, landings of snappers ranked second to those of groupers and represented about 23% of the total offshore finfish catch. Because of their higher unit value, the aggregate snapper catch was the most

valuable component and contributed about 47% to the overall landed value. Most of this production was accounted for by handliners, with red and vermilion snappers contributing roughly equal amounts. In 1976-1977, silk snappers also comprised a substantial portion of the snapper catch.

Snappers made up a significant part of the trawl catch as this fishery expanded during 1979-1983. During 1979-1981, production of snappers by handline boats was depressed and the increased trawl landings were responsible for the continued rise in overall snapper landings. Although the 1976-1977 trawl catches contained appreciable amounts of red snappers, the large increases in subsequent years were attributable to vermilion snappers, most of which were smaller than those landed by handline fishermen. In 1982, handline landings of all snappers combined equalled those of trawlers and have been substantially greater since then.

The minimum trawl mesh size (4 inches) imposed in the Fishery Conservation Zone in 1984 was primarily designed to eliminate the harvest of small vermilion snappers. Since these fish represented the major source of income to most offshore fish trawlers, many fishermen either reduced their effort or quit altogether. This removed the bulk of the small vermilion snappers from the annual harvest, as well as most of the trawler contribution to overall snapper landings.

After 1977, catches of silk snappers were negligible. During 1977-1979, average handline trip production of red snappers (Fig. 26b) declined greatly, then remained at a very low level during 1980-1984. In 1983, a minimum size limit (12 inches) was imposed on red snappers in the Fishery Conservation Zone. This regulation appeared to have a negligible effect on South Carolina landings, since historically practically all of the fish brought in here were larger than this. Although annual handline catches of red snappers increased during 1980-1983, most of this was attributed to fish much smaller (less than 4 pounds) than those landed in earlier years. Since 1984, annual handline landings have declined sharply and the 1986 catch of red snappers was the lowest in ten years.

Most of the increase in overall snapper landings during 1979-1983 was accounted for by vermilion snappers. Average trip production by handliners decreased sharply during 1977-1979 (Fig. 26c), but then trended significantly upward. The substantial catches in 1983 and 1984 were largely supported by the same year classes that were exploited heavily as small juveniles by the trawlers. This suggests that the trawlers capitalized on an unusually strong series of recruitments. In 1984-1986, however, annual handline landings steadily declined.

Stock status of silk snappers appears to be severely depressed compared to the probable level at the beginning of the reporting

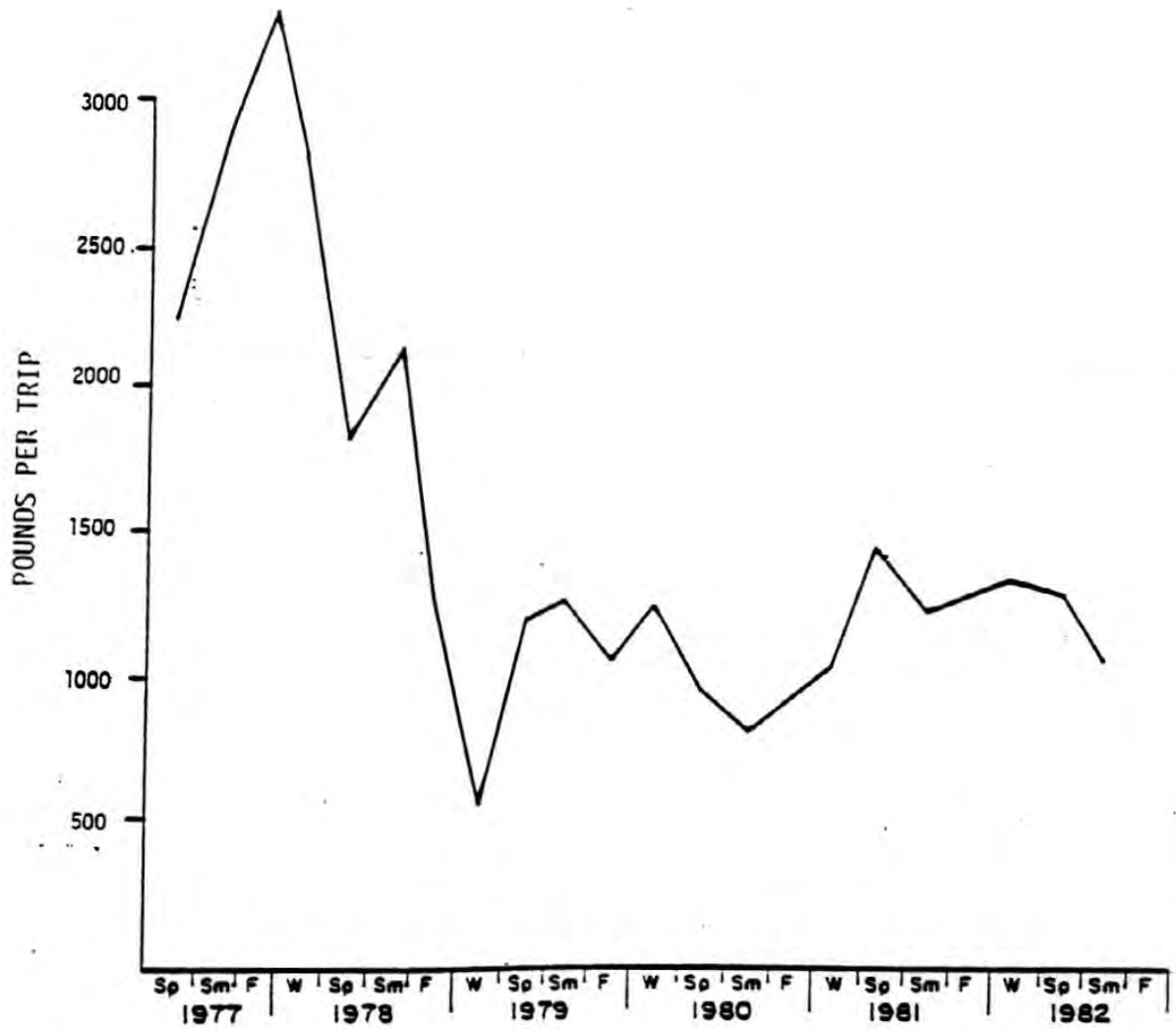


Fig. 25. Trend in seasonally adjusted commercial handline trip production of deep-water groupers in South Carolina.

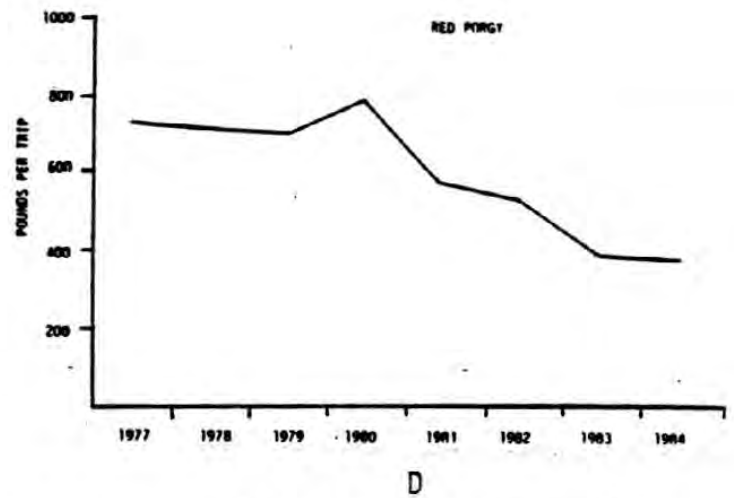
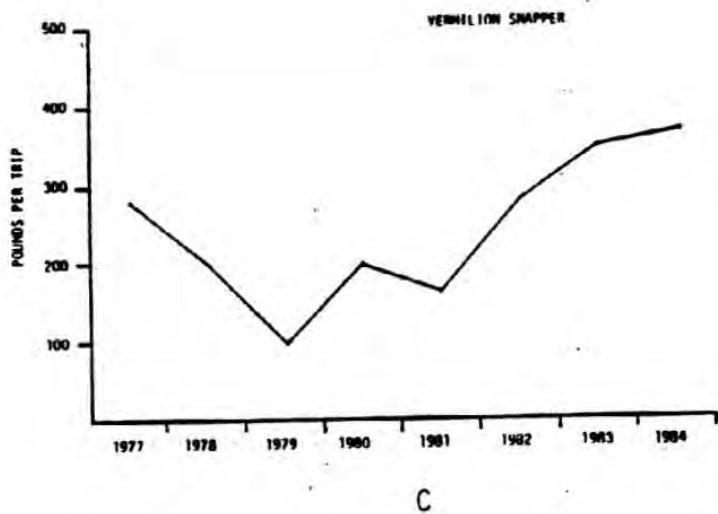
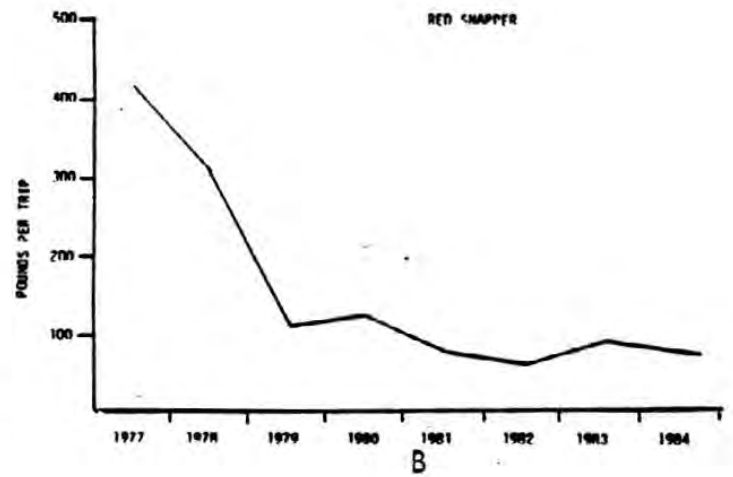
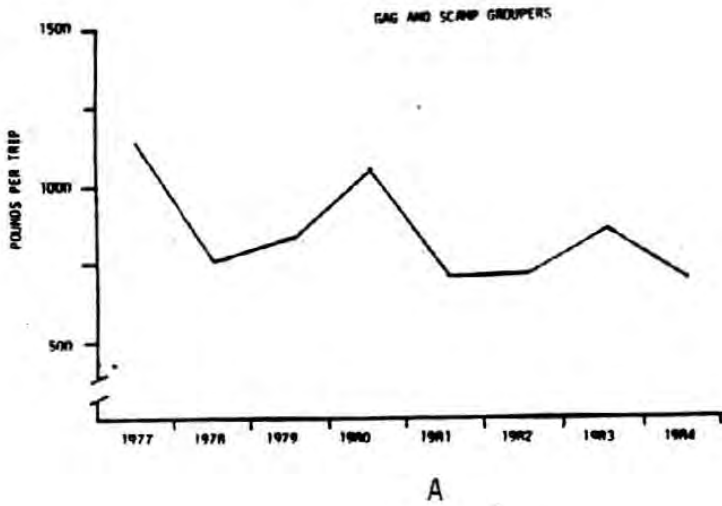


Fig. 26. Trends in average trip production by commercial handline fishermen in South Carolina: a) gag and scamp groupers, b) red snapper, c) vermilion snapper, and d) red porgy.

period. Small red snappers are much more prominent in recent catches than was the case historically, which suggests either an improvement in recruitment or overfishing. A combination of both factors is probably responsible. The stock of vermilion snappers has recently been in good condition, due to probable strong recruitment during the early 1980's, but fish in these age groups no longer dominate the fishery.

Porgies

In 1977, porgies (primarily red porgies) ranked third behind groupers and snappers in contribution to the total landed weight of bottomfish, although representing substantially less of a value contribution because of their low unit value. In the next few years, the relative unit value improved and the availability of porgies made them attractive to many of the new entrants in the handline fishery. Large trawler landings in 1980-1981 contributed significantly as total production reached a peak in 1981. The subsequent decline in overall landings reflected a decrease in both trawl and handline landings. Since 1983, porgies have ranked fourth in importance to the total landed weight of bottomfish. Their relative contribution to overall landed value has gradually decreased and porgies now represent a small percentage (less than 10%) of the total annual value of bottomfish.

The probable status of the stock is indicated by the trend in handline average trip production (Fig. 26d), which declined steadily during 1980-1984. The average individual size of fish landed by handliners has also continued to decrease.

Black Sea Bass

Black sea bass was the first offshore species to be harvested by South Carolina fishermen, since it ranges farther inshore than other bottomfish. Historical landings have fluctuated greatly, although the tendency has been for periods of high production to be separated by five to seven years of very low to modest catches. Nearly all of the production has been attributed to trap fishermen.

The price structure for black sea bass is atypical and exerts considerable influence over production. Large fish are in strong demand in northern markets and the prevailing price for this grade is usually much higher than that for medium-sized fish. Small black sea bass are largely limited to local distribution at low prices. The size composition of commercial trap catches suggests that effort is strongly influenced by the size composition of the available fish. Years of peak production have followed years in which reduced fishing pressure allowed the stock to generate a significant quantity of large fish. Effort and production have expanded until this surplus

has been harvested. Then both effort and production have fallen. Thus, there is some indication that production is cyclic, dependent on the replenishment of large fish rather than the overall abundance of the exploitable stock.

The start of the reporting period coincided with the lowest level of landings in 20 years. Annual production increased sharply to a peak in 1981. Landings dropped off greatly after two years of high production and remained depressed for several years. Increased landings in 1986 probably indicate the start of another cyclical upswing in production.

In 1983, a minimum size of 8 inches was placed into effect in the Fishery Conservation Zone. Since this corresponds closely to the smallest size of sea bass normally retained by the traps customarily used, the effect of this regulation on commercial landings appears to have been negligible.

Tilefish

Prior to 1980, tilefish were an incidental (though marketable) catch of handline fishermen. Most of the early landings consisted of blueline (grey) tilefish, which inhabit rough bottom and are found in somewhat shallower depths than golden tilefish.

In 1980, a few handline fisherman began to direct their effort to deep-water species, primarily golden tilefish and snowy grouper. During exploratory fishing, substantial catches of golden tilefish were made over previously unfished mud bottom at the 100-fathom curve southeast of Charleston. A few shrimp boat operators rigged up with snapper reels and made occasional trips to this area during slow periods of shrimping. Landings continued to rise sharply in 1981 as more boats entered the deep-water fishery and targeted this species. Average trip production (Fig. 27) continued to drop sharply, however, and handliners began to investigate the feasibility of bottom longlining, which was the method used to harvest large quantities of tilefish in the mid-Atlantic and southern New England areas.

In 1982, several boats were equipped with bottom longline gear and began fishing for deep-water species, primarily golden tilefish. During that year, these boats caught more tilefish than did the handliners. The advantages of longlining were clearly demonstrated in the deep-water fishery, particularly over the smooth mud bottom where the principal golden tilefish population was located. A number of boats from Florida and Georgia moved into the area off South Carolina and began landing their fish in local ports, while others transported their catches back to their home ports. Catches landed in South Carolina therefore accounted for only an unknown part of the total harvest of tilefish off this state. Expansion of the longline

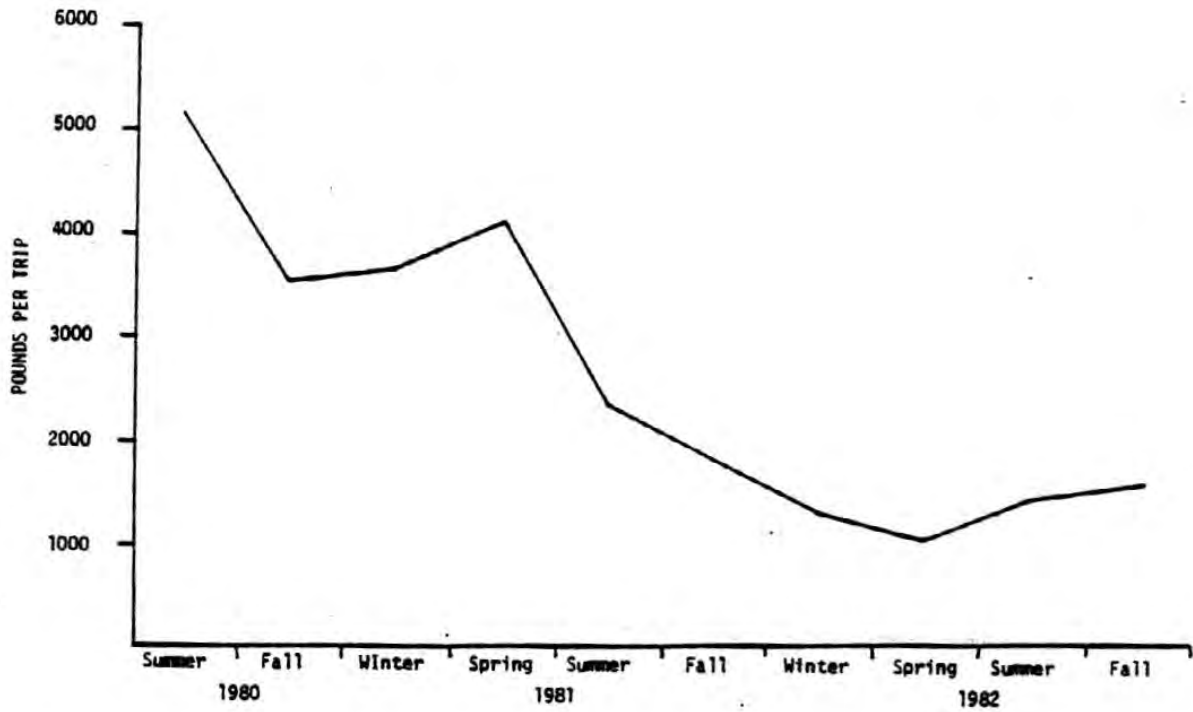


Fig. 27. Trend in seasonally adjusted commercial handline trip production of golden tilefish by South Carolina commercial handline fishermen.

fleet and total landings continued to increase substantially during 1983, while handline effort in the deep-water fishery declined to a very low level. Part of the total tilefish catch was landed in other states. South Carolina landings in 1984, although down slightly from those in 1983, were still very substantial and golden tilefish ranked second behind swordfish as a single species fishery.

Landings in 1985 dropped off drastically, due to a 60% decrease in bottom longline production of tilefish. There was very little effort after June, as most of the boats turned to swordfishing. In 1986, swordfish landings plummeted and some boats devoted more of their effort to bottom longlining. Tilefish landings in 1986 doubled and landed value exceeded \$0.5 million for the first time.

King Mackerel

Like swordfish, king mackerel are pelagic, migratory fish, with only a small and variable portion of the Atlantic stock available off South Carolina. Stock-dependent trends in production are largely determined by factors elsewhere.

Commercial landings, primarily by handliners and trollers, were very low during the late 1970's. At the same time that the snapper boats moved into this area, several Florida boats that specialized in trolling for this species also arrived and much of the initial increase in production was attributable to their effort. As market conditions improved and catch rates of snappers and other bottom species declined, more handline boats resorted to fishing for king mackerel at night to supplement their bottomfish catches. The additional landings contributed to a further rise in overall production, which peaked in 1980.

In 1983, South Carolina landings declined. Growing concern over the status of the king mackerel population(s) has led to increasing regulation of the fishery since then, although the greatest impact of such restrictions has been on fishermen off Florida. The commercial fishery in the Fishery Conservation Zone was closed for two months in 1983 after the commercial quota was reached. There was no effective enforcement in this area, since state water remained open, and it appeared to have little effect on local landings. Landings declined sharply in 1984 and 1985, then leveled off in 1986. Since 1985, there have been increased permit requirements and catch limitations on charterboats which land their catches for sale and these regulations may have had an impact on fall landings.

Sharks

Historically, most of the sharks landed commercially in South Carolina have been

incidental catches taken by shrimp trawlers. Virtually all of this production was consumed locally.

During 1977-1984, landings of sharks (Fig. 28) trended sharply upward. Contributing factors included improved market status and value, due to growing consumer awareness of the product, and increased landings by nontraditional gears, such as longlines. Sharks taken by these gears have been primarily larger, offshore species, with the sandbar probably being the most common. The increased effort in the swordfishery also produced increased bycatches of pelagic sharks, such as dusky and blues, although most of the sharks caught by swordfish boats are released.

Most of the increase, however, has been accounted for by net fisheries and the trend in overall production has closely paralleled that of this sector. Net gears include shrimp trawls, offshore fish trawls, gill nets, and stop nets, with gill nets and shrimp trawls being the major producers in recent years. Most of the sharks taken by these more traditional gears have been small, inshore species, such as the Atlantic sharpnose and bonnethead, and sandbar sharks. Landings in 1985 and 1986, although substantial compared to historical levels, were well below the peak set in 1984. Reasons for this decline are not clearly understood.

Unlike many other offshore fish stocks, the shark population is underutilized and offers the potential for substantially increased landings. Because they grow slowly and produce very few young, sharks must be exploited at a very low level, far below that typically seen in commercial fisheries for fish. Lack of effective limits on fishing pressure has resulted in the failure of nearly every shark fishery.

Most of the important species groups are or have been exploited by more than one sector. The notable exceptions are swordfish and black sea bass, which are taken almost exclusively with single types of gear. The following accounts describe major developments applicable to each type of gear.

Trawl Fishery

Early attempts at fish trawling in South Carolina were unsuccessful, due to gear damage and low revenues. A study by the Marine Resources Division in 1974 concluded that this activity was economically less feasible than trapping for black sea bass, which was the principal offshore fishing activity at the time.

Subsequent review suggested that the inexperience of the captains and design of their nets may have been factors contributing to the lack of success. In 1976, the Sea Grant Marine Advisory Program, in collaboration with the Marine Resources Division, selected an experienced captain and

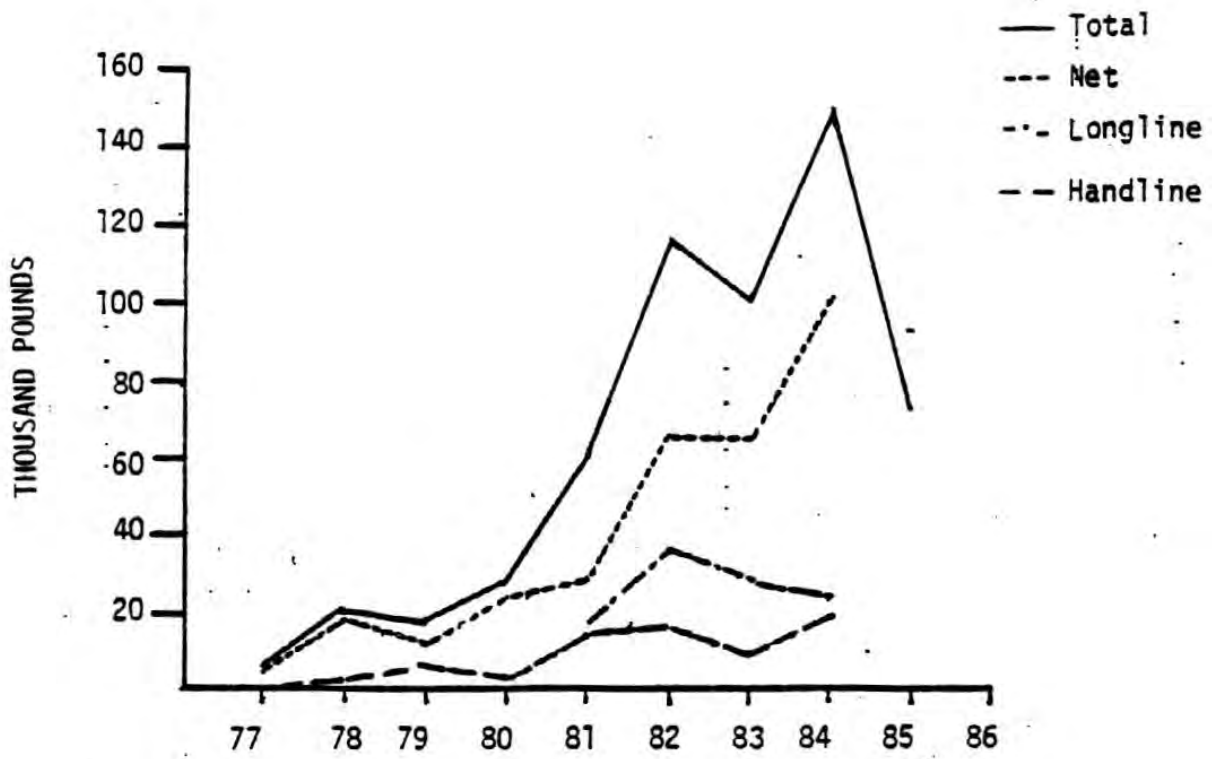


Fig. 28. Landed weight of sharks caught by South Carolina commercial fishermen.

new type of net for experimental trials to re-evaluate the feasibility of offshore fish dragging. Fishing was conducted during winter and spring (i.e., the off season for shrimping in local waters) from a typical shrimp trawler of offshore capability.

This effort produced an average trip production of 3,977 pounds, with a daily catch rate (2,107 pounds) that compared favorably to the average (719 pounds) reported by commercial handline boats. About one-third of the catch consisted of high-valued red snapper. This demonstration attracted considerable attention from owners of large shrimp boats looking for local employment for their vessels during the closed shrimp season.

During the next few years, more than a dozen shrimpers equipped their vessels for offshore trawling and began learning the technique and fishing areas. Between 1976 and 1979, the most notable development was the change in species composition (Fig. 29). The relative contribution of red snappers and groupers rapidly declined. Since these fish had a high unit value, this would have had a significant impact had not the landings of lower-priced porgies increased substantially. The percentage of vermilion snappers (a comparatively high-valued species) increased as well, which also compensated for the reduction in landings of red snapper and groupers. By 1979, vermilion snappers were the most important component in landed value.

In 1980, an estimated 13 vessels participated in the fishery and estimated effort (trips) nearly tripled (Fig. 30). Total landings (Fig. 31) more than tripled. The increase in landed value, while very substantial, was not proportional because porgies comprised most of the catch. The relative contribution of vermilion snappers again increased and represented half of the total value of trawl landings.

Landings peaked in 1981, although effort remained nearly the same as in 1980. Species composition also resembled that in the previous year. This was one of the worst shrimp years in recent history and there was significant offshore trawling during the summer, although catch rates then were lower than during the normal winter-spring season.

Total landings turned downward in 1982, although trip production (Fig. 32) reached its highest level. Much of the drop in landings was attributable to a reduction in effort; 1982 was a fairly good shrimp year and there was very little offshore trawling after May. Several boats also left the fishery, attracted by the higher profitability of the expanding swordfishery. There was a substantial difference in species composition reported from different ports. Most northern boats fished larger mesh nets and directed their effort at different grounds. Although some boats made large

landings of vermilion snappers, much of their catch consisted of lower-priced species considered incidental catches by other units (e.g. handliners) of the bottomfish fleet. Although Charleston boats averaged fewer pounds per trip, most fished small-mesh nets and targeted much of their fishing on vermilion snappers, which represented nearly 40% of their total production. In spite of their small size, these fish had a high unit value and represented the principal source of (offshore fishing) revenue for these boats.

In 1983, landings, effort, and average catch rates all declined. Most captains apparently made fewer trips, probably because of the significant reduction in average trip production. For the first time, vermilion snappers replaced porgies as the principal volume component of the statewide catch and increased their relative standing as the leading value contributor.

In 1984, landings, effort, and participation continued to decline. Although average trip production in winter was comparable to that in previous years, that during spring dropped to a very low level. Compared to performance in previous years, many of the trips were relatively unsuccessful (Fig. 33) and the overall annual catch rate was the lowest since the fishery began. In the 1976 experimental fishery, in which a smaller net was used, the average catch rate was 2,107 pounds per day. In 1983, the daily catch rate had dropped to 1,851 pounds and in 1984 it declined to 1,231. Species composition and value contribution did not change appreciably from 1983.

By the end of the 1984 trawling season (May), several factors were apparent. The number of boats participating regularly in the fishery during winter and spring was substantially below that which had operated several years previously. Those few boats that remained apparently made fewer trips than in previous years, probably as a result of sharp declines in average trip production. Over 50% of the total catch by weight consisted of very small vermilion snappers, although these fish represented over 60% of the landed value of offshore trawl catches. Landings of larger (but lower-valued) fish, primarily porgies, had declined for several years. Catches of large fish of high unit value, such as red snappers and groupers, remained at very low levels.

Studies by the South Atlantic Fishery Management Council suggested that the overall economic benefit from the harvest of vermilion snappers could be substantially increased if the catch of very small fish was reduced. There was also concern as to the biological impact of continued exploitation of these fish, many of which were below the size of first spawning. These factors were major elements of supportive arguments for eliminating trawl catches of very small vermilion snappers, which culminated in imposition of a 4-inch minimum mesh regulation

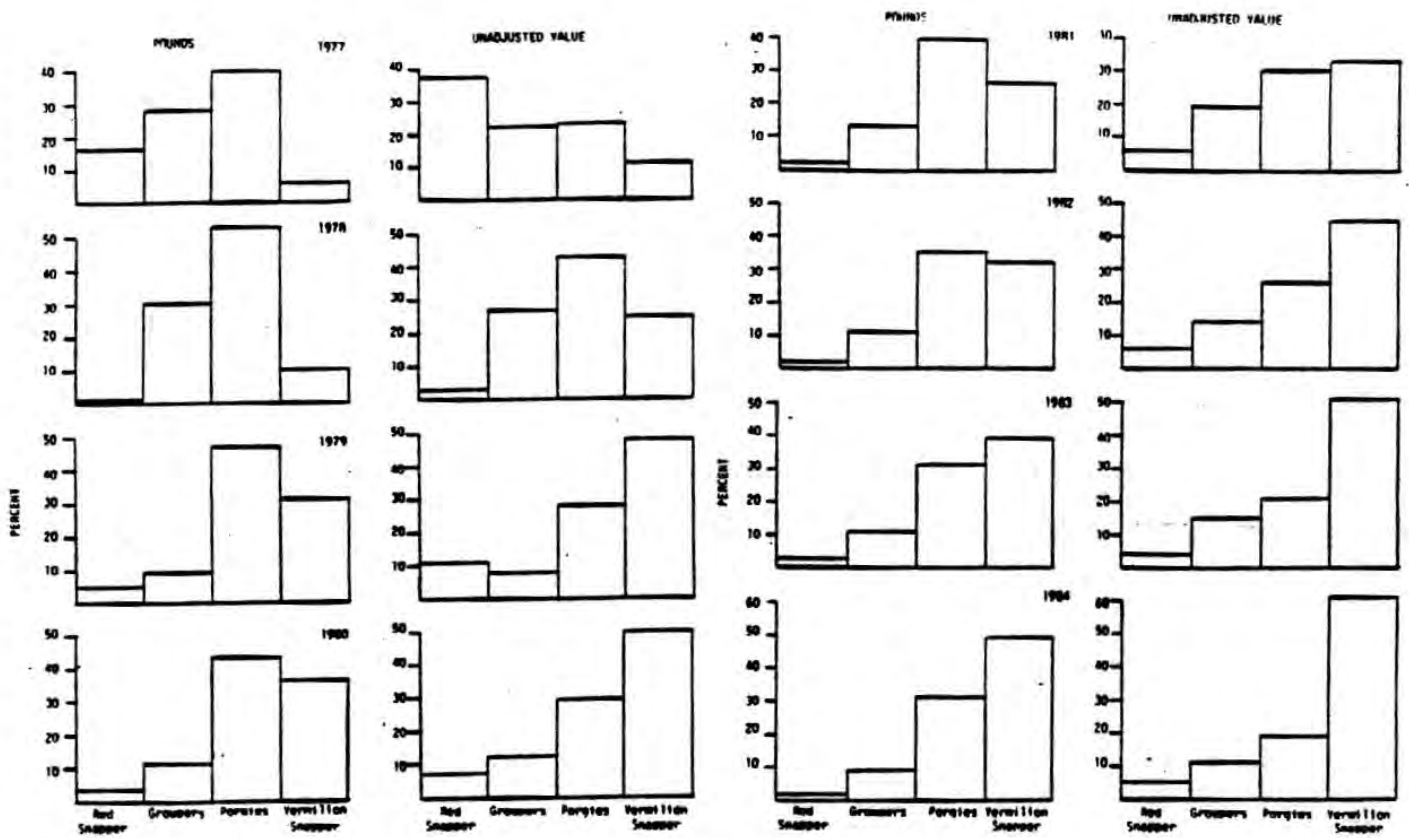


Fig. 29. Composition of South Carolina commercial finfish trawl landings, in landed weight and ex-vessel value. The 1985-1986 figures are subject to confidentiality.

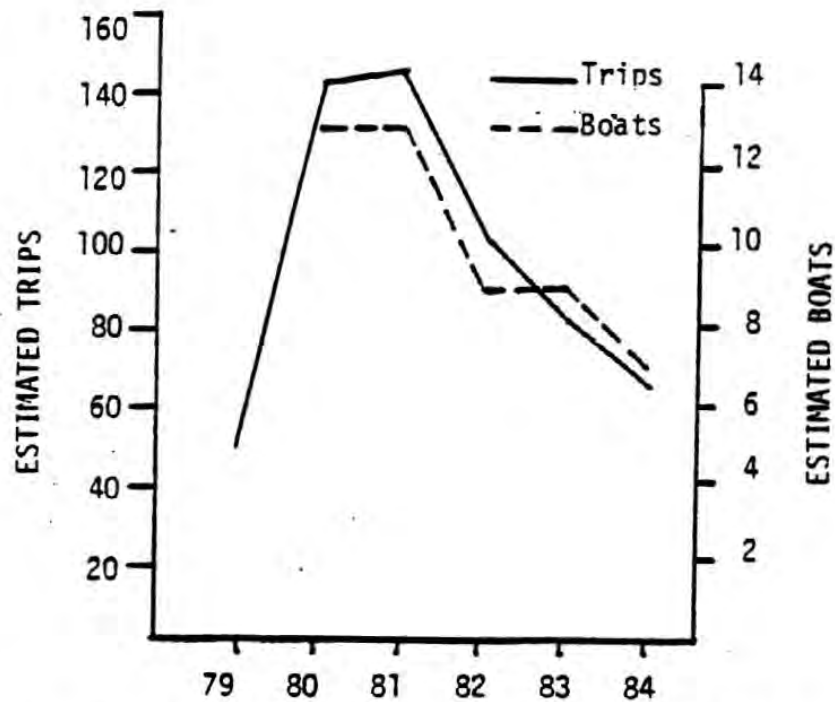


Fig. 30. Participation (number of boats) and effort (number of trips) in the South Carolina commercial finfish trawl fishery.

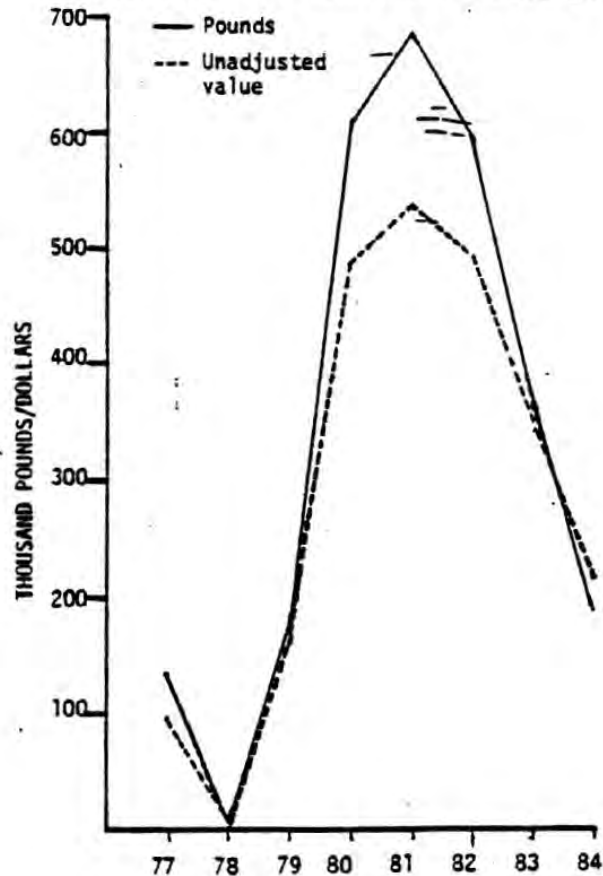


Fig. 31. Landed weight and value of offshore fish produced by the South Carolina commercial offshore trawl fishery. Data for 1985-1986 are subject to confidentiality.

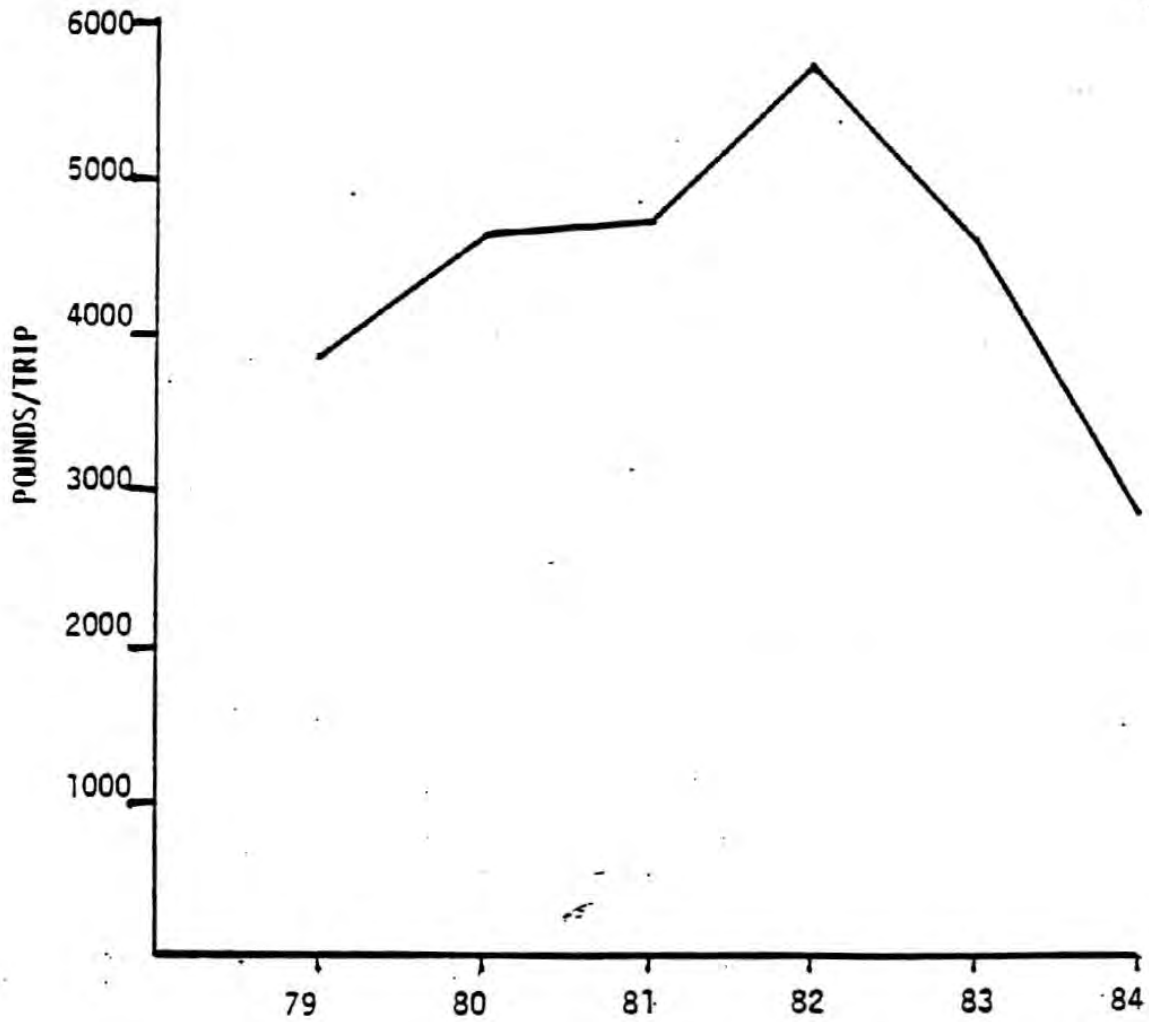


Fig. 32. Average trip production of South Carolina commercial finfish trawlers.

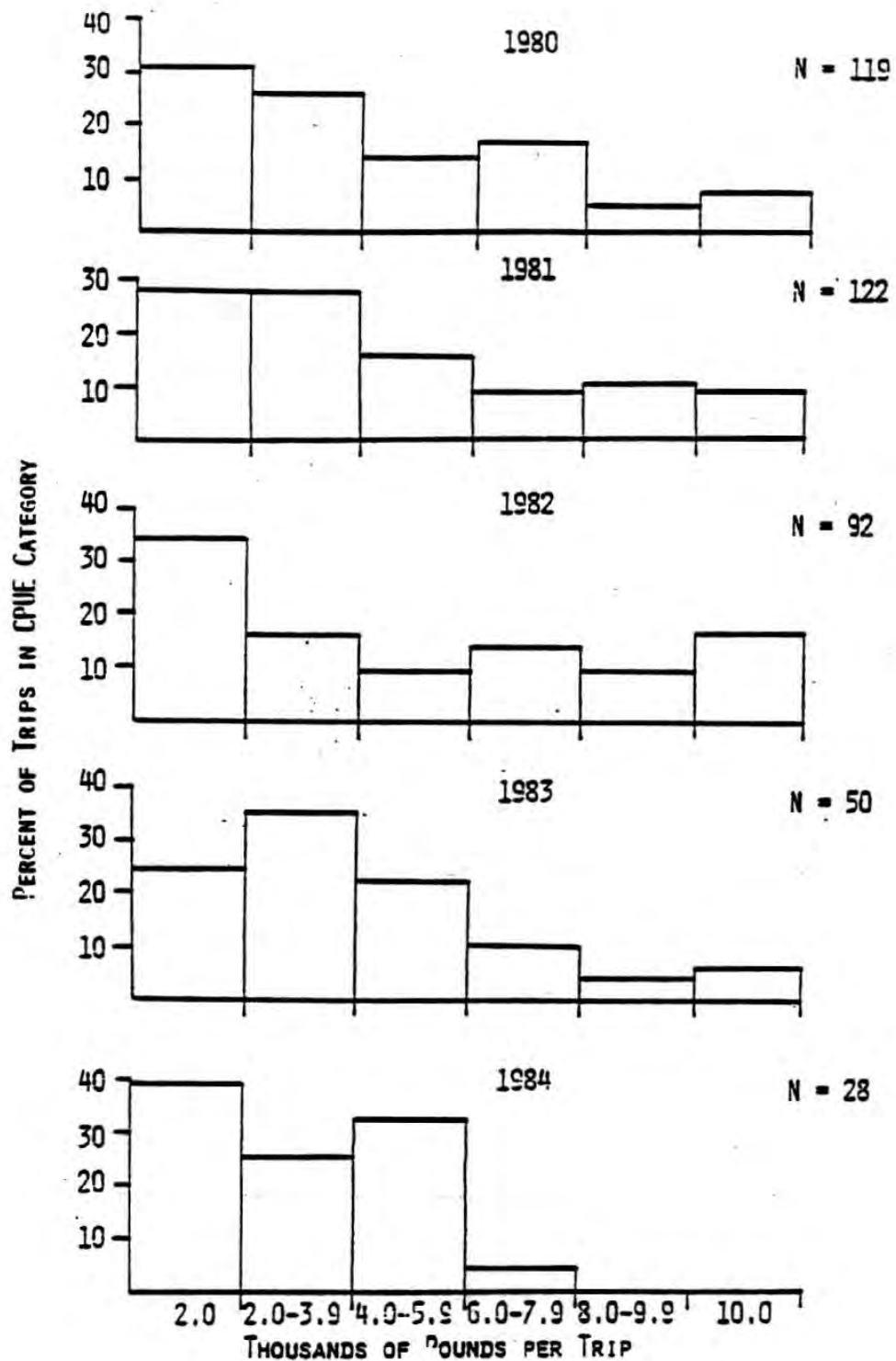


Fig. 33. Distribution of reported finfish trawl trips, by levels of production (CPUE), by South Carolina commercial fishermen.

in fall 1984. Although this measure was opposed on the grounds that it would effectively eliminate the trawl fishery because of the loss of revenue from small vermilion snappers, most trawl fishermen accepted the regulation with resignation. This atypical apathy probably was due to the unfavorable economic conditions already present in the fishery, which had caused most of the participants to voluntarily withdraw prior to imposition of the mesh regulation.

Statistics for 1985 and 1986 are not included because of confidentiality requirements. Both landed weight and value were considerably lower than in 1984 and only a few boats participated.

Bottom Longline Fishery

Bottom longlining off South Carolina began in 1981, with about seven boats participating. Nearly all effort was directed at deep-water species. Depending on the species sought, fishing has been concentrated in two areas. The principal habitat of golden tilefish is a narrow strip of mud bottom along the 100-fathom curve off southern South Carolina and northern Georgia. The other area is a rectangular section of rocky bottom off northern South Carolina, populated by snowy groupers, yellowedge groupers, and blue-line tilefish. Some golden tilefish occur there also. Many trips have been made only to the mud bottom, where the catch has consisted exclusively of golden tilefish. To some extent, therefore, trends for these deep-water species can be examined separately.

Initially, the principal species targeted was golden tilefish and the mud bottom fished by handliners received most of the early effort. Although strong currents sometimes restricted effective deployment of longlines, the superiority of this gear to handlines was quickly demonstrated. During comparative fishing trials between a Division research vessel equipped with snapper reels and a commercial longline boat, the longliner's catch rate in fish per hour was double the snapper reel production. Comparison of commercial production rates (pounds per day) between handline and longline boats suggested the same degree of difference in fishing power. As the average trip production of handline boats declined during the summer of 1981, there was an accelerated shift to longline gear. During the latter part of 1981, longline boats averaged almost 1,700 pounds of golden tilefish per day.

In 1982, most of the deep-water catch was accounted for by longliners, with golden tilefish the major component. Both the number of boats and total number of trips increased greatly (Fig. 34). Most of the new entrants were out-of-state boats, including several new vessels built primarily for longlining. Average daily catch rate of tilefish declined to about 1,150 pounds per day. This prompted many boats to divert more

of their effort to rocky bottom and about 60% of the total deep-water grouper catch in 1982 was landed by longliners.

The bottom longline fishery peaked in 1983 (Fig. 35) in terms of participation, effort, and total landings (in South Carolina). Average trip production (Fig. 36) also reached its highest level, as did average annual production by individual vessels (Fig. 37). Golden tilefish represented about 60% of the total catch. Catches of deep-water groupers also topped out, with most of the landings of all deep-water species being produced by longliners. The average trip catch was 3,758 pounds and the typical vessel landed slightly less than 21,000 pounds for the year. It should be noted that some vessels landed the major portion of their annual production in other states. Because of their range, it is difficult to assign catches for out-of-state boats to various areas and landings are reported by port of unloading. In 1983, an unknown percentage of the total catch taken off South Carolina was reported as landed in other states.

The total catch of deep-water species by bottom longliners (reported in South Carolina) declined 27% in 1984. In a departure from the pattern of the previous two years, very few boats pursued the bottom fishery on a full-time basis. Nearly 80% of the trips occurred during January-June, before the peak local availability of swordfish, and many of the top producers later switched to swordfishing. Again, a large amount of fish caught off South Carolina was reported as landed in other states.

A large part of the fleet experienced low catch rates (Fig. 38) during 1984 and the annual production of many boats was very low. The average boat produced almost 40% less bottomfish (pounds) per trip than in 1983. Judging from this low level of reported production, the bottom longline fishery was not especially important, in financial returns, to most of its participants. The major source of income for most longline vessels was swordfish. A large number of fishermen apparently fished bottom gear simply to fill out seasonal employment for their boats and crews, while waiting for swordfish to become available.

Longline landings in 1985 were well below those reported in 1984. The grouper catch was down 44% and tilefish landings declined by 60%. There was very little effort during the second half of the year, when most of the boats went swordfishing. In 1986, bottom longline production increased significantly, though not returning to the 1984 level (for tilefishes). Poor swordfishing may have caused many boats to expend more effort in bottomfishing.

The erratic production trend of the last three years emphasizes the importance of alternative employment opportunities for longline vessels. Counterproductive

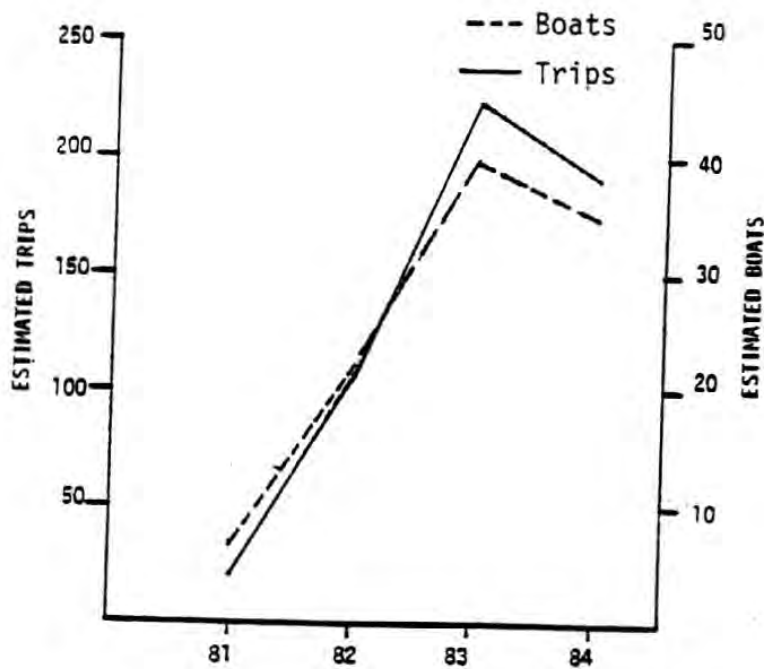


Fig. 34. Participation (number of boats) and effort (number of trips) in the South Carolina bottom longline fishery. Data for other years are subject to confidentiality.

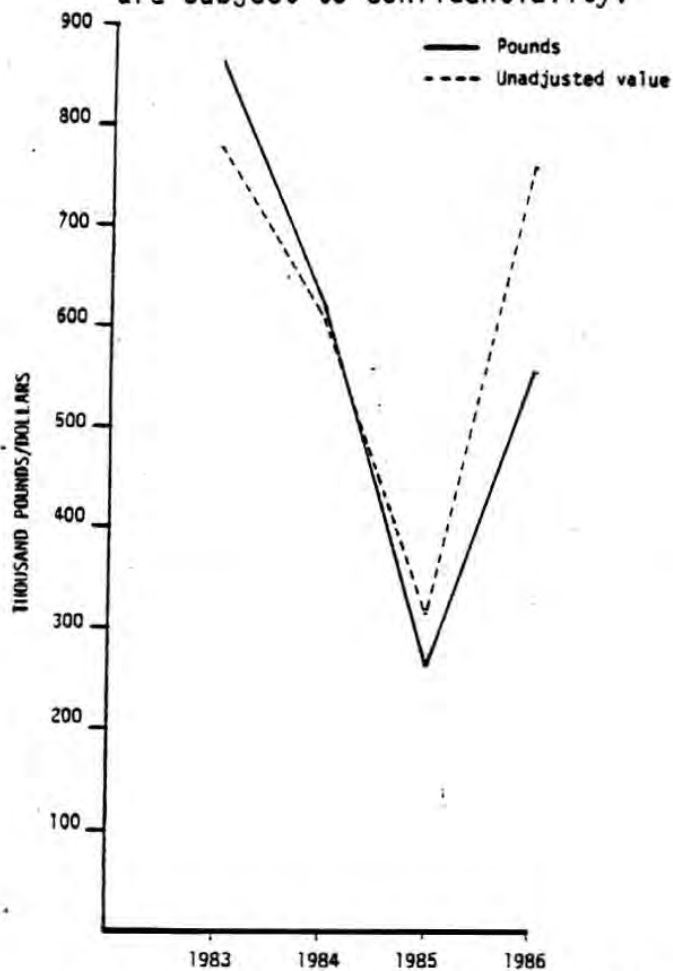


Fig. 35. Landed weight and value of offshore fish produced by the South Carolina bottom longline fishery. Data for other years are subject to confidentiality.

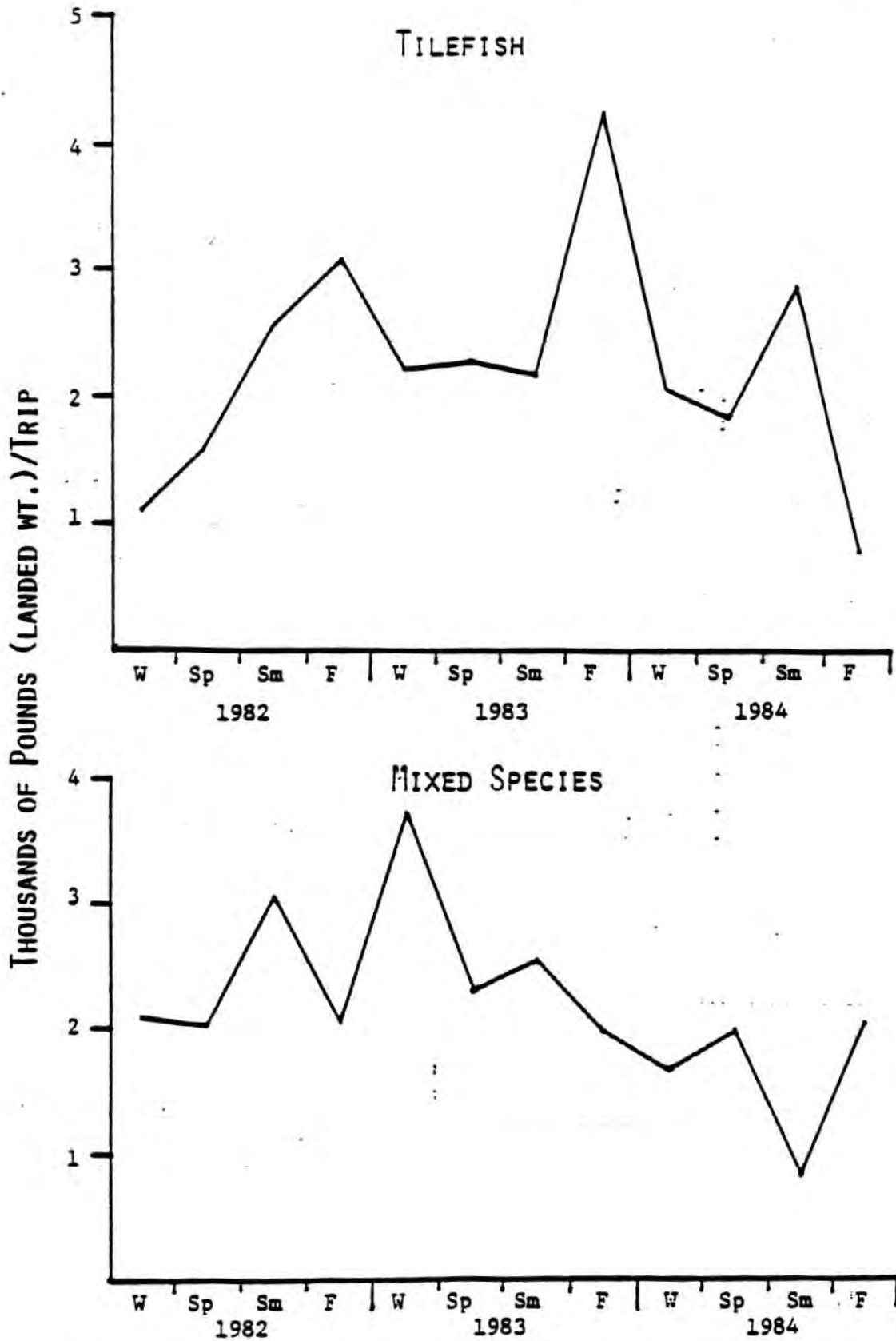


Fig. 36. Trends in seasonal catch rates by South Carolina bottom longline vessels.

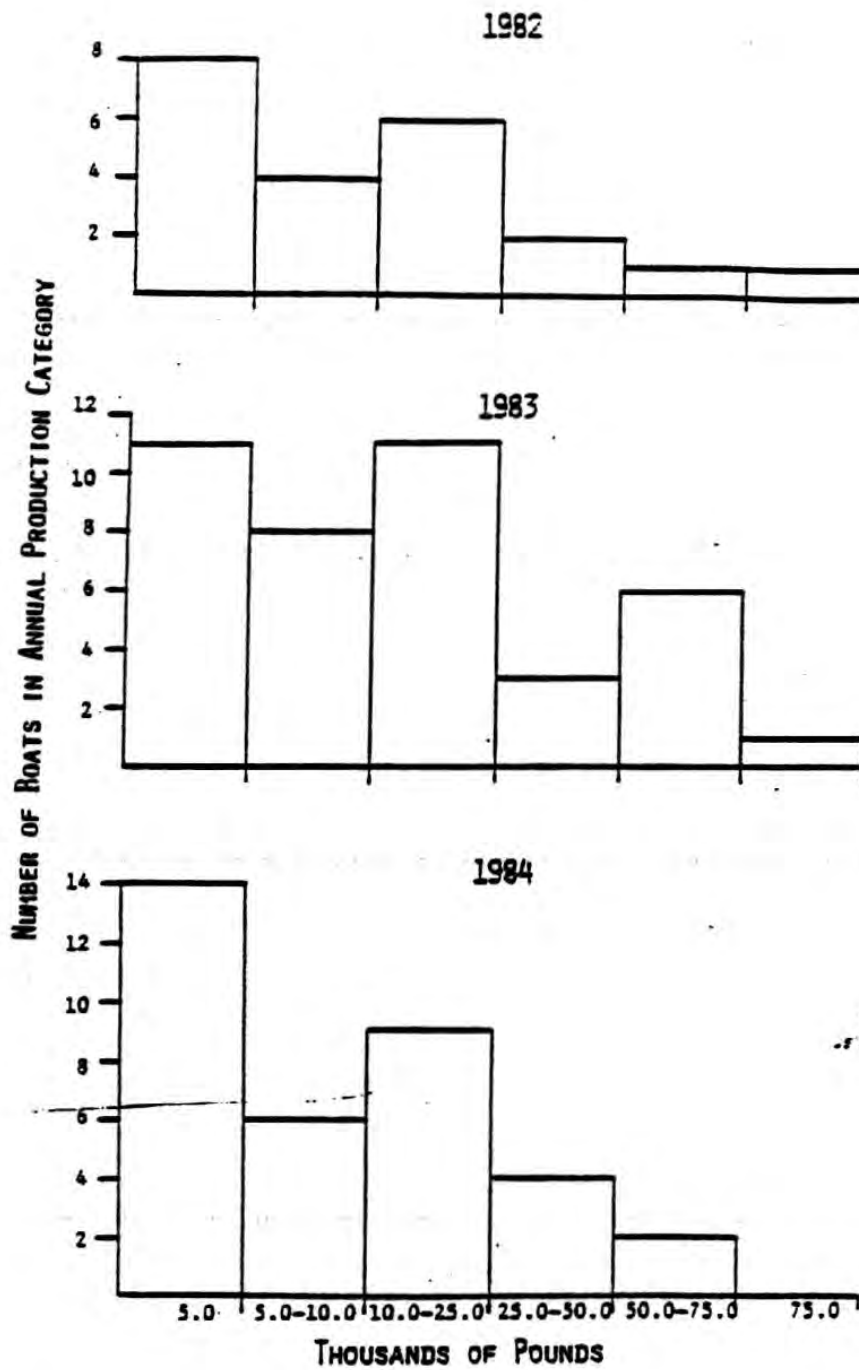


Fig. 37. Distribution of South Carolina bottom longline boats by annual production category.

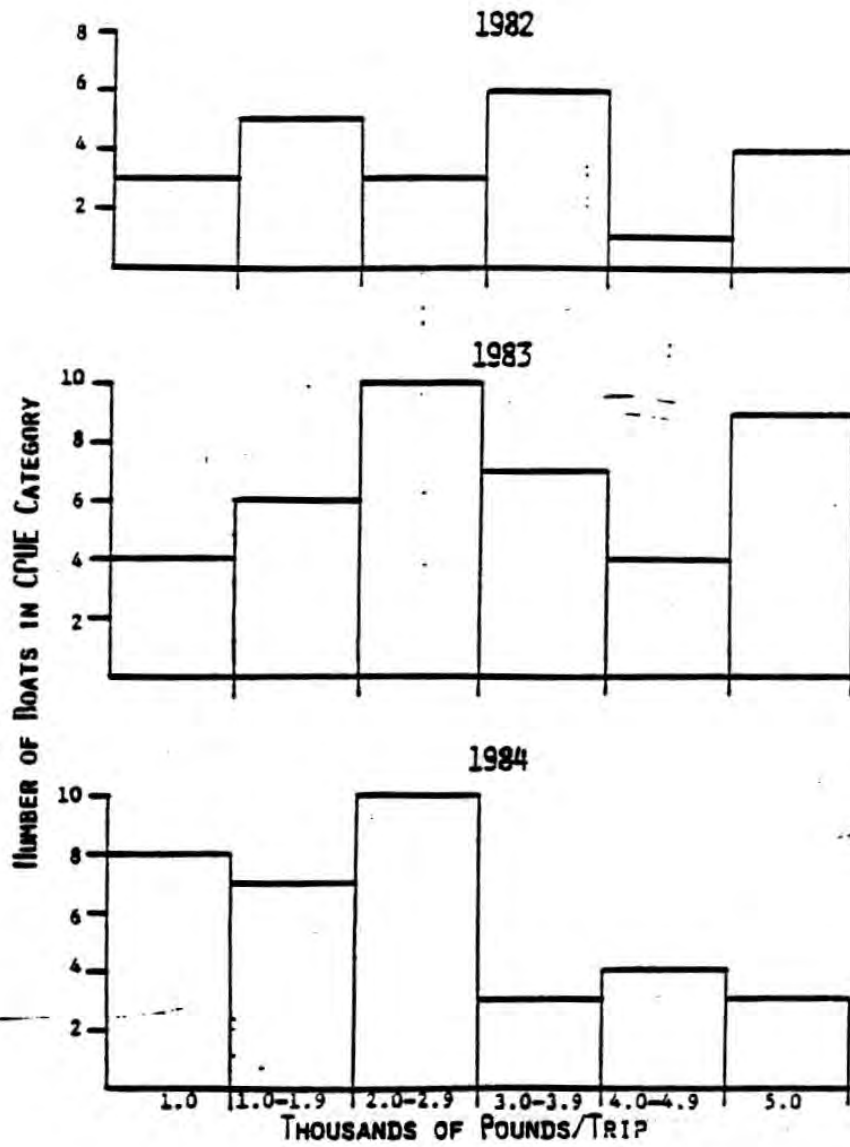


Fig. 38 . Distribution of South Carolina bottom longline boats by average catch rate (CPUE) category.

conditions in one fishery are answered by a move into another fishery that offers greater opportunities at the time. Any shift in the relative status of the two is simply countered by a realignment of fishing effort to the perceived optimal level in each fishery. This suggests that increased regulation of one fishery, e.g. that for swordfish, will result in increased effort in another (e.g. for bottomfish or tunas) by the displaced vessels. This in turn enhances the prospect of fishing mortality-related problems in these other fisheries.

Trap Fishery

The South Carolina marine trap fishery (for fish) is directed almost exclusively at black sea bass, although minor quantities of porgies are taken incidentally. Catches of other commercially important species have been negligible, even though fish traps have been used successfully for groupers and snappers in south Florida and throughout the Caribbean. Both the Marine Resources Division and local fishermen have experimented extensively with various kinds of traps. Most designs are effective for black sea bass, but no type has proven to be consistently productive for other species. Most local fishermen use wire traps that are virtually identical to those employed by crabbers.

In most years, about 90% of the commercial catch of black sea bass has been taken by trap fishermen. The fishery is highly seasonal, with catch rates and production peaking during January-March. April and May are also usually good months, when the fish are congregated for spawning. Although prices often reach their annual peak in fall, there is very little fishing then. A variety of boats are employed in this fishery on a part-time basis. Charterboats and small shrimp boats utilize the trap fishery as a seasonal opportunity during their off season. Many crabbers with larger boats fish with the same gear that they use for crab in warmer weather.

Historically, trap fishery production (Fig. 39) and participation (Fig. 40) have fluctuated greatly in a somewhat cyclical pattern. Peaks in production have occurred after a build-up in the percentage of large fish available. Effort and landings have characteristically plunged afterward, then the fishery has gradually rebuilt over several more years. The last peaks in effort and production occurred in 1981-1982. As many as 65 boats fished in 1981, although many made only a few trips, and most boats had relatively high average trip catches. The relationship between total catch and total effort during the reporting period has been fairly proportional. These characteristics suggest that most fishermen have devoted serious effort to the trap fishery only in years when large fish have been abundant and fishing success has been consistently good. This is typical of a

seasonal, opportunistic fishery.

During the years of peak production, a substantial portion of the state's harvest was landed in the Beaufort area, most of it through one dealer. This operation ceased in 1982 and landings in the southern district since then have been negligible. Normally, most of the sea bass trap catch has been landed in the northern district (at Little River, Georgetown, and Murrells Inlet), where there have been about 16 trap boats in recent years.

During 1982-1984, average trip production (Fig. 41) declined sharply. Trap landings were depressed during 1983-1985, when small sea bass dominated the catch (see below). The contribution of smalls in 1986 exceeded 50% for the only time in the ten-year period. Most of the increase in overall production resulted from a doubling of the catch of small sea bass. Increases in the other categories (58% for mediums, 71% for larges) were more modest.

Year	% Small	% Medium	% Large
1977	20	30	42
1978	27	35	38
1979	33	27	40
1980	37	26	37
1981	43	28	29
1982	42	28	30
1983	41	28	31
1984	46	30	24
1985	47	31	22
1986	53	27	20

Although production appears to be moving into another cyclical upswing, both the gradual increase in percentage contribution and the prevailing high level of small sea bass in recent years are disturbing, from the perspective of optimal economic utilization. The commercial fishery would benefit from a substantial transfer of these small fish into the large size grades.

Handline Fishery

Prior to 1976, most of the commercial fishing offshore (except for sea bass) was conducted by handline boats from northeast Florida. These boats ranged along the coast between St. Augustine and Cape Lookout, with the area around Cape Fear (Frying Pan Shoal) being popular because of the concentration of snappers there. South Carolina lacked dealers with marketing experience with offshore fish and the Florida boats offloaded in Florida ports or in North Carolina.

In 1976, a Charleston company began purchasing offshore fish at competitive ex-vessel prices and several Florida boats relocated to Mt. Pleasant. High catch rates and favorable prices attracted additional boats and offshore fish landings increased substantially. Other wholesalers in Edisto, McClellanville, Georgetown, and Murrells Inlet

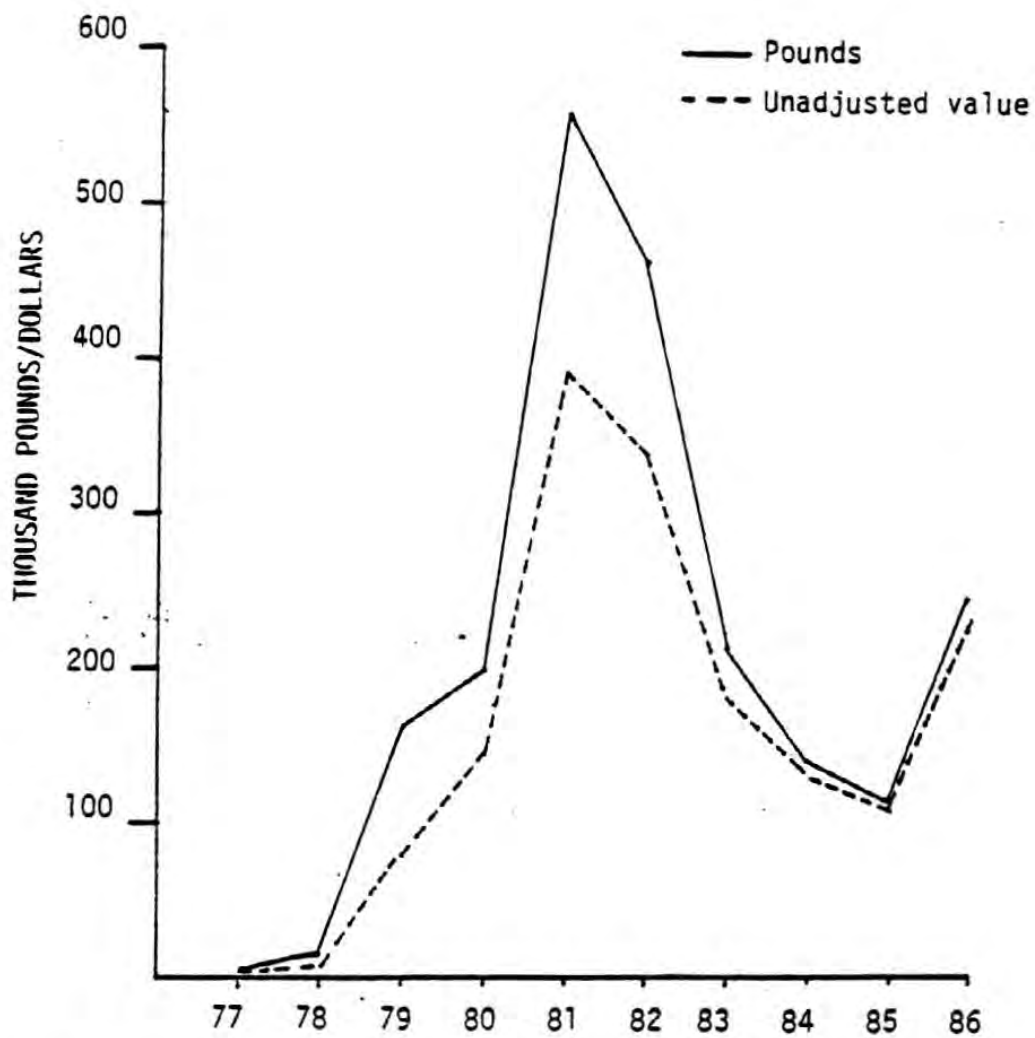


Fig. 39. Landed weight and value of fish produced by the South Carolina marine trap fishery.

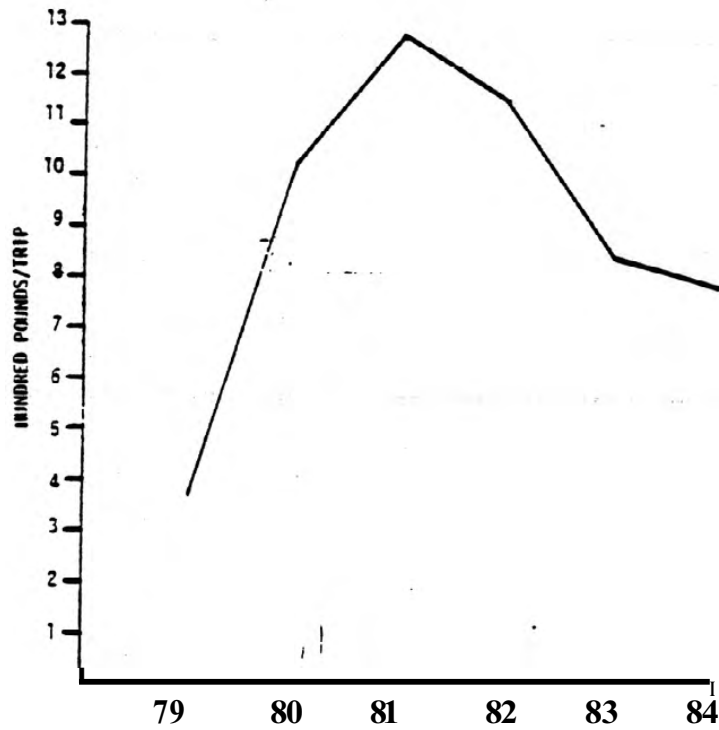
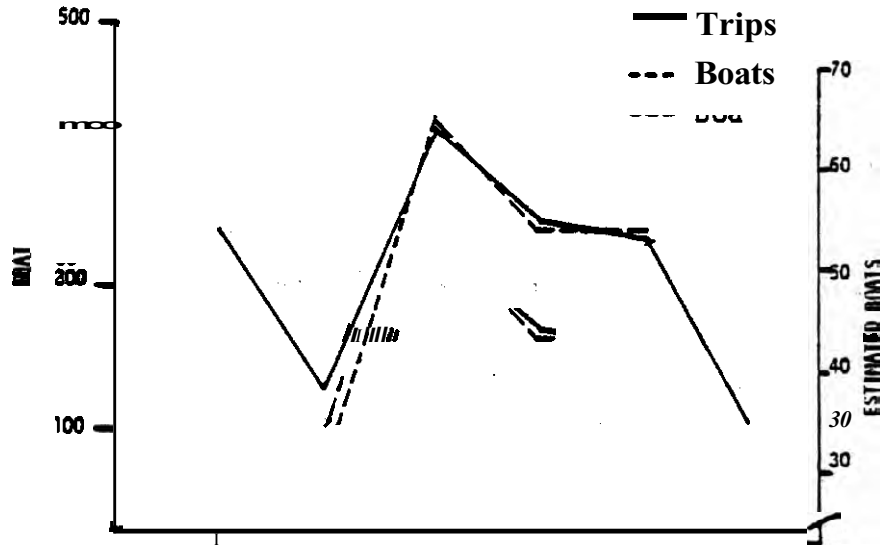


Fig. 41. Average catch per trip by South Carolina black sea bass trap boats.

began handling offshore fish, both from local trawlers entering the fishery and relocated Florida handliners.

In the late 1970's total landings of offshore fish increased substantially during each year. Handline boat production (Fig. 42) contributed most of the catch, as effort in this sector expanded (Fig. 43). Initially, mid-depth groupers (gag and scamp) comprised the largest category, although both the total handline landings and relative contribution of red porgies increased substantially. In 1977, interest in deep-water species, particularly snowy groupers, increased and deep-water species represented the largest category in the 1978 landings (Fig. 44). The catch rates of deep-water groupers declined drastically in the second half of 1978, however, and have remained at a low level thereafter. During 1976-1979, landings and catch rates of snappers steadily declined. Silk snappers, a major contributor to the overall snapper catch in the mid-1970's, virtually disappeared from the fishery. In 1979, red porgies, gag, and scamp accounted for about 65% of the total handline catch, with red porgies the most important single species.

During 1980-1982, deep-water species regained a significant percentage the total handline catch, due to the newly developed fishery for golden tilefish. The catch rate of porgies peaked in 1980 and then declined. Production of red snappers remained at a very low level, while catch rates and landings of vermilion snappers increased substantially. The contribution of pelagic species, primarily king mackerel, gradually increased. Landings of deep-water groupers remained very depressed, but those of mid-depth species were the largest component of the handline catch, in spite of a gradual decline in average trip production. There appeared to be a sharp drop in effort in 1980. In 1981, effort increased greatly and the total number of trips peaked in 1982. The handline catch of all species combined also peaked in 1982 at about 1.6 million pounds.

During 1983-1984, effort and total landings declined moderately. Mid-depth groupers remained the most stable component of the landings, as well as the most important. The relative percentage contributions of gag and scamp, red porgies, and vermilion snappers remained constant in both years. Compared to the 1980-1982 interval, the contribution of vermilion snappers increased, while that of red snappers remained stable, but at a very low level. Catch rates of snappers also followed those trends. Landings of deep-water species in 1983-1984 were very much reduced, as bottom longliners displaced handline boats in the deep-water fishery. The relative importance of king mackerel to handliners continued to trend gradually upward. Overall trip production continued to decline at a modest rate (Fig. 45). Of 32 boats which

reported catches in both years, 21 reported a decrease in their average trip production in 1984, while four maintained about the same level. Relatively few boats pursued the handline fishery on a fulltime basis, based on the number of trips reported, although some landed catches in other states. Judging from reported individual boat production (Fig. 46), the handline fishery appeared to have become a secondary activity for most fishermen.

Overall handline production continued to decline during 1985 and 1986; the average annual rate of decrease in the last four years has been 15%. Landed value (unadjusted) has also declined, but at a much slower rate, due to the substantial rise (after inflation) in fish prices. The relative species composition of the annual landings has remained similar since 1983.

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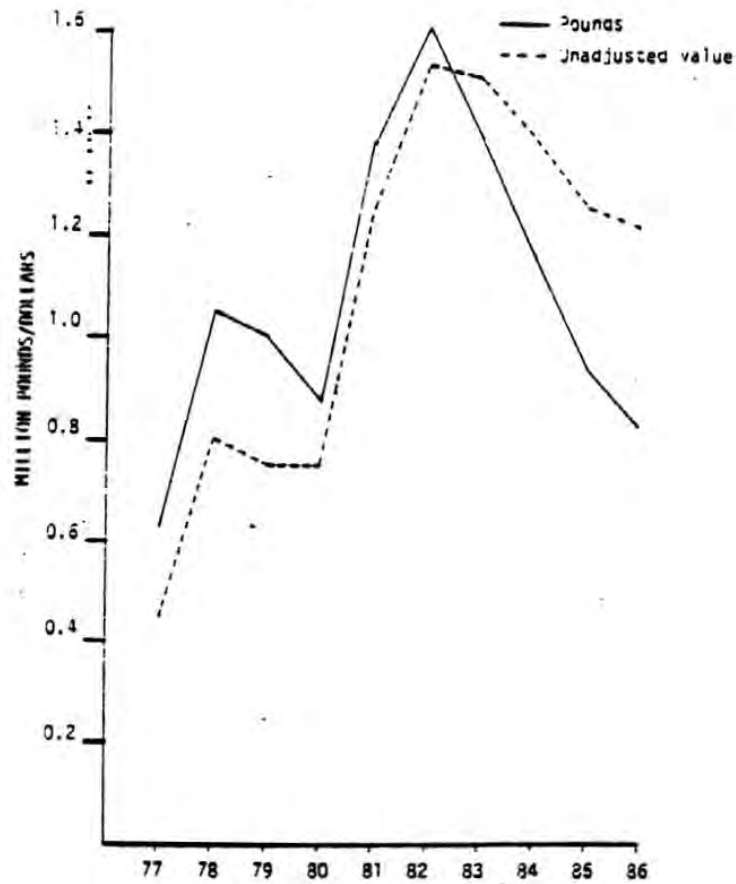


Fig. 42. Landed weight and value of fish produced by the South Carolina commercial handline fishery.

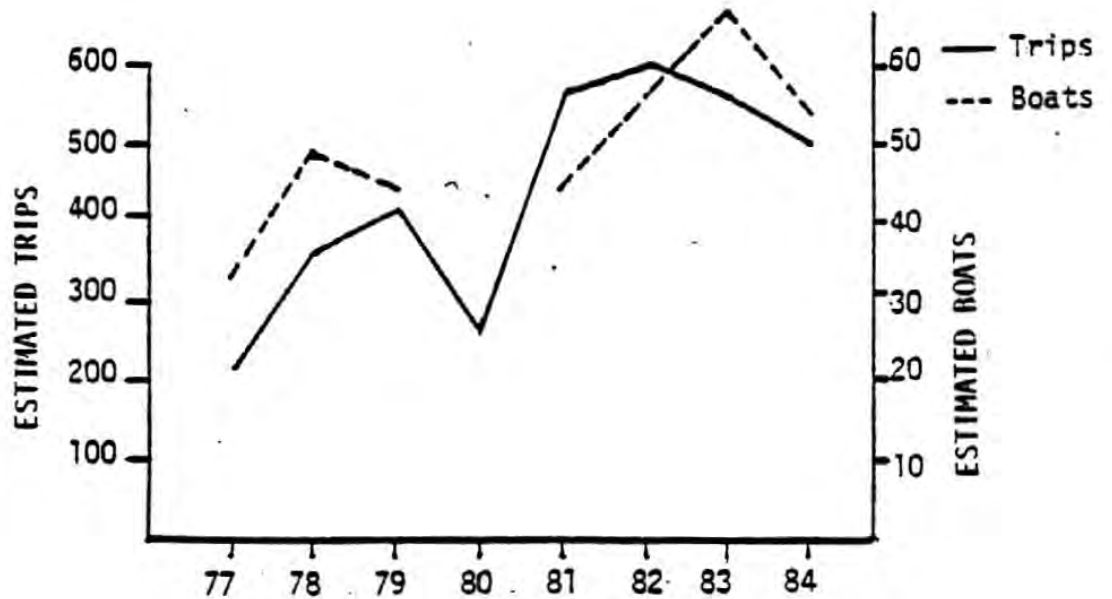


Fig. 43. Participation (number of boats) and effort (number of trips) in the South Carolina commercial handline fishery.

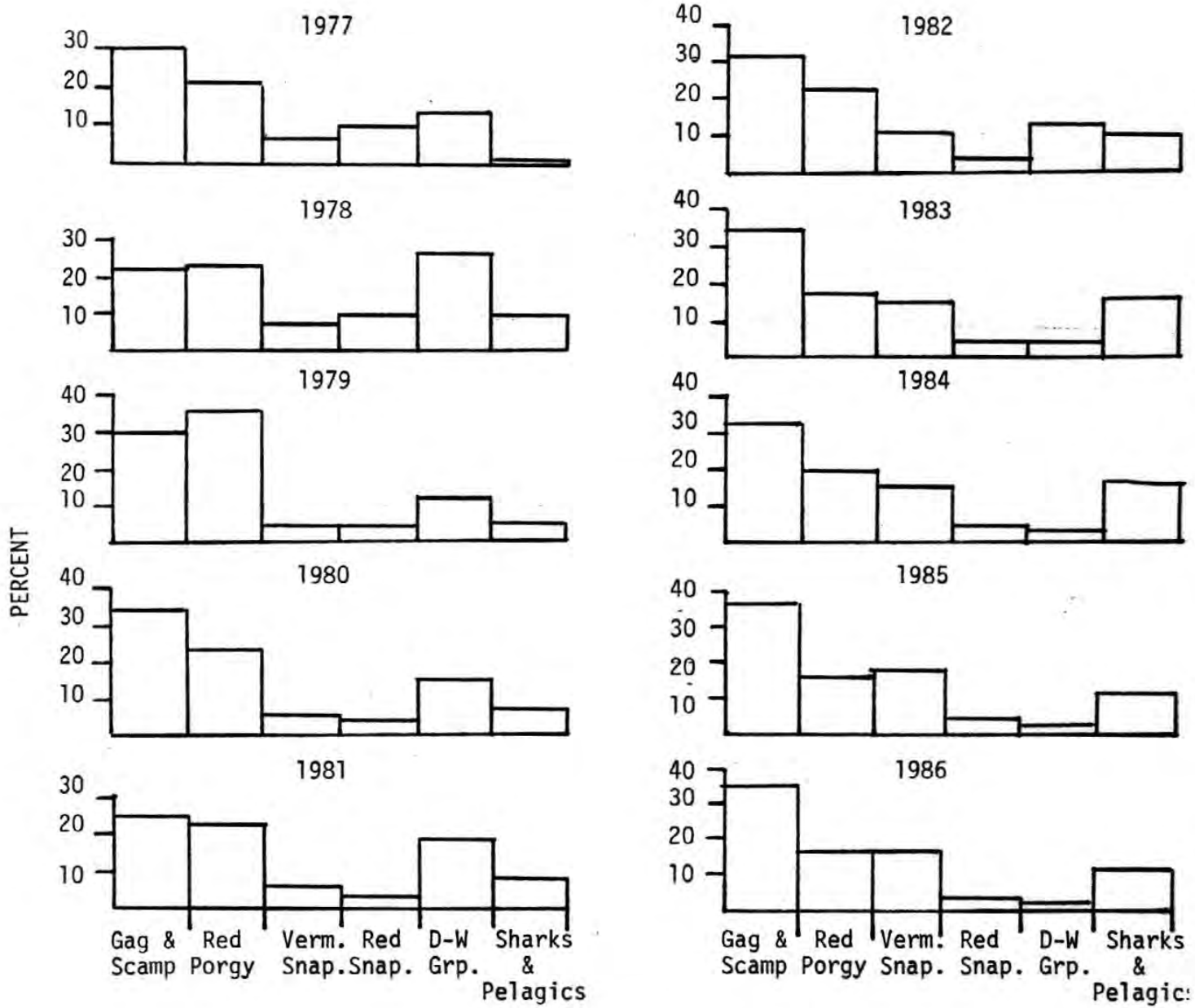


Fig. 44. Composition of landings in the South Carolina commercial handline fishery.

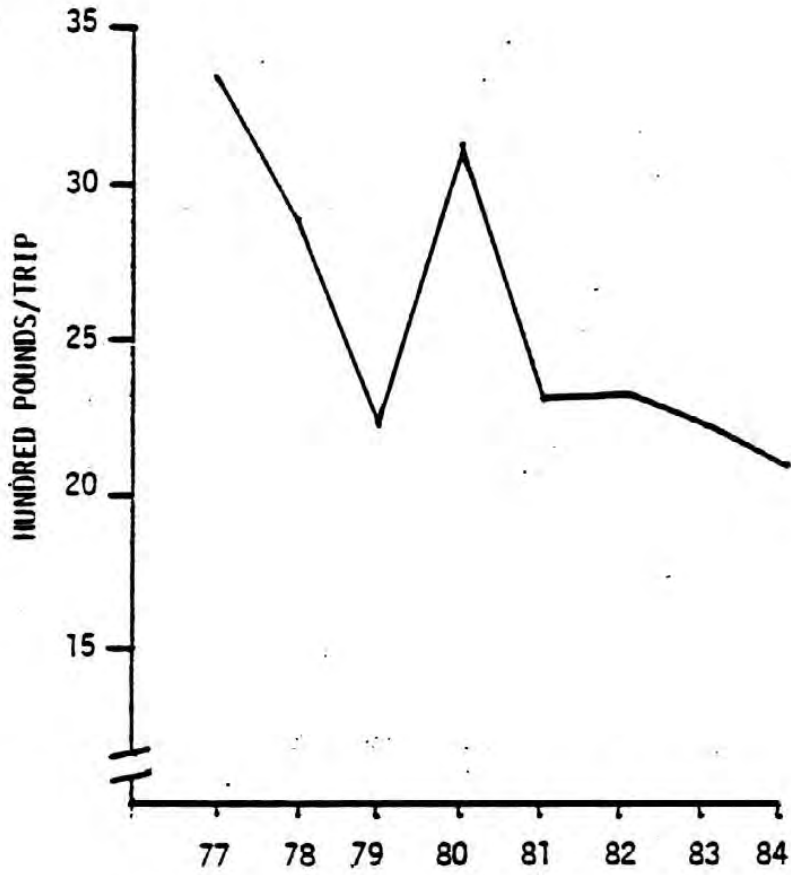


Fig. 45. Average trip production of South Carolina commercial handline boats.

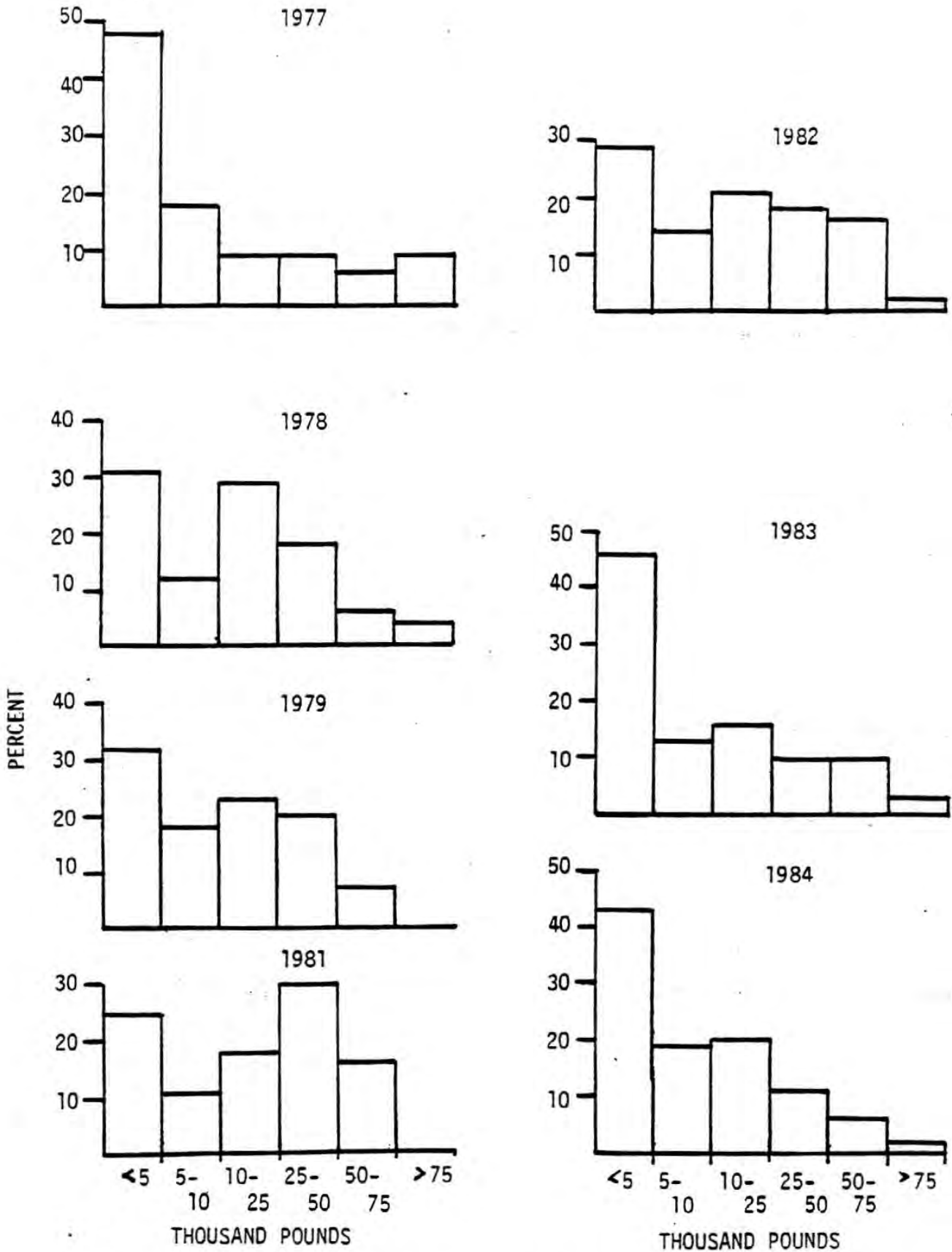


Fig. 46. Distribution of South Carolina commercial handline boats by annual production categories.

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COASTAL FISH

This category refers to species taken in state waters (out to 3 miles from the beach), except for anadromous (river) fish.

Coastal fish have traditionally comprised a minor part of South Carolina's total commercial seafood production, peaking at about 10% of the landed weight. Because of the low unit value of most species, the contribution to overall landed value has been even less important. Most of the catch is either taken during directed seasonal fisheries (e.g. the haul seine fishery) or as bycatch incidental to other fisheries (e.g. the shrimp fishery). Although coastal fish provide supplemental earnings for many fishermen, very few fishermen depend on them as a major source of their income.

Production (Fig. 47) has fluctuated considerably during the ten-year reporting period, with a slight downward trend. The adjusted landed value recently has been about the same as it was ten years ago, after recovering from depressed levels.

With the exception of 1979, the haul seine fishery has provided the bulk of the annual landings (Fig. 48). This fishery has been limited to five or six crews working long nets from the Grand Strand beachfront during the fall runs of mullet and spot. The fishery has usually lasted about two months, with success heavily dependent upon weather and movements of the fish. Annual production has been extremely variable, but has trended downward. Landings in recent years have averaged about half of the 1977 level.

This downward trend could be attributable to at least three factors, all of which are independent of the status of the resource. Shorefront development has reduced beachfront access. Traditional fishing areas have also been eliminated or restricted by regulations enacted in 1984 prohibiting nets within 500 yards of fishing piers. The level of production is controlled by demand and much of the catch has been sold to traditional buyers from instate or to local consumers. The principal species (mullet and spot) are most popular with low-income groups and the market for them tends to be easily glutted. Much of the total amount of fish consumed probably is imported from other states, e.g. North Carolina. Haul seine fishermen have stated that they could produce substantially more fish if the demand for locally produced fish was present.

The other major producer of coastal fish has been the shrimp trawl fleet. Although large quantities of fish are caught, more than 90% (by weight) are unmarketable due to small size or lack of species acceptability. Flounders and kingfishes (whitings) have been the principal marketable components, although spot and small sharks occasionally have contributed substantially. Most of the trawl production is landed during summer and early fall and is consumed locally. As with the fish caught by haul seiners, unit value is generally low.

The remaining production has been largely

accounted for by gillnets (including stop nets), with fall being the peak season. Although a variety of species are caught, mullet and spot have accounted for most of the landed catch. The total contribution from gillnetters has typically been very small relative to that from haul seiners and shrimpers. The major exception was in 1979, when large spots were abundant and represented about 86% of the total gillnet harvest. In 1986, production from gillnets, stop nets, and related gears surpassed that from shrimp trawlers for the first time since 1979. In recent years, gillnetters have been landing greater quantities of sharks to satisfy growing local demand. Gillnet-caught fish also are typically low in unit value.

Mullet

Mullet have dominated coastal fish landings in every year except 1979 and 1986 (Fig. 49). Production (Fig. 50) has been extremely variable, being dependent on demand, the migratory movements of the fish, and the abundance of roe (female) mullet. In some years, most of the southward-moving roe fish have remained offshore and unavailable to the beach netters; 1985 was one such year.

Production peaked in 1980. A purse seine boat from Florida was issued a special permit for a limited experimental fishery around Murrells Inlet. In a few weeks, this boat produced 33% of the year's mullet catch. Catch rates were high and, if roe fish had been available in normal quantities, the fishery would have been economically successful. Unfortunately, most of the fish were small and of low value. This trial effort did demonstrate the feasibility of harvesting commercial quantities with this gear in South Carolina.

Since 1979, haul seine catches of mullet have fluctuated in the 300,000-500,000 pound range. Landings in 1985 were the lowest since 1979 and only about 55% of the ten-year average.

Spot

This species has ranked second to mullet in importance in most years. Demand, in part influenced by the size of the fish, purportedly has been a major influence on production. Catches by haul seiners have generally been depressed since 1980, although the 1986 landings were the largest of the ten-year period.

Overall landings of spot during the reporting period have been extremely variable (Fig. 51), with peaks occurring in 1978-1980 and 1986. In 1979, when large spots were available, this species represented over 60% of the total catch of coastal fish. Landings in recent years had been relatively low, but the 1986 catch was by far the largest in the reporting period, due to the haul seine contribution. Spots represented 56% of the total coastal fish landings in 1986.

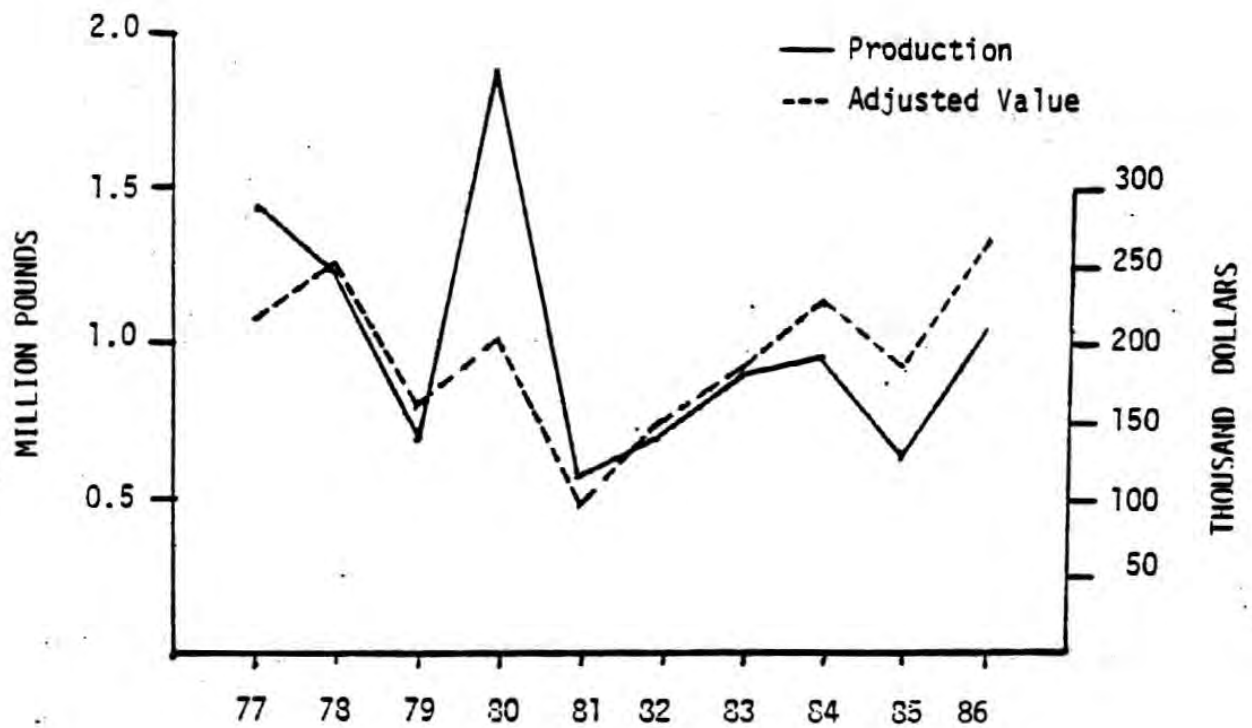


Fig. 47. Landings of coastal fish by South Carolina commercial fishermen.

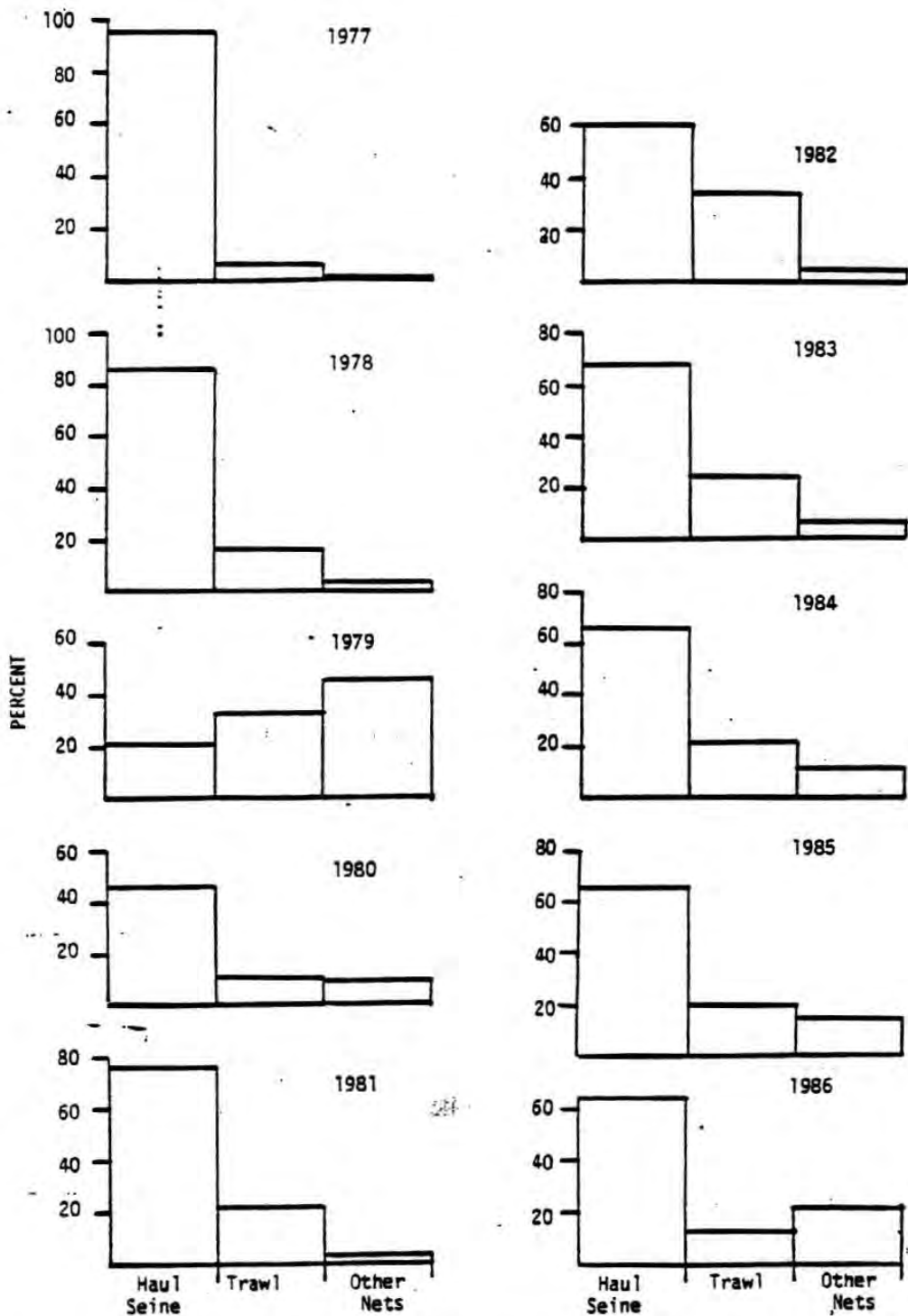


Fig. 48. Contribution of various gear types to landings of coastal fish by South Carolina commercial fishermen.

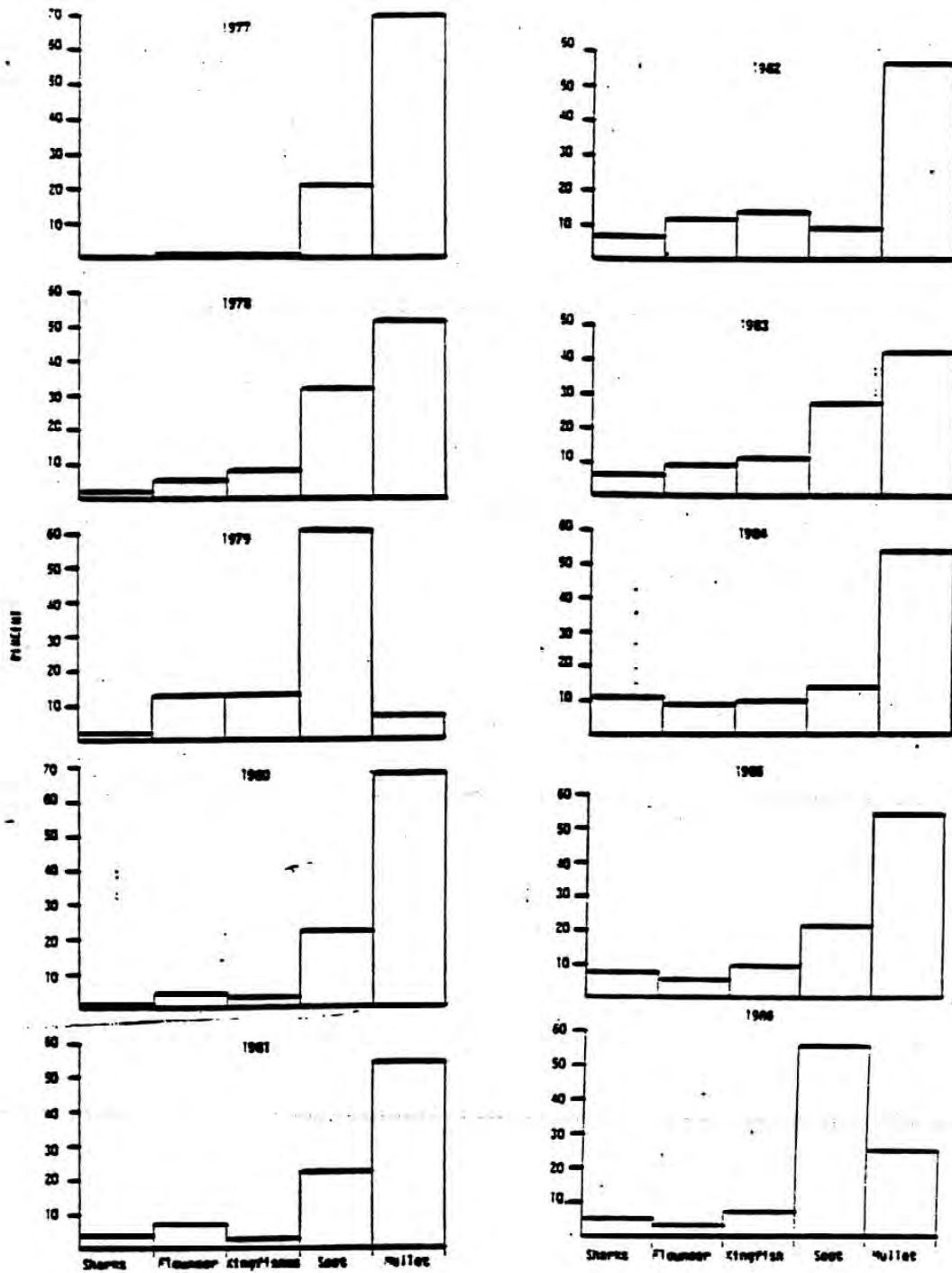


Fig. 49. Composition of landings of coastal fish by South Carolina commercial fishermen.

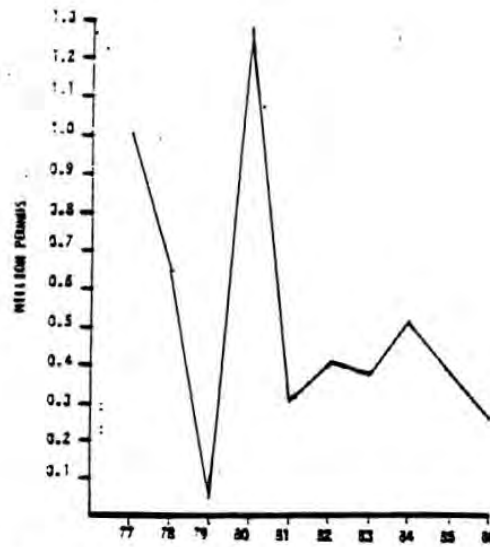


Fig. 50. Landed weight of mullet produced by South Carolina commercial fishermen.



Fig. 51. Landed weight of spot produced by South Carolina commercial fishermen.

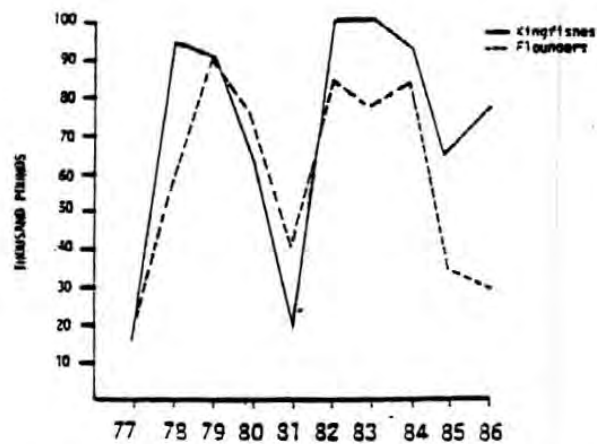


Fig. 52. Landed weight of kingfishes and flounders produced by South Carolina commercial fishermen.

Other Species

Sharks have been landed in appreciably greater quantities in recent years, primarily by gillnetters. In 1984, they contributed almost 11% of the total coastal fish landings. The most likely contributing factor has been increased consumer awareness of the competitive quality and price.

Landings of flounders and kingfishes, mostly by shrimp trawlers, have shown highly variable, but similar trends (Fig. 52). The most significant departure in this similarity of production trends occurred during 1985-1986. Landings of both groups declined sharply in 1985, although the drop was much more pronounced for flounders. In 1986, landings of kingfishes increased somewhat, while those of flounders declined to the lowest level since 1977.

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RIVER FISH

This category includes anadromous species. (American shad, blueback herring and sturgeon), eels, and catfishes.

During the reporting period, landings of river fish (Fig. 53) have fluctuated widely, with no pronounced directional trend. Adjusted value has followed a similar pattern. In 1977, catfishes dominated the annual landings, with blueback herring being the other major category and these species combined represented about 75% of the annual catch by weight (Fig. 54). Since then, both the relative contribution and landed weight of catfishes have steadily declined. Catches of blue back herring have remained large and have represented the major component in recent years. Although landings of shad (Fig. 55) have fluctuated widely from year to year, the overall trend has been sharply upward. Shad have been the second most important component in landed weight in recent years and combined catches of this species and herring have represented more than 90% of the total annual harvest since 1983. Prior to 1982, sturgeon consistently represented about 10% of the annual landings by weight, but their value contribution was

considerably greater due to caviar production. During 1982-1985, the importance of this species was negligible.

Catfishes

Landings, which are not shown because of confidentiality requirements, have steadily declined, with virtually no effort or production since 1984. The increasingly unfavorable economic climate caused by competition from farm production has probably been responsible. Although consumer acceptance and demand have increased dramatically during the last ten years, aquaculture output (mostly from Mississippi) has also increased tremendously. Improved technology contributed to lower cost of unit production of farm-raised fish, while expenses associated with the harvest of wild fish steadily increased.

Species composition of the wild stocks that previously supported the commercial fishery in Lakes Marion and Moultrie, as well as many rivers, has changed drastically during the last ten years. Introduced species, notably blue and flathead catfish, have largely displaced channel and white catfish.

Blueback Herring

Annual landings in recent years have been subject to confidentiality and are therefore not shown. Landings have been highly variable, but have generally been greater in recent years. Unlike catches in North Carolina, local production has not been processed for human consumption. The value has therefore been very low. The fishery is highly seasonal, being dependent on the inland migration in late winter and early spring. Division biologists believe that substantial quantities of herring are caught in the rivers with gillnets, sold and consumed locally, but are not reported.

Shad

The shad fishery is also seasonal, being open during February-April in most inland areas during most years. Upper portions of the rivers have remained open for a few additional weeks after the lower areas have been closed, in order to allow upper river fishermen to harvest shad without competition from fishermen in the other areas.

Shad have been fished commercially with drift and set or anchored gill-nets. Vulnerability of the fish to each type differs depending on environmental conditions. Catch rates of different gear types have generally followed similar trends. The upward trend in catch rates by drift net fishermen (Fig. 56) in the lower Waccamaw, Pee Dee, and Edisto Rivers probably is the most reflective of the relative status of the stocks. Most of the upper river production is landed by independent fishermen who sell directly to local consumers and probably goes unreported.

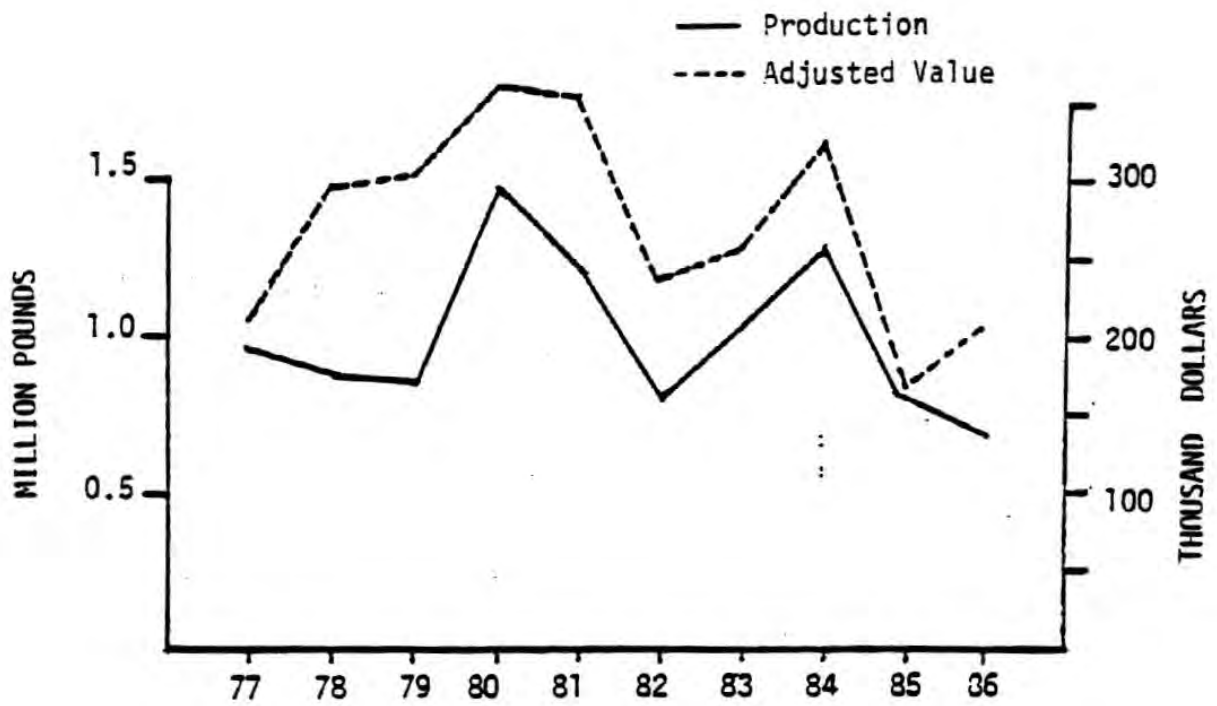


Fig. 53. Landings of river fish by South Carolina commercial fishermen.

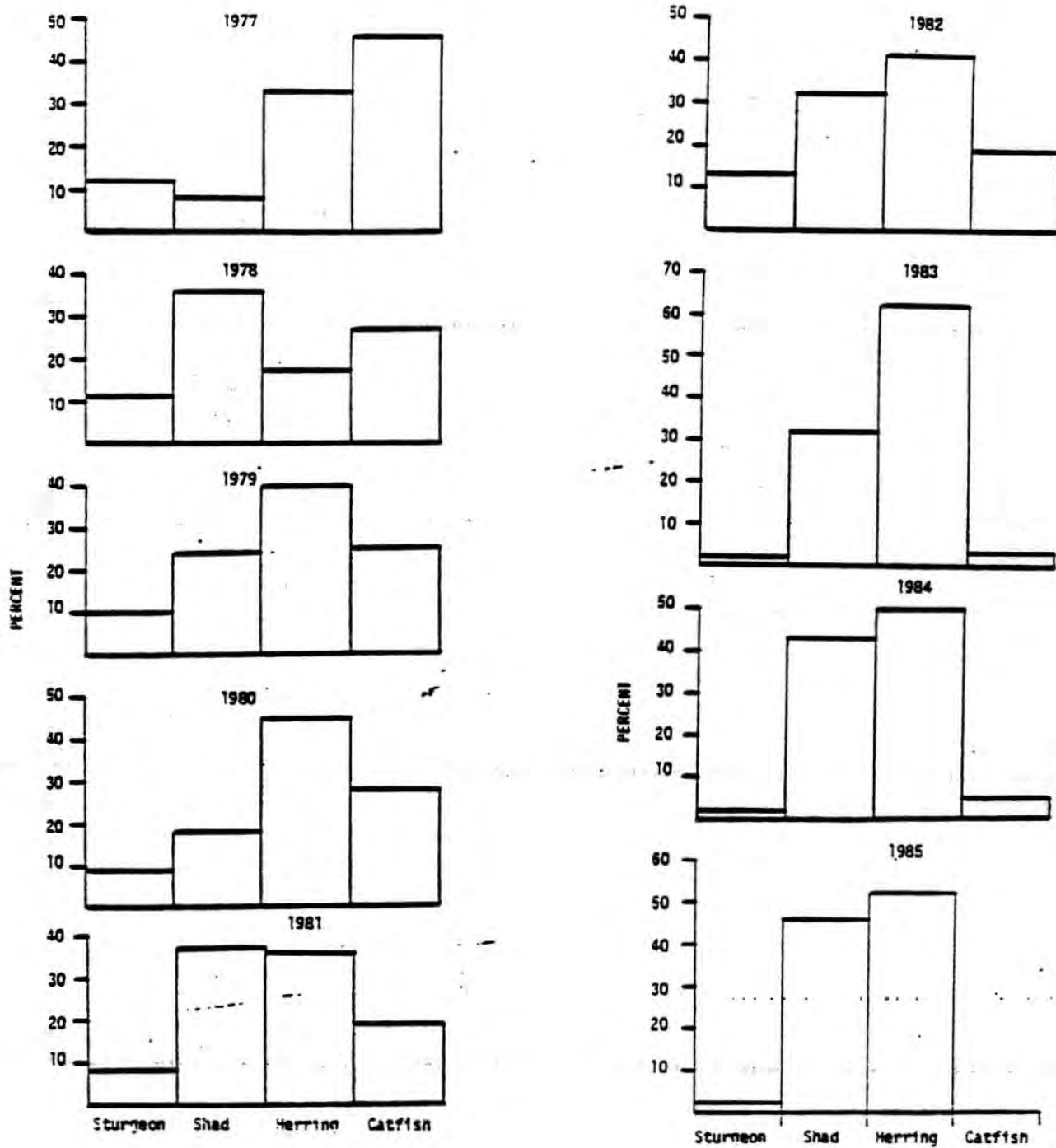


Fig. 54. Composition of landings of river fish by South Carolina commercial fishermen. The 1986 landings are not shown because of confidentiality requirements.

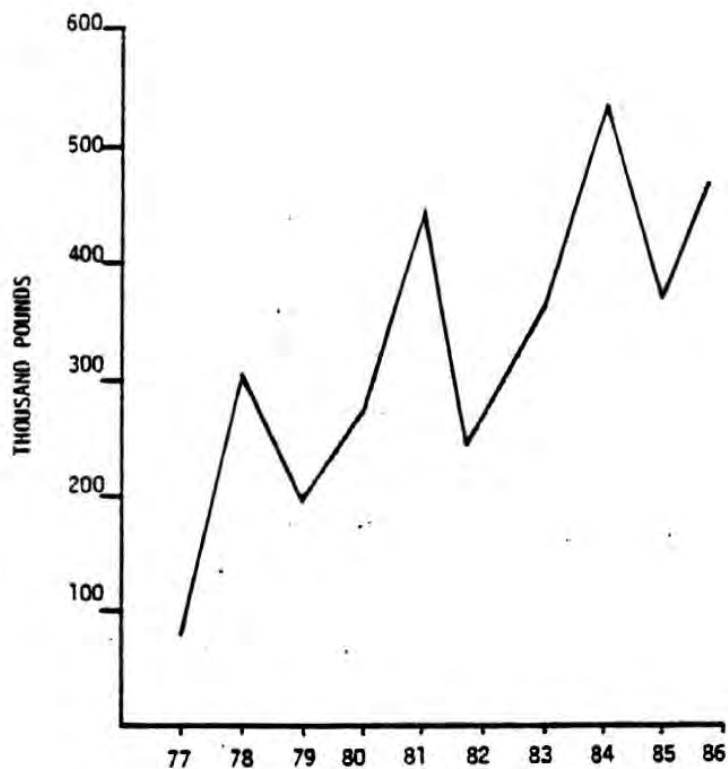


Fig. 55. Landed weight of American shad produced by South Carolina commercial fishermen.

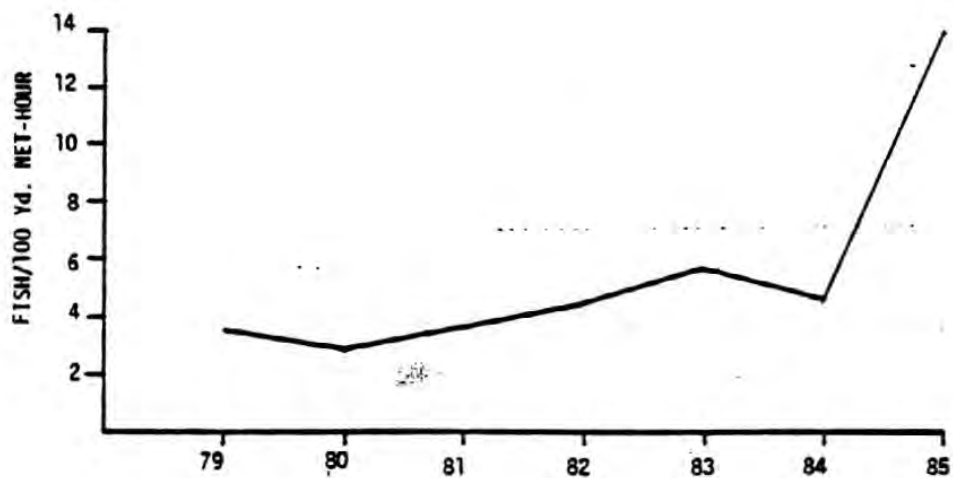


Fig. 56. Trend in average catch rate of drift-net commercial fishermen in selected South Carolina rivers.
(Source: Commercial Finfish Management Section)

Regulations appear to have had relatively little influence on overall landings, although the shad fishery has been among the most intensively managed ones in state waters. Much of the early season production in recent years has been produced by ocean fishermen off the northern part of the state. Initially, anchored nets were allowed and contributed most of the ocean production. These nets often were left unattended for days due to bad weather or market conditions, with a resultant loss of fish. Bycatch of seabirds has also been a concern. In 1984, state law limited the ocean fishery to attended drift nets. Although this caused some ocean fishermen to modify their methods, it apparently had no adverse impact on ocean landings. In 1985, about 36% of the reported shad landings came from the ocean.

Market factors appear to have had considerable impact on annual landings. The South Carolina ocean fishery is one of the first sources of supply each year and relative demand in the northern markets probably has been a major control of the amount of effort. River landings early in the season also have gone primarily out-of-state, with effort again being influenced by demand. As production from the northern states has come on the line, demand for southern fish typically has dropped off sharply. Most of the South Carolina production later in the season has been directed to limited local markets, which have been easily saturated in years of high production rates. Unit value typically has declined as the season progressed, often reaching a very low level by season's end.

Sturgeon

During 1975-1982, South Carolina produced over 50% of the sturgeon taken commercially along the Atlantic coast. Annual production in that interim fluctuated moderately around the 100,000 pound level, although the relative value of the catch was considerably more important because of the high price of caviar. The directed fishery was selective for large, spawning females for this purpose and the average age of the fish caught was 15 years.

After 1982, sturgeon landings (Fig. 57) dropped abruptly to a very low level and remained there. Landings in neighboring states also dropped sharply in the period. In South Carolina, this drop coincided with a continued increase in the amount of effort, thus the average catch rate also declined drastically.

These factors indicated that the stock was being severely overfished. In addition to the directed fishery for female spawning stock, the bycatch of immature fish in shad nets contributed to the biological problem. The sturgeon season closed in May 1985 and has been under a complete moratorium since

then, with little likelihood of reopening soon. Resumption of commercial fishing will be dictated by the status of the stock, which must recover significantly in order to permit an economically viable fishery. Hatchery production of juvenile Atlantic sturgeon has been largely unsuccessful, due to difficulties associated with the capture and handling of brood stock. High mortalities of these large spawners have been a major impediment to the development of practical hatchery techniques. Rearing programs for shortnose sturgeon have been much more successful, because of a dependable supply of brood fish. Scientists have projected that recovery of the Atlantic sturgeon population will take many years, because of the delayed maturity of the female brood stock and the age structure of the population.

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RECREATIONAL FISHERIES

This section is brief because of the lack of data available on marine recreational fishing activities. Unless otherwise indicated, all figures are based on published results of the annual National Marine Fisheries Service (NMFS) surveys.

In South Carolina, approximately 2,876 miles of tidal shoreline and 500,000 acres of tidal bottom were available for recreational use as of the early 1970's. Marine recreational fishing activities historically have been widely diversified, including rod-and-reel angling, gigging (graining or spearing), gillnetting, crabbing, shrimping, and shellfish gathering. Such activities have also been geographically dispersed along the entire coast, in tidal creeks and rivers, on the front beaches, in the sounds and coastal waters, and in offshore waters out to and including the Gulf Stream. Opportunities for access have included the natural shoreline, man-made structures such as bridges and piers, public boat launching sites, private marinas, headboats, and charterboats. Utilization of some part of the resource has occurred during every season.

Marine recreational fishing has been of major social and economic importance in

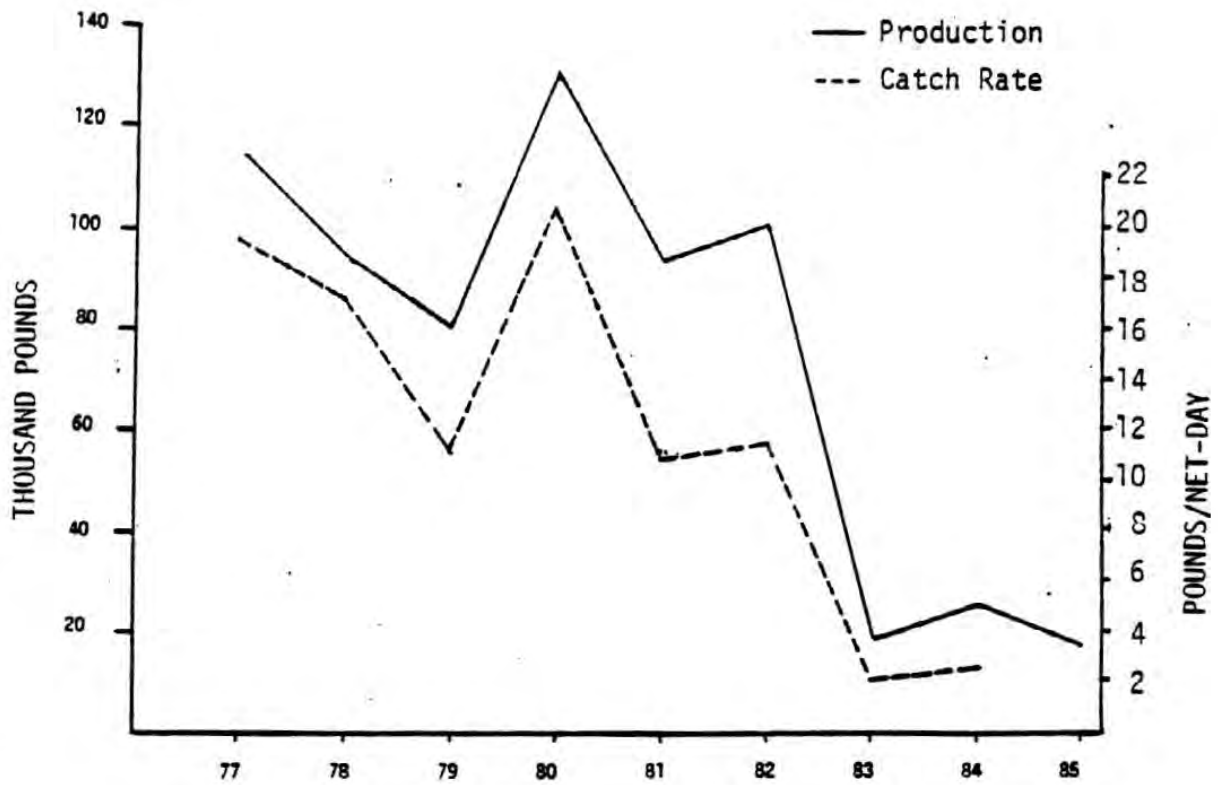


Fig. 57. Landed weight and average catch rates of sturgeon by South Carolina commercial fishermen.

(Source: CPUE data, T.I.J. Smith, SCWMRD)

coastal South Carolina. During 1979-1986, nearly 8% of all coastal residents (those within 50 miles of the coast) contacted in the NMFS telephone survey had gone saltwater fishing within the previous two months. Estimated annual participation during 1979-1986 (1984 data excluded) included an average of 201,000 resident and 262,000 out-of-state anglers (Fig. 58). The average combined effort of these groups during the period was about 1.41 million trips each year (Fig. 59). As of 1980, a national survey estimated total (direct and indirect) expenditures on marine recreational fishing in South Carolina at about \$40.3 million. Division personnel estimate total expenditures during 1983 at \$187 million. This information refers primarily to rod-and-reel fishermen.

The 1984 results (from the NMFS survey) appear to be anomalously high. When these figures are omitted, participation by coastal residents has averaged about 60% of the total in-state participation and accounted for 75% of the total in-state effort. Participation by coastal residents appears to have increased at an average rate of 7-10% per year during 1979-1985, while total participation appears to have increased by about 3-4% per year. Total effort has grown at an average annual rate of slightly less than 10%.

Catch estimates have been on estimated effort and catch rates reported from periodic sampling of anglers' catches. Such estimates are subject to significant error, depending on such factors as the number of anglers interviewed (and catches inspected), the average size of catches, and the frequency with which they are observed. When particular species are of interest, their correct identification is essential. Misidentification can cause gross errors in the estimated catches of similar species. These factors must be kept in mind when considering the results of the NMFS annual surveys. The estimate of total catch are probably the most accurate. Although there have been wide annual fluctuations, the overall catch of fish by marine recreational anglers has trended upward during the reporting period (Fig. 60).

Private Boat Fishery

A division study at the beginning of the reporting period indicated that private boat fishermen represented the largest component of the state's marine angling population. A 1985 Division survey, which was directed at coastal resident fishermen, found that 83% of the respondents preferred the private boat mode. Inshore fishing was most popular (56% of all respondents), while 27% of the respondents preferred ocean fishing.

There have been no surveys that estimated the total participation or effort by inshore private boat fishermen. A 1977 study of offshore fishing found that residents of

Charleston, Beaufort, Horry, and Georgetown Counties accounted for about 30% of the state's private boat offshore fishermen. In 1977, resident private boat anglers expended an estimated 127,099 days of offshore fishing effort. The estimated total direct economic impact of this activity was about \$17.3 million. About 26% of this effort was directed at the artificial reefs. Most private boat offshore fishermen were professional people, self-employed, managers, or supervisors, with relatively high family income levels. The species most often caught by them were king mackerel and black sea bass. A 1985 Division creel census found that sharks had also become popular with ocean fishermen.

The 1985 surveys found that red drum, spotted seatrout, and flounders were the species most preferred by inshore private anglers, although spot and croakers were also commonly caught.

Charterboat Fishery

In 1977, a Division survey estimated that 2,212 offshore fishing trips were made by charterboats, with about 14% of these directed at the artificial reefs. The total direct economic impact of offshore charterboat fishing was estimated at \$1.47 million. About two-thirds of the passengers were professional and managerial people, with high family incomes. Slightly over 50% were state residents. King mackerel and dolphin were the species most frequently caught.

Headboat Fishery

NMFS has conducted an annual survey of regional headboat fishing since 1972. Headboats in the Carolinas fish primarily for bottomfish, with minor landings of pelagic species such as king mackerel. Inshore headboats generally fish within 20 miles of port and target primarily black sea bass. Offshore or "Gulf Stream" boats usually fish from 30 to 70 miles out and seek porgies, snappers, and groupers. Numerous species contribute to the landings of both groups.

Landings and effort, as estimated by the Beaufort, North Carolina Laboratory of NMFS, are shown in Fig. 61. Except in 1978, black sea bass have dominated the landings. This species typically represents about three-quarters of the inshore catch by weight, although it is a minor component of the off-shore catch. Since 1980, landings of black sea bass have gradually, but steadily, declined. CPUE of this species by inshore anglers during 1984-1986 averaged about 15% lower than during 1977-1981.

Landings by offshore headboat fishermen have been dominated by red porgies, although catches of this species have declined substantially during the reporting period. The percentage contribution of vermilion snappers has increased greatly in the last few years. Annual catches of groupers have

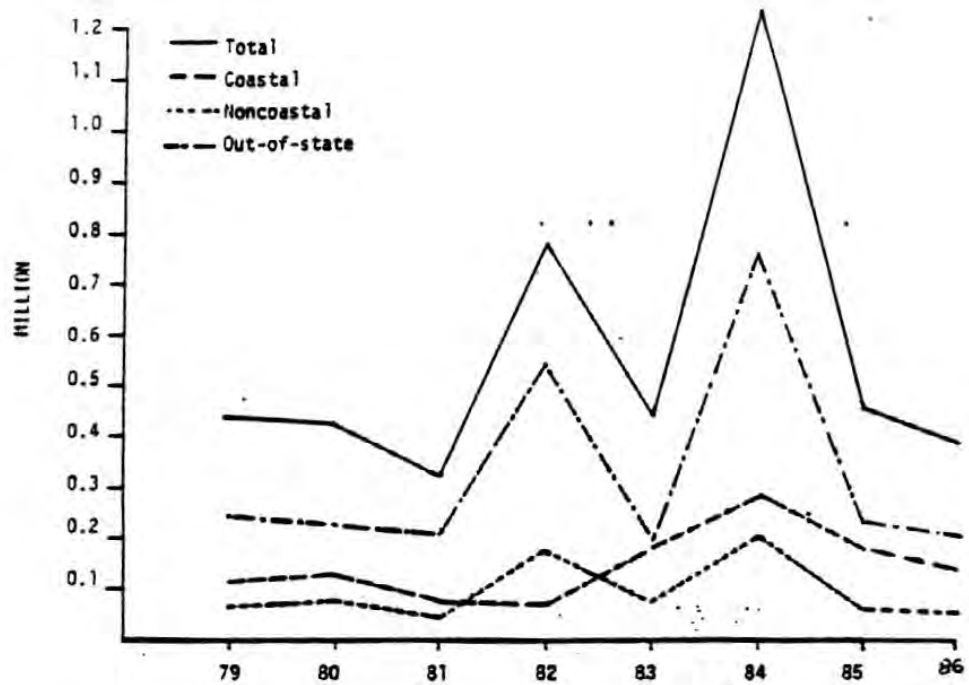


Fig. 58. Estimated participation (number of anglers) in the South Carolina marine recreational fishery. (Source: NMFS annual survey reports)

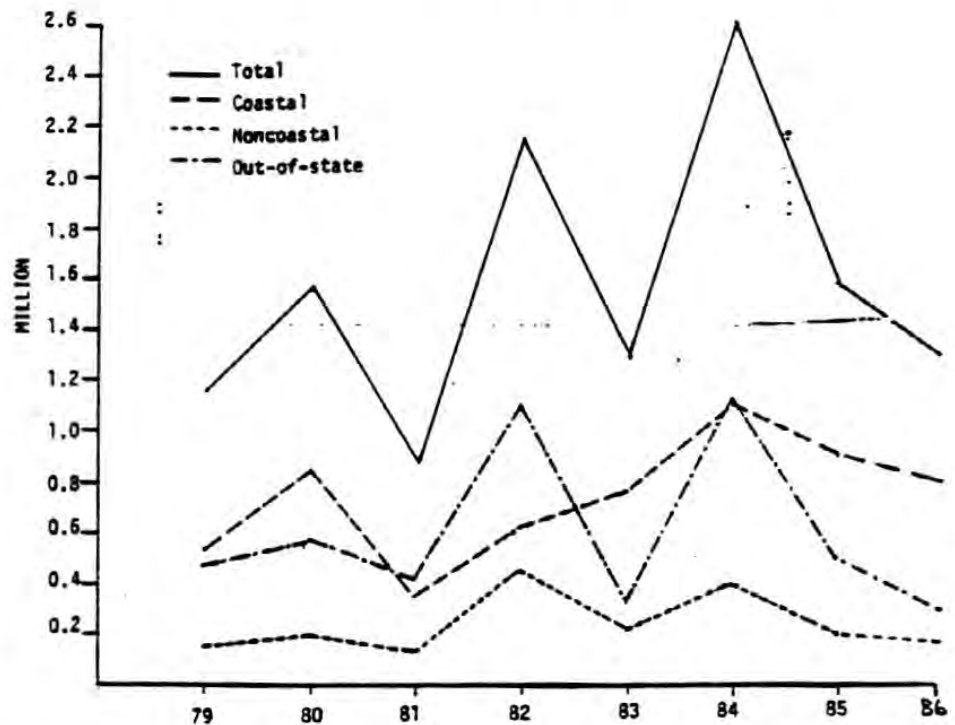


Fig. 59. Estimated effort (number of trips) in the South Carolina marine recreational fishery. (Source: NMFS annual survey reports)

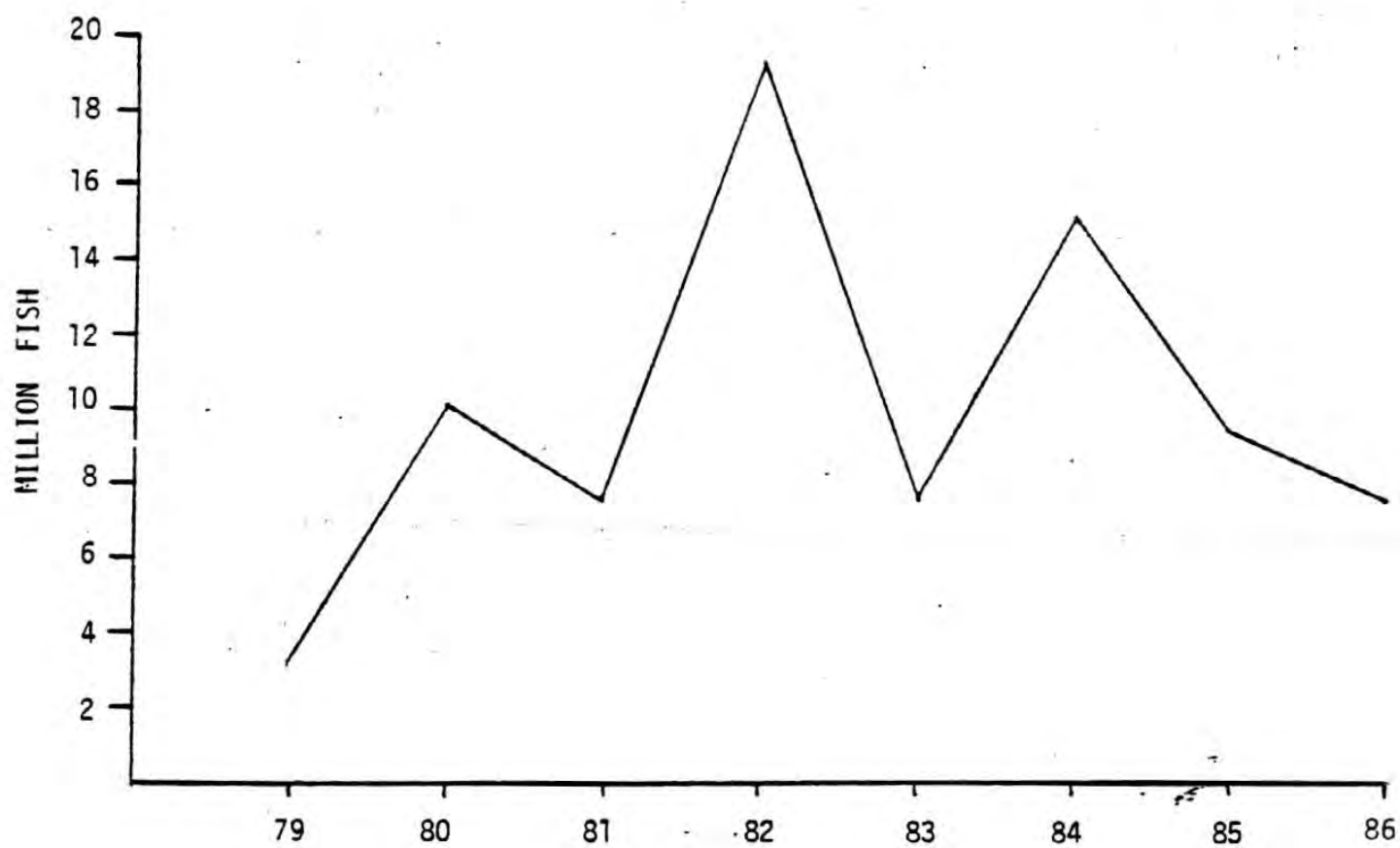


Fig. 60. Estimated annual recreational finfish catch of all species combined in South Carolina's marine waters.

(Source: NMFS annual survey reports)

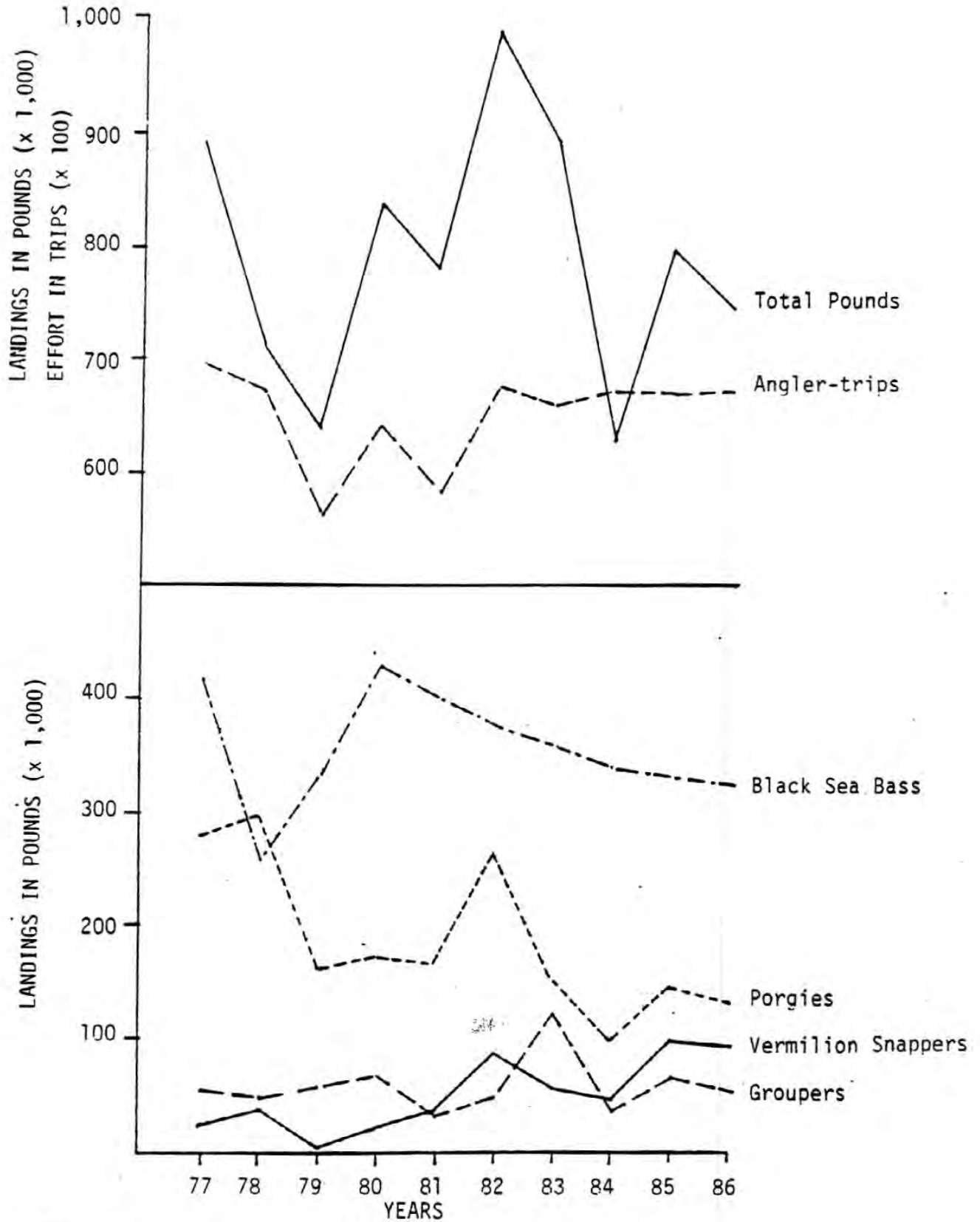


Fig. 61. Estimated annual headboat catch and effort (Source: NMFS, Beaufort, North Carolina Laboratory).

fluctuated moderately, with no pronounced trend, although there have been significant changes in species composition. Catches of the Epinephelus group (speckled hind and deep-water groupers) have decreased substantially, while landings of the Mycteroperca group (gag and scamp) have increased moderately.

Total annual landings have fluctuated widely with no significant trend. In contrast, effort (angler-trips) has remained fairly stable. CPUE of inshore anglers has been below the ten-year average during the last three years (1984-1986), presumably reflecting the decline in catch rates of black sea bass. CPUE of offshore fishermen was substantially higher during the early 1980's than in recent years (Fig. 62).

A 1977 Division survey estimated that about 10% of the headboat trips were made to artificial reefs. The estimated total direct economic impact of headboat fishing was about \$3.5 million. Headboat anglers were a diverse group in terms of occupations and income levels. About 67% came from out-of-state.

Shore-based Fishery

About 14% of the respondents to the 1985 Division survey indicated that bank, bridge, surf or pier fishing was their preferred fishing mode. These respondents were primarily coastal residents. A survey of pier fishing during 1974 indicated that only 17% of the participants were local residents and about 57% were out-of-state people. During April through November of that year, it was estimated that 25,000 pier anglers expended approximately 747,000 hours of effort. About \$1.3 million was attributed to expenditures directly related to the pier fishery. Pier fishermen caught an estimated 183,000 pounds of spot, croaker, and kingfishes, about 36% of the total commercial landings reported in 1974 for these species.

There presently are eight piers operating in the state, with seven being on the Grand Strand. Three are open year-round, while the others are generally open during March-December.

Tournaments

Fishing tournaments, both for inshore and offshore species, have grown rapidly during the reporting period. In 1972, only eight were held. By 1980, the total had increased to 40 and 74 were held during 1986.

Until the start of the reporting period, these tournaments focused on offshore pelagic species in general or billfishes in particular. One or two were held for general inshore species. Species-targeted events did not become popular until the late 1970's, following the first Arthur Smith King Mackerel Tournament. Now, species-specific contests account for one-third of the

competitions. King mackerel is by far the most popular species, followed by blue marlin, sailfish, spotted seatrout, tarpon, spadefish, and amberjack. The popularity of inshore tournaments increased during the early 1980's and such events now comprise about 15% of the competitions.

The premier tournament in South Carolina has been the Arthur Smith King Mackerel Tournament, which began in 1977. From 1977-1982, it was held in the Little River-North Myrtle Beach area. In 1983, it was expanded to include Murrells Inlet, in order to accommodate the increased number of boats. The number of boats, initially 407, has steadily increased to over 1,000 in recent years. In 1979, this tournament had an estimated participation of 1,844 anglers, with a direct economic impact of \$880,000. By 1983, participation had increased to 3,811 anglers and the direct economic value to nearly \$3.0 million. The 10th anniversary tournament, held in 1986, offered \$540,000 in awards and attracted 5,000 fishermen on 1,244 boats - the largest field ever assembled in the southeastern U.S. for such an event. Sponsor Arthur Smith estimates that his advertising reaches 57 million people.

Economics is the underlying reason for the expansion of tournaments in number and scope as implied in the dollars attached to the Smith events. This segment of sportfishing has become an important industry. There are three primary types of sponsors: 1) clubs, 2) marinas, and 3) private businesses. Sportfishing clubs view competitions as a fund-raising opportunity and as the primary service for their memberships. Marina managers consider tournaments a means of increasing sales, promoting their facilities, and gaining extensive media exposure. Private businesses that cater to anglers find that tournaments are useful for marketing products and services.

The apparent success of saltwater tournaments here, as in much of the southeastern U.S., is probably due to the ability and willingness of an increasingly affluent angling public to spend a large part of their discretionary expenditures on such competitive events.

Catches

With the exception of some of the tournaments, catches by South Carolina recreational anglers have seldom been reported. Available estimates (from the annual NMFS surveys) are extremely rough and the probability of substantial sampling error for some species is very high. For these reasons, very few meaningful interpretations of stock status can be drawn from them.

Trends in estimated catches of the three most popular species sought by inshore anglers are shown in Fig. 63. From other studies, it is known that recent abundance of red drum, the most preferred species statewide, has been

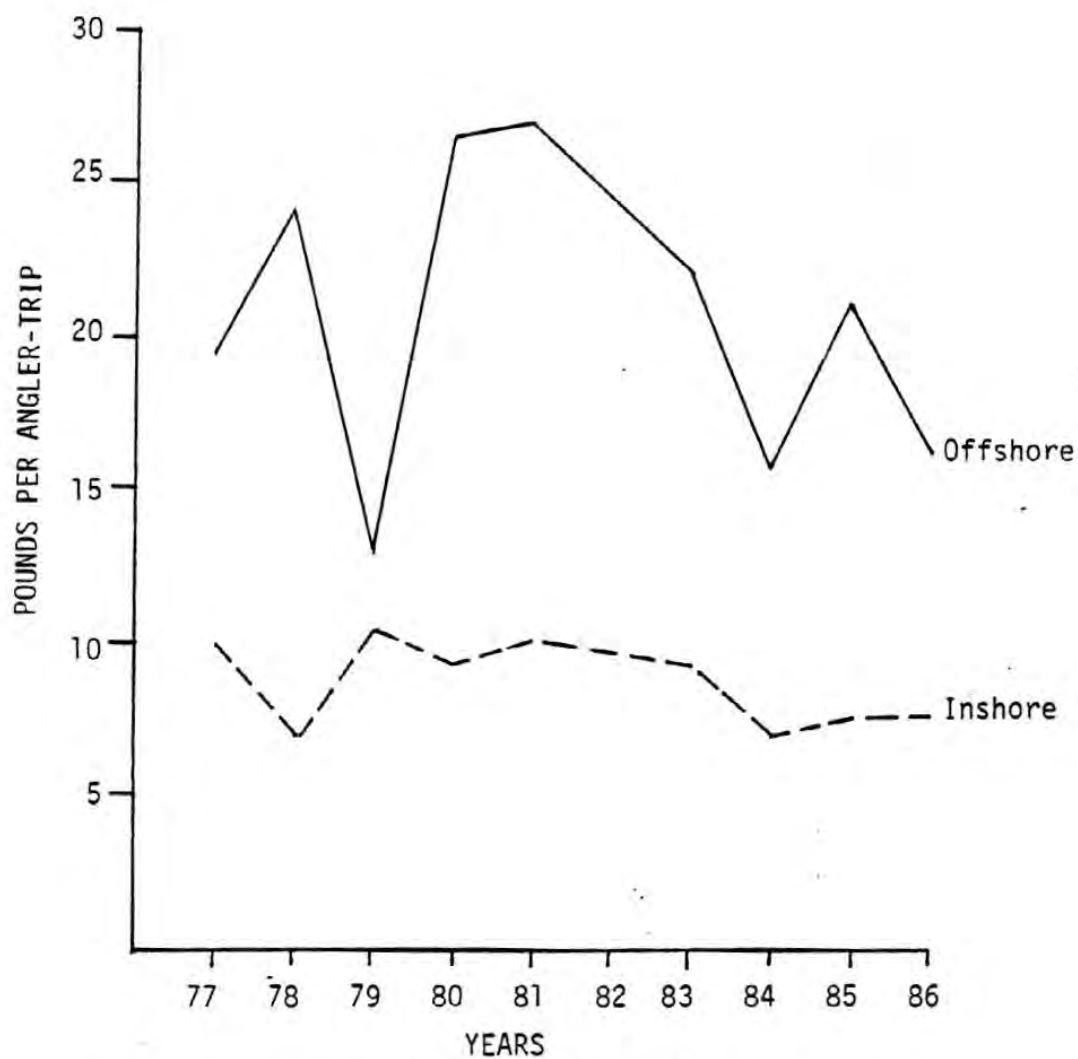


Fig. 62. Headboat catch-per-unit-of-effort. (Source: NMFS, Beaufort, North Carolina Laboratory)

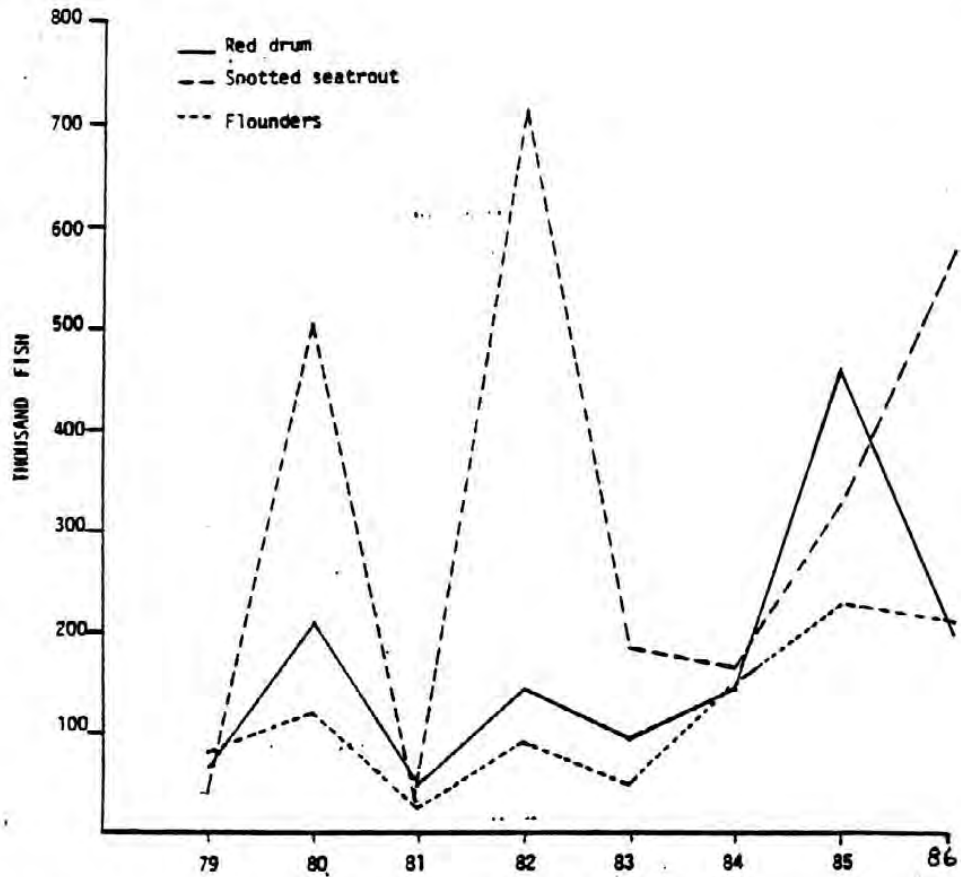


Fig. 63. Estimated annual recreational catches of preferred inshore species in South Carolina. (Source: NMFS annual survey reports)

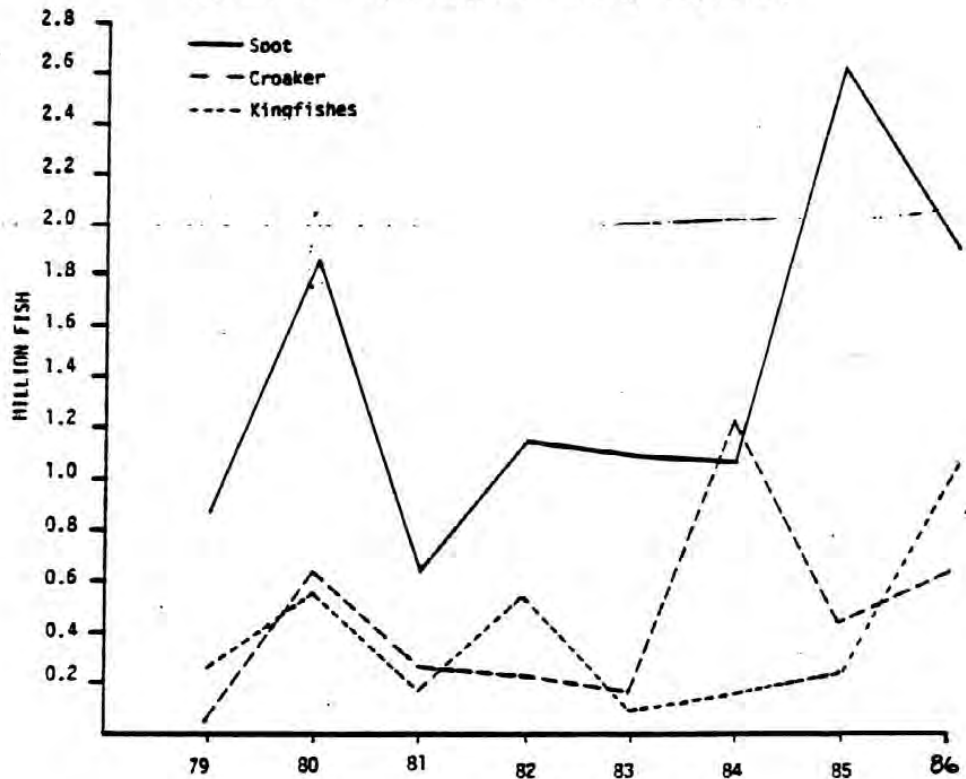


Fig. 64. Estimated annual recreational catches of marine inshore bottomfish in South Carolina. (Source: NMFS annual survey reports)

high, as is also indicated by the estimated recreational catch. General knowledge also confirms that annual abundance of spotted seatrout was very low following the severe winters of 1976-1977 and 1977-1978 and has been highly variable since then, though probably not to the extent suggested by the estimated catches. Spotted seatrout populations throughout much of the species' range were very high during 1986. Because of their life history, flounders would be expected to be more stable than either red drum or seatrout and this appears to be reflected in the estimated catches.

The species shown in Fig. 64 are of secondary preference to inshore anglers, but are important components of the overall catch, particularly by shorebased anglers. Catches of spot have been extremely variable, as has been also the case for the commercial fishery. Little can be said concerning the other species.

Catch estimates for offshore bottomfish (Fig. 65) are the least reliable. Misidentification was a major problem during the early years of the survey, since many anglers referred to red porgies as red snappers and other species also were frequently incorrectly identified. Sample sizes (i.e., numbers of bottomfish anglers interviewed) tend to be very small and high catch rates by a few anglers can therefore have a pronounced effect on the catch estimates. This inherent problem of the estimation methodology probably accounts for the extremely high catch estimates shown for some years. For example, the extremely large snapper catches reported in 1982 and 1984 were attributable to very high estimates for vermilion snapper and almost certainly are due to sampling error. In both cases, the estimated recreational catches far exceed the reported commercial landings, which is completely unrealistic. Although the high estimates for black sea bass during 1980-1982 coincide with a period during which commercial production peaked, the extremely high estimate for 1984 is difficult to explain other than through sampling error. The anomalously large catch indicated for porgies in 1982 is another example. It is instructive to note that the consistency in years (i.e., high estimates across the board in 1982 and 1984) probably reflects a similar source of error, perhaps a few trips in which the interviewed fishermen had very large catches.

The species shown in Fig. 66 are also highly popular with offshore fishermen; king mackerel is the overwhelming favorite of both private boat and charterboat anglers. The estimated king mackerel catches far exceed the reported commercial landings for the same years, although the trend appears realistic given that in commercial production. Shark catches also appear to follow the trend seen in commercial landings, although most of the recreational catch (about 70%) is released.

Other Fishing Activities

About 8% of the respondents to a 1985 tackle shop survey of coastal fishermen indicated that they did some gillnetting. This activity has historically been most popular in the Grand Strand area during the fall, with mullet, spot, and bluefish being the most common catches. During a 1985 creel census at public launching ramps, only 2% of the fishing trips observed included gillnetting as an activity and nearly all of this effort was seen in the northern area. Gillnets are the only gear used by recreational fishermen that require a license, although some of the licenses have been held by commercial fishermen. Most of the gillnetting effort has been recreational, according to a 1978 Division survey of license holders. Current participation, as indicated by the number of licenses issued, is at about the same level as in 1977 (Fig. 67).

The extent of gillnetting effort and the level of catches in recent years are not known.

Gigging (graining, spearing) has been a traditional sport in coastal South Carolina and is apparently quite popular; 23% of the respondents to the 1985 survey of coastal resident anglers indicated that they participated in this activity. Gigging is a nighttime activity, whereas most surveys have been conducted during the daytime, so virtually no information from creel census surveys is available. Most of the activity is directed at flounders during summer and early fall, although there is also some fishing during very cold weather for red drum and spotted seatrout. Because the conditions required for successful gigging are seldom encountered, most fishermen probably make fewer than a dozen gigging trips a year. Since a license is required in Beaufort, Jasper, and Colleton Counties only, license sales are not a valid indicator of statewide participation.

Crabbing and shrimping both appear to be popular recreational pursuits. About 27% of the coastal fishermen who responded to the 1985 Division questionnaire survey indicated that they did some crabbing, although this activity was reported during only 5-7% of the trips intercepted during the 1985 creel census. About 47% of the questionnaire survey respondents said that they cast netted for shrimp and 15% indicated that they did some seining. Many of the people appear to cast net for shrimp as bait for fishing. Cast netting over bait at night has become a popular, but highly controversial, practice that received much public attention in 1986. A comprehensive survey of recreational shrimping was conducted during 1986, although results are not yet available.

Virtually nothing is known about the level of crabbing effort and catches. During

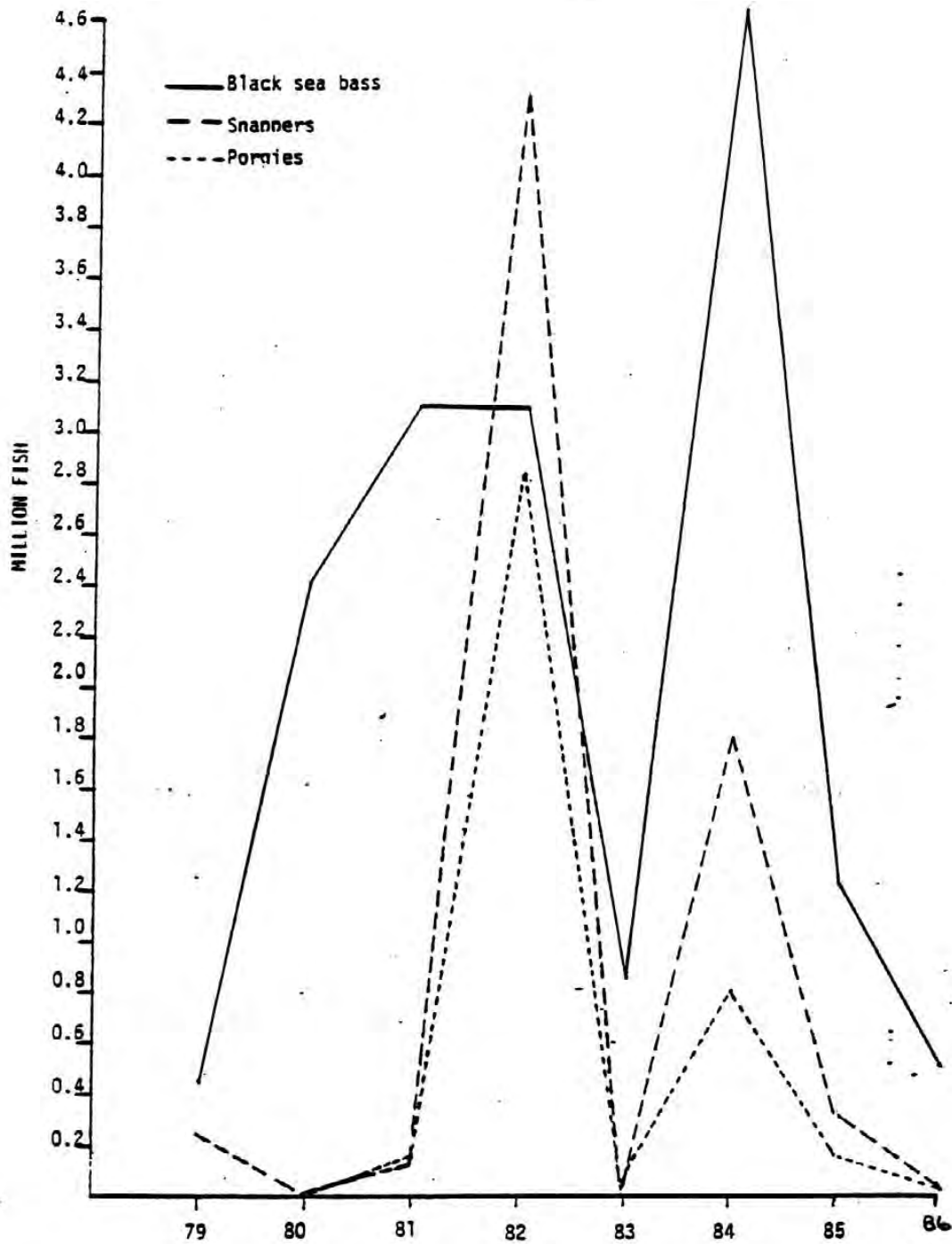


Fig. 65. Estimated annual recreational catches of offshore bottomfish by South Carolina anglers.

(Source: NMFS annual survey reports)

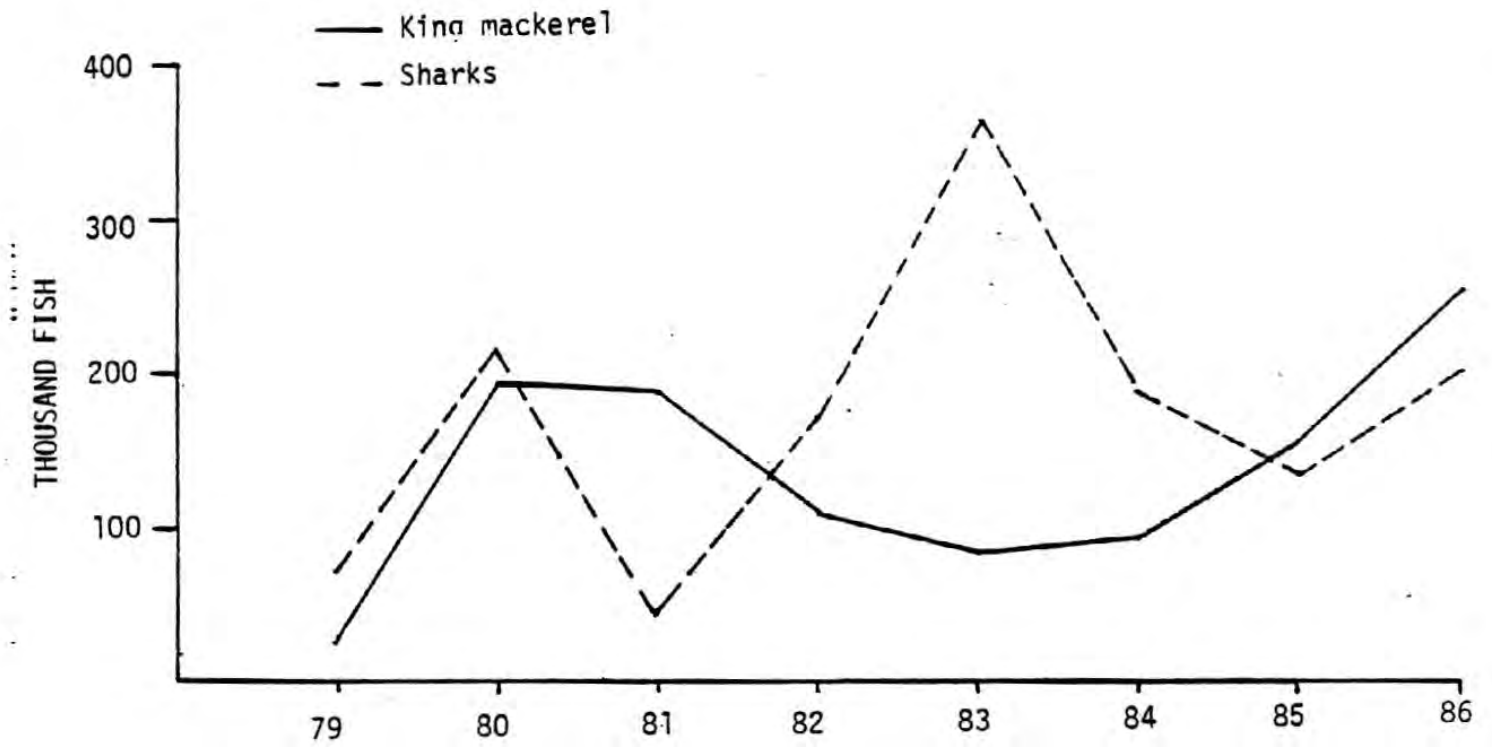


Fig. 66. Estimated annual recreational catches of king mackerel and sharks by South Carolina anglers.

(Source: NMFS annual survey reports)

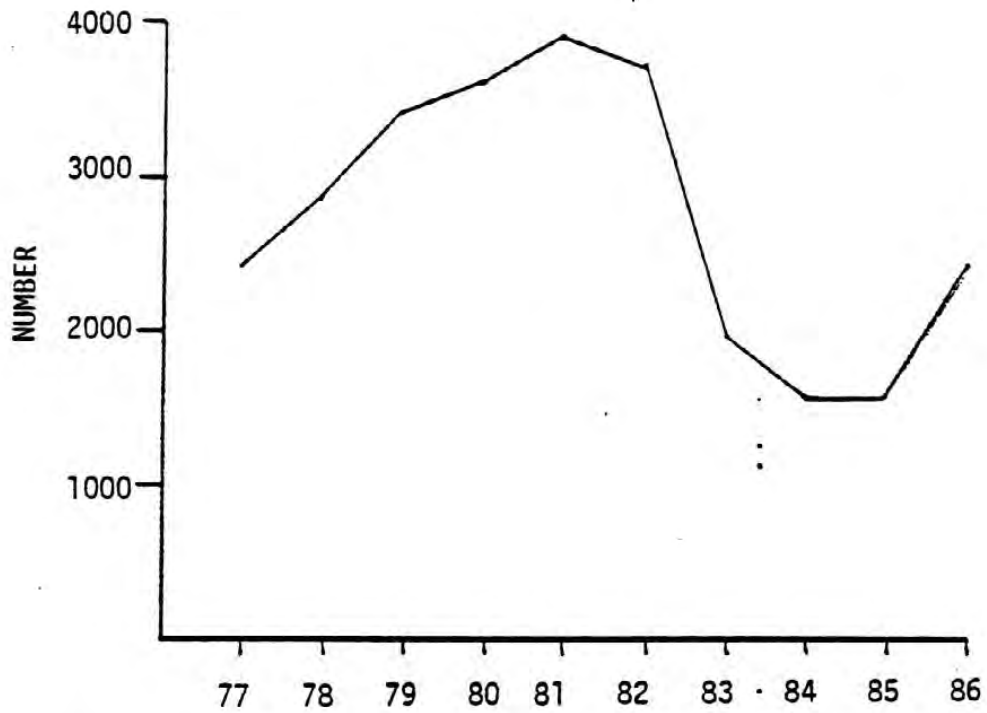


Fig. 67. Gillnet licenses issued by the South Carolina Wildlife and Marine Resources Department.

the early 1970's, a Division survey estimated that the recreational shrimp harvest was about 10% of the commercial catch.

Shellfish gathering is also a popular and traditional recreational activity in coastal South Carolina. A survey of the 1980-1981 season estimated that 38% of the boats 20 ft or less registered in coastal counties had been used for shellfish gathering. About 10% of those registered in the rest of the state had participated. During the season, a total of 26,600 boats was estimated to have been used. During approximately 106,600 trips, about \$1.2 million worth of shellfish (217,000 bushels of oysters and 27,000 bushels of clams) were believed to have been harvested. The clam harvest represented about 55% of the reported commercial production during that same period.

Artificial Reef Program

South Carolina's artificial reef program was initiated in 1967. At first, the program depended heavily on the state, BOR, and Regional Commission for funding of construction projects. By 1977, nine artificial reefs had been established and were being maintained on a regular basis. By the end of 1977, federal support had been terminated and subsequent work depended on limited SCWMRD budget funding only.

In 1978, the Liberty ship Betsy Ross, obtained from the Maritime Administration, was sunk off Hilton Head Island and two wrecks were marked with Department buoys.

No additional construction was accomplished until early 1980, when sufficient state funds were appropriated for several projects. Three new reefs were established, including the first estuarine reef and the first offshore mid-water reef. The South Edisto River inshore reef was constructed from concrete pipe, tires, and designed concrete and PVC pipe habitat structures, at a cost of \$22,000. The Edisto Trolling Alley was constructed of 120 mid-water fish aggregation devices placed in a mile-long row. The trolling alley concept was developed to improve fishing for pelagic species, such as king mackerel, dolphin, and sailfish. A new reef was also permitted off Georgetown, close to a wreck five miles offshore. This brought the total number of artificial reefs to 13.

In 1981, 24 new buoys were placed on the reefs and many others were upgraded. Five major construction projects, including the establishment of the Gray Bay reef behind the Isle of Palms, were undertaken. Ten-Mile Reef, Edisto Offshore Reef, Kiawah Reef, and Hilton Head Reef were all significantly expanded. Research to assess the feasibility of continued utilization of auto tires was also initiated.

During 1982, additions, consisting mostly of donated vessels and other steel

structures, were made to the Edisto Offshore Reef, Ten-Mile Reef, and Hilton Head Reef. A new reef site 2.5 miles off Hilton Head was selected, with assistance from the Hilton Head Sportfishing Association and the Beaufort and Hilton Head Shrimpers Associations.

In late 1982 and early 1983, 26 new yellow buoys were placed on 12 reefs to comply with new Coast Guard regulations. Later in 1983, a second steel vessel was donated to the program and sunk on the Edisto Offshore Reef.

In 1984, a 100-ft trawler was added to the Capers Reef off Charleston. Additional construction projects included installation of trolling alleys on Ten-Mile, Kiawah, Fripp, and Hunting Island Reefs, sinking of three 35-ft boats and a 200-ft barge on Kiawah Reef, placement of two 100-ft barges on the Georgetown Reef, and the establishment of the Fish America Reef 2.5 miles off Hilton Head. Two new reefs, the Hector Reef off Georgetown and the Springmaid Fishing Pier Reef near Myrtle Beach, were created in the fall. This raised the total number of artificial reefs to 17. Buoys were replaced as necessary throughout the year.

In 1985, there was a great deal of construction activity. A new trolling alley was established on the Georgetown Reef and four barges were placed on the Hector Reef. The reef program also began a project to assess the effectiveness of designed habitat units. In August, 87 concrete pipe units were placed on the Capers Reef and evaluation began immediately. A new reef with a trolling alley was established ten miles off Little River Inlet and a 180-ft. tanker was sunk 32 miles offshore.

The Cape Romain Reef, 12 miles offshore from the entrance to Winyah Bay, was begun in January, 1986, with the sinking of a 100-ft. dredge barge. This brought the total number of reefs in the system up to 20. Construction took place on the FishAmerica Reef, BP-25 Reef, Hilton Head Reef, Kiawah Reef, Little River Offshore Reef, and Capers Reef. Most of this construction involved the sinking of donated steel vessels and the addition of mid-water trolling alleys, but work was also continued on the design and installation of prefabricated habitat units. As 1986 ended, plans were being formulated for the continued evaluation of designed reef units and the eventual establishment of two new deep-water ship reefs and a second fishing pier reef. Another noteworthy year-end development was the designation of many of the state's reefs as Special Management Zones by the South Atlantic Fishery Management Council. This measure limited fishing on specified sites to rod-and-reel angling and spearfishing.

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