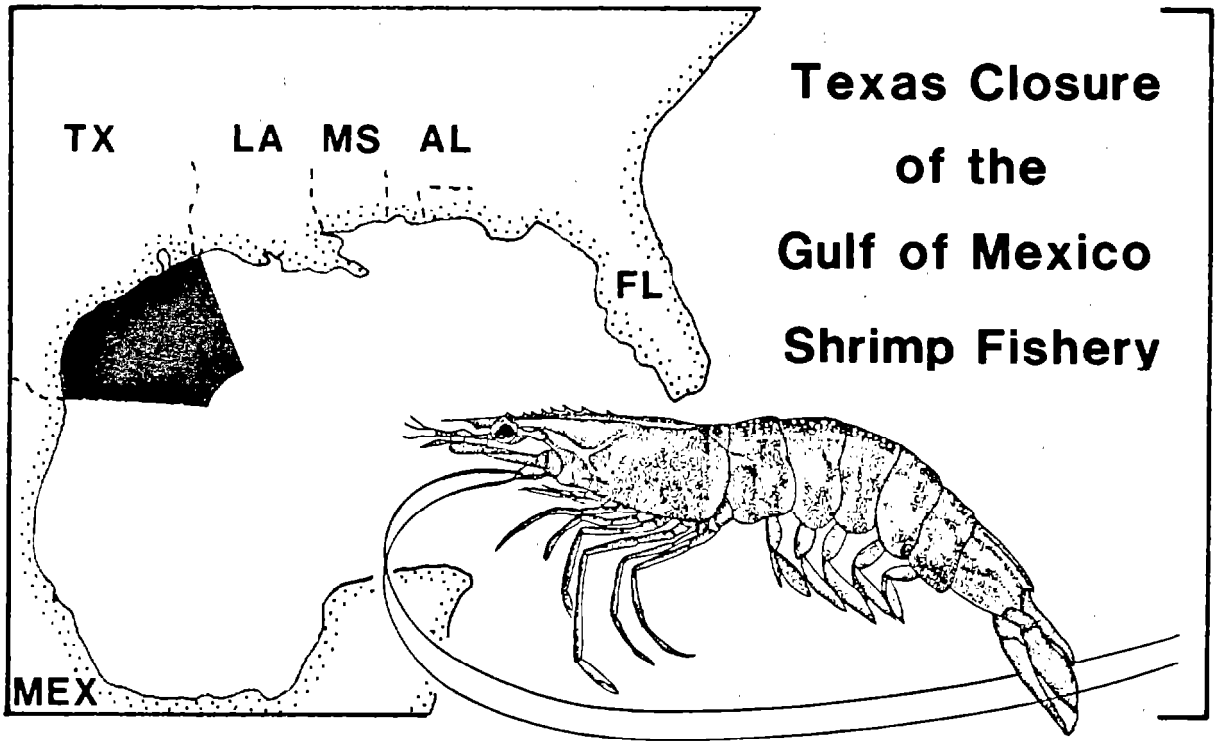
NOAA Technical Memorandum NMFS-SEFC-156

Review of the 1984 Texas Closure for the Shrimp Fishery off Texas and Louisiana



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U. S. DEPARTMENT OF COMMERCE
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1984 TEXAS CLOSURE REPORT

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INTRODUCTION

The implementation of the Gulf of Mexico shrimp fishery management plan (FMP) in May 1981 permitted, for the first time, closure of the brown shrimp fishery from the coastline to 200 miles off the Texas coast and was in effect from 22 May to 15 July 1981. The Gulf of Mexico Fishery Management Council (GMFMC) agreed to continue the seasonal closure of the brown shrimp fishery off the Texas coast in 1982, 1983 and again in 1984. The 1984 Texas Closure-was implemented from 16 May to 6 July.

The objectives of the Texas closure management measure are to increase the yield of shrimp and to eliminate waste caused by discard of undersized shrimp in the fishery conservation zone (FCZ). According to the FMP, shrimp yield would be increased by protecting shrimp from fishing during the period when they are predominantly small and are growing rapidly. Discards would be reduced by eliminating the count restriction in order to allow all shrimp caught to be landed.

The purpose of this report is to provide information to determine how well the objectives of the Texas closure regulations were achieved in 1983 and 1984. This report reviews and analyzes 'the characteristics of the Texas and Louisiana fisheries west of the Mississippi River and describes the catch, fishing effort, relative abundance and recruitment to the offshore fishery from June 1983 to August 1984.

MATERIALS AND METHODS

Fisheries Statistics

A collection of detailed catch statistics describing the U.S. Gulf of Mexico shrimp fishery (since 1956) is available and the procedures used to collect them are described by Klima (1980). The monthly statistics compiled by the Southeast Fisheries Center, (SEFC), Fishery Information and Management Division (FIMD), consist of catch, effort (in 24 hrs of fishing time, expressed as days fished, and number of trips), and size composition of the catch data by statistical subareas (Fig 1). These data were used to analyze the effects of the Texas closure. Only commercial catch statistics from areas west of the Mississippi River (statistical subareas 13-21) were examined.

Locations and amount of fishing effort expended in 24-hr fishing days were obtained by interviewing fishing vessel captains at the termination of trips. All catch data were recorded as pounds of shrimp (heads-off) by species, size category, statistical subarea, depth zone, and month. They are reported in "Fishery Statistics of the United States (1956-1979)" and "Shrimp Landings (1956-1979)". Catch and effort data from 1980 to the present are on file at the SEFC/FIMD office where they are available for inspection. These data were used to compute catch per unit effort (CPUE) as pounds per 24 hours of fishing and as pounds per trip. The number of shrimp caught was estimated by multiplying the pounds caught in each size category by the mid-point of the size category, and in the case of (15 and >116 categories, by 15 and 116, respectively. Starting in May 1982, FIMD recorded pounds caught in size categories larger than 68 count as follows: 68-80, 81-100, 101-115 and 116 count or greater. Messrs. Orman Farley[1] and Tom Dawley[2]

[1]Dept. of Commerce, NOAA, NMFS, SEFC, Galveston Laboratory, 4700 Avenue U, Galveston, Texas 77550

[2]Dept. of Commerce, NOAA, NMFS, SEFC, Room 1000, 600 South St., New Orleans, Louisiana 70130

provided specific information concerning the Texas and Louisiana inshore and offshore shrimp fisheries relative to fleet activities, changes in the fleet, number of trips, discards and specifics of catch and effort for the fishing area during 1983 and 1984.

Statistical Treatment

Catch data frequently follow skewed distributions, show heteroscedasticity and have non-additive components. Transformations applied to the original data are often able to alleviate these problems and permit valid statistical analyses of the data employing t-tests and 2-way analysis of variance (ANOVA) (Sokal and Rohlf, 1969). Taylor's (1961) test analyzing relationships between means and variances was applied to the brown shrimp fishing data. It showed that catch data should be transformed to their logarithms, fishing effort data did not need to be transformed, and CPUE data should be transformed to their square roots. The analyses of these transformed data provided statistical support to what the untransformed data showed. The summaries are presented here with untransformed data.

The commercial catch data were grouped into biological Years May-April since brown shrimp are recruited to the fishery in May of each year. The first and last biological years identified are May 1960-April 1961 and May 1983-April 1984.

Mean monthly catch, mean monthly fishing effort and mean monthly CPUEs for the 1960-1979[3] period were compared with the May 1983-April 1984 monthly data via 2-way ANOVA using paired observations. Additional comparisons between the May-August monthly means of the fisheries data for statistical subareas 13-17 and 18-21 for the historical time series (1960-1979) and the five latest years prior to the closures (1975-1979[3]) were compared with

[3]Does not include 1980 data because this data file has not been reconciled at this time.

the 1984 monthly data from May-August, using paired observations in a 2-way ANOVA and in t-tests. The shrimp size distributions for each month were compared with the historical data set and 1983 and 1984 monthly size distributions by graphical analyses. Unless otherwise stated, tests of significance were performed at the 95% level (P = 0.05).

RESULTS

1983 TEXAS CLOSURE

The 1982 offshore brown shrimp fishery from the mouth of the Mississippi River to the U.S./Mexican border yielded 30.7 million pounds. Louisiana produced 12.6 million pounds and Texas produced 18.1 million pounds, well below the historical average production of 27.3 for Texas. Total brown shrimp production in this area amounted to 48.7 million of which 12.1 and 5.9 were harvested from the inshore waters of Louisiana and Texas, respectively.

Klima et al. (1984) reported on the 1983 closure for the months of July and August and showed that the catch and CPUE off the Texas coast (statistical subareas 18-21) were. greater than the catch and CPUE off Louisiana (statistical areas 13-17) during the same period, but were not significantly different from the historical catch, effort and CPUE for Texas. The September-December 1982 landings off Texas were 7.3 million pounds with 18,000 days of effort whereas the landings off Louisiana (subareas 13-17) were 2.8 million pounds and only 6,200. days of fishing effort (Figs 2 and 3). The CPUEs were about the same, 447 and 403 pounds per 24-hr day for Louisiana and Texas, respectively. Historically the January-April fishery contributes less than 10% to the annual production, and the January-April 1983 fishery was no exception as only 1.4 and 0.8 million lbs of brown shrimp were produced off Louisiana and Texas, respectively. Fishing effort was low in both states as was the CPUE (Table 1). The monthly landings, effort and CPU'S from September 1982 thru April 1983 for Texas and Louisiana

offshore waters were compared in 2-way ANOVA's. The landings in Texas and Louisiana offshore waters during this period were not significantly different. Fishing effort was significantly greater and CPUE was significantly lower off Texas than off Louisiana for this period (Figs. 2 and 3; Tables 2 and 4).

Catch, fishing effort and CPUE for each month from September 1982 thru April 1983 were compared with the respective historical data for the same months for the Texas coast (statistical subareas 18-21). Results of t-tests revealed no significant differences between recent and historical catches, effort or CPUE for each month (Fig. 4; Tables 5 and 6).

We also examined the differences in the catch, fishing effort and CPUE from September 1982 to April 1983 with the means for the same months from September 1975 to December 1979 off Texas. This comparison was made because there may have been some slight changes in the fishery patterns in the last five years compared to the historical 20-year data set. Results of t-tests in the catch, fishing effort and CPUE showed no significant differences (Table 6). We have noted in previous reports (Klima et al., 1982) that fishing effort has decreased slightly from January to April in the last few years.

VESSEL MOBILITY/ACTIVITY

Commercial statistics are recorded by landings within a given state and can also be traced to the location of capture. We have utilized the data to depict the percent of each state's landings and its location of capture from June 1979 through December 1984.

Texas landings from 1979 to 1980 in the peak production periods of June, July, and August were concentrated off of Texas with less than 35% being caught off Louisiana and virtually none being caught off any other state (Table 7). Likewise, Louisiana landings in 1979 and 1980 were virtually exclusively off Louisiana.

Mississippi landings were variable in that fishermen occasionally fished off Louisiana but predominantly fished off Mississippi the rest of the time. Alabama landings were caught either off Louisiana or Mississippi. Florida landings were caught off that state with a small amount caught off Louisiana and Mississippi.

With the initiation of the Texas Closure in 1981, Texas landings in June and July were predominantly off of Louisiana, and by July 16 with the opening of the season, 93% of the landings were from Texas waters. In 1981 no change was observed in the pattern for Louisiana in that virtually all of their landings were from Louisiana until July 15; however, from July 16 through August an appreciable amount of their landings, approximately 30%, were from Texas waters. In 1981 18% of their Mississippi landings in August were caught off Texas. Alabama fishing switched rapidly to Texas where over 20% of their landings in July and August were from Texas waters, where in past years virtually none of Alabama landings were from Texas waters. Florida did not change its pattern, with very little of their landings occurring from Texas: the major portion of their landings were off Florida. This pattern appeared to remain similar through 1984, with Texas landings coming predominantly from Louisiana in June and early July with other state vessels fishing in Texas waters after the closure.

Port agents stationed in Texas have not only reported the commercial catch from the inshore and offshore fisheries, but have designated home ports of all vessels that have unloaded in Texas ports. We have used these data as a means of monitoring vessel activity for Texas home port vessels. Unfortunately, we do not have comparable data for other states; therefore, the view we provide is of the activity of home port vessels in Texas.

The percent of Texas landings caught by Texas vessels is depicted in Table 8 for the years 1981 through 1983. Data prior to the time is not available. The most startling features of this

shows that Texas vessels unloaded less than 3% of their catch in Louisiana during the closure periods. This was at one time a major fear by Louisiana processors that Texas vessels would unload their catch during the closure period in Louisiana and cause serious loading and processing problems at Louisiana ports. This did occur, but at an extremely low level from 1981 to 1983. Ward and Poffenberger (1982), showed that weekly ice sales did not exceed productive and storage capacity in 1981 despite increased shrimp landings and the Texas Closure regulations. An interesting piece of information, shows that 60% of the Texas landings from June through July 15, 1981 were from Louisiana waters as one would expect. This pattern repeated itself in 1982 where over 50% of Texas landings were produced from offshore Louisiana waters and again in 1983 and 1984, when 17% and 28% of the landings came from Louisiana waters from June 1 to July 15, respectively. It is not known why such a small share of Texas landings was produced off Louisiana in 1983, except that 1983 was an extremely poor brown shrimp year.

In 1981, over 50% of the landings in Texas were by Texas vessels from July 16 through December. In 1982 this percentage dropped to 40% for the last two weeks in July, 44% in August, and 29% for September through December. In 1983 this percentage dropped even further to around 20% for the July through September to December period, which means that vessels. from other states were taking a larger share of the landings. This complaint that Texas fishermen are getting less and less of the share of the total catch has been voiced by some in the Texas shrimp industry. These data tend to support the conclusion that out-of-state vessels are catching more of the shrimp as compared to home port Texas vessels.

1984 TEXAS CLOSURE

In 1984, the FCZ of the United States and the territorial sea of the State of Texas were closed to all shrimp fishing from 16 May to 6 July, except for a daytime nearshore fishery directed at white shrimp.

Recruitment

Louisiana

In 1984 Louisiana Department of Wildlife Fisheries (LDWF) projected there were about 1.2 million acres of optimum brown shrimp nursery grounds in Louisiana (Bowman, P. C.) [4]. This is approximately the same amount of acres recorded in 1982 and a 50% reduction from the 3.0 million acres recorded in 1981. Bowman found the April 1984 hydrological parameters were improved over 1983, with the possible exception of Mississippi River discharge, which was approximately the same as observed in 1983. Brown shrimp postlarval catch was significantly higher in 1984 than 1983, as was the 6' trawl catch of juvenile brown shrimp in Barataria Bay, particularly during the last two weeks of April. The average size of brown shrimp in Barataria Bay 6' trawl samples indicated that juvenile brown shrimp responded favorably to the improved environmental conditions as average size during the last two week in April was substantially larger than that observed during 1983. Based on this information, Bowman projected the Louisiana 1984 brown shrimp season would be improved over 1983. The total Louisiana catch from May-August 1984 was 28.5 million pounds, which was indeed an improvement over the 20.9 million pounds for the same period in 1983. It was 38.3 in 1981 and 28.8 in 1982.

[4]Bowman, Phillip, personal communication, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

Texas

Estimates of the potential yield from the spring 1981 and 1982 brown shrimp crops were made by the Texas Parks and Wildlife Department (TPWD)[5] and the National Marine Fisheries Service (NMFS). Both estimates indicated that the 1981 crop was projected to be slightly better than average (Klima et al., 1982). We (NMFS1 estimated a yield of approximately 29 million pounds (+2.7 million pounds at the 95% confidence level); however, more than 40 million pounds of brown shrimp were caught in offshore Texas waters from July 1981-May 1982. The difference in the projected estimates and actual higher catch was attributed to the Texas closure (Klima et al., 1982).

Our most reliable means of predicting the brown shrimp season is our bait shrimp index which is based on the relative abundance of brown shrimp caught by the Galveston Bay bait shrimp fishery. Indices of postlarval and juvenile abundances for 1984 were based on information collected from Galveston Bay from February through 10 June, 1984. We feel these also provide reasonable forecast adjustments for the entire Texas coast brown shrimp fishery.

Bait Shrimp Index - Galveston Bay

Our best estimate of the relative magnitude of the brown shrimp crop comes from data collected from the Galveston Bay bait shrimp fishery during May and early June (Table 9). This year's index is slightly below average, and we predict a total catch from July 1984 to June 1985 of about 22.9 million lb, average offshore brown shrimp production off Texas from 1960 to 1983 was 26.9 million lbs.

[5]Bryan, C. E., personal communication; Texas Parks and Wildlife Department, 4200 Smith School Road, Austin, TX 78744

All of the 1984 indices indicate a slightly less than average year. We conclude that the brown shrimp season off Texas will be better than in 1982 and 1983, and we expect the catch for July 1984-June 1985 to be about 22.9 million lbs with a range between 18.0 and 29.0 million lbs.

Postlarval Brown Shrimp Index - Galveston Bay

Mass movements of postlarval brown shrimp into nursery areas usually occur after water temperatures reach or exceed 60°F. This year, bay waters were generally above 60°F by the first week in February. Extremely high catches of postlarval brown shrimp were observed throughout the spring (February-May) and were much higher than the 15-year average postlarval index for Galveston Bay. Unfortunately, the water levels were dramatically lowered by two northers, one in late February and another in March, resulting in an inability of juvenile shrimp to use the extensive marsh grass for several days. We observed many dead shrimp stranded in exposed mud flats during these periods.

Juvenile Brown Shrimp Indices - Galveston Bay

Sampling of juvenile shrimp with the drop sampler in a salt marsh at Galveston Island State Park indicated much higher densities in March and April 1984 compared with 1983, and similar densities to those of 1982.

Another measure of the abundance of brown shrimp is an estimate of the standing stock of shrimp in Sydnor Bayou, a secondary bay in Galveston Bay. In 1970, an above average brown shrimp year, we estimated that standing stock to be 6,500 shrimp per acre: in 1983 we estimated the standing stock to be 2,600 per acre. For 1984 we estimated the population in Sydnor Bayou to range from 3,500 to 4,900 shrimp per acre, i.e., about a 35-88% increase over that of 1983.

Texas Inshore Bay Fishery

The Texas inshore brown shrimp season opened on May 15th. Catch rates were relatively low (20 to 32 lbs per hour) in Galveston and Matagorda Bays, especially in Galveston Bay 'where shrimpers concentrated on catching white shrimp in May as the size of brown shrimp was extremely small coupled with low prices, which resulted in most fishermen not fishing until June. Catch rates in Aransas and San Antonio Bays were high, averaging more than 70 lbs per hour in May and June. Although we do not have comparable measures of catch rates from previous years, we feel that the 1984 catch rates are average; good catch rates from previous years are in the range from 75 to 100 lbs per hour.

Early Offshore Fishery Production

Another indicator of annual production is the offshore catch in July and August in statistical subarea 18-21. Historically, the July-August brown shrimp catch averages 47% of the total annual production from July to June. Since 1981 with the inception of the first closure, the July-August catch amounts to about 60% of the total annual production. The offshore catch in July-August 1984 from subareas 18-21 amount to 15.2 million pounds or an estimated annual production of 32.3 or 25.3 million pounds for the 47 and 60 percentages, respectively.

Discards

Mr. Farley[6] indicated that no major culling of juvenile brown shrimp occurred immediately after the season's opening on 6 July 1984. The minor culling of from 1 to 10 pounds of shrimp per

[6]0rman Farley DOC, NOAA, NMFS, SEFC FIMD, 4700 Ave. U, Galveston, Texas

drag and scattered discards of shrimp when drags contained several hundred pounds of small fish and few shrimp were typical for the year. Farley indicated that culling before 1982 was dependent upon size count laws and the absence of markets for small shrimp. He further indicated that since 1982 there has been a market for small shrimp, but that in July and August 1984, quite heavy landings were comprised of 31-40 count shrimp, with only a small percentage of 60-count or larger shrimp.

Some discarding of shrimp was noted by Dr. Terrell Roberts[7] inside 10 fathoms in statistical area 18 and to a lesser degree in area 19 at the opening of the season. Discarding was due to few shrimp amongst the high concentration of fish in the catch. This prevented sorting the shrimp from fish and resulted in discarding of shrimp. Vessels operating off Louisiana, Mississippi and Alabama did not discard large quantities of small shrimp. Generally, it appears that low discarding of small shrimp was encountered during the 1984 brown shrimp season in July and August.

Inshore Fisheries

Inshore shrimp fisheries of Texas and Louisiana are managed by the respective states. Specific regulations concerning fishing activities are in force for both states, limiting the time of fishing during the day, size of fishing gear, fishing areas and seasons.

Louisiana

The inshore Louisiana brown shrimp fishery averaged 10.9 million pounds + 4.0 million pounds standard deviation from 1960 to 1982 (Fig. 6). Peak production in Louisiana appears to be

[7]Dr. Terrell Roberts, DOC, NOAA, SEFC Galveston Laboratory, 4700 Ave. U, Galveston, TX 77550.

cyclic in that low production was observed from 1960 to 1966 and above average production on all other years except in 1973, 1975 and 1980. Historically, the Louisiana inshore fishery is concentrated from May thru August, with peak production in May and June.

The May-August 1984 catch in Louisiana for inshore waters amounted to 14.9 million pounds, with peak production in May and June. This year's inshore production was higher than the 12.1 million pounds recorded in 1983, and only slightly lower than the 15.1 and 15.2 for 1982 and 1981, respectively. In 1984, May production was 4.4 million pounds and June production was 8.1 million pounds, dropping to slightly more than 1.8 million pounds by July. The size composition of the Louisiana catch in 1981 during the peak months was dominated by 68-count or smaller shrimp. In 1982, FIMD agents collected specific size information of shrimp smaller than 68-count; the May-August 1982 and 1983 data revealed that the size composition in Louisiana was predominately 116-count or larger size group (Klima et al., 1984). The May-August 1984 catch was also predominantly composed of shrimp in the 116-count size group (Table 10).

Texas

Landings for the Texas inshore brown shrimp fishery for Texas have been increasing for the past several years. The average catch over the 23-year period (1960-1982) is 2.0 million pounds + 1.6 million pounds standard deviation (Fig. 7). The landings in 1979, 1980, 1981, 1982 and 1983 were 4.2, 5.0, 4.3, 4.3 and 5.9 million pounds, respectively. These are significantly above the 23-year average.

The inshore brown shrimp fishery takes place from late April through August. Peak production in Texas waters occurs in June. The total inshore catch for Texas in 1984 was 7.1 million pounds, up from the 5.9 million pounds in 1983 and well above the

historical average of 2.0 million pounds. Specifically, the catch in 1984 peaked in June, with a production of about 3.2 million pounds compared with 2.0 million pounds in May. Matagorda and Aransas Bays had the major inshore production this year, whereas, in the past, Galveston Bay was one of the major producing bays. This year, almost 1.6 million pounds, or 23% of the total inshore catch, was caught in Galveston Bay. In 1981, 1982 and 1983, Galveston Bay produced 29%, 24% and 15% of the inshore crop, respectively.

The size composition of the inshore catch from May through August is dominated by 68-count or smaller size shrimp. In 1982, FIMD statistical agents collected information on the specific size categories larger than 68-count. These data indicated that the catch was composed primarily of 116-count shrimp or larger size groups in May and June of 1982 and 1983 (Klima et al., 1984). The 1984 catch in May and June was also predominantly of shrimp in the 116-count size group (Table 11).

Size Distribution

The inshore size distribution of brown shrimp caught in Louisiana and Texas is remarkably the same from May through August. Generally in 1984, the average count in May was 108 and 112 shrimp/pound in Texas and Louisiana, respectively, whereas in June the average count in Texas and Louisiana was about 100. In July, the average count dropped to approximately 85-89 shrimp/pound in both states, and by August, when the fishery drops drastically, the average count dropped to less than 68 shrimp/pound in Texas and 63 shrimp/pound in Louisiana (Fig. 8).

Offshore Fisheries

Louisiana

Annual production of brown shrimp from May to April in Louisiana offshore water averaged 15.0 million pounds + 8.1 standard deviation from 1960 to 1983. The annual yield was low in the early 1960's and increased to about 18 million pounds by 1967 and remained near this level through 1972 (Fig 9). The yield dropped to about 10 million pounds from 1973 through 1975. Thereafter the yield was above the historical average of 15.0 million pounds, with yields topping about 30 million pounds in 1977 and 1978.

In 1983 the Louisiana offshore fishery produced 12.7 million pounds of brown shrimp. Total offshore brown shrimp production of the 1984 year class from May through August in statistical subareas 13-17 was 13.6 million pounds from 21 thousand days of fishing effort with an average CPUE of about 650 pounds per day. The 1983 catch from May-August was 8.8 million pounds from 21 thousand days of effort and an average CPUE of about 420 pounds per day.

In May 1984, the fishery off Louisiana produced 2.6 million pounds of brown shrimp and occurred primarily in the shallow waters of statistical subarea 13. Little production was realized from other zones (Figs 10, 11). Fishing effort was relatively low off Louisiana (3,300 days) but the CPUE averaged 769 lbs/day. Highest CPUE of about 1,100 lbs/day was recorded off statistical subarea 13, with a CPUE less than 700 lbs/day in all other statistical subareas.

In June, the fishery off Louisiana produced 4.5 million pounds of brown shrimp with a fishing effort of 6,500 days and an average CPUE of 691 lbs/day. The highest CPUE of 1,100 lbs/day was recorded off statistical subarea 13. The CPUE in all other areas was about 600 lbs/day (Fig 12).

During June, Texas vessels did not fish off the Texas

coast for brown shrimp but concentrated their activities primarily in western Louisiana in statistical areas 15, 16 and 17. Approximately 1.2 million pounds of brown shrimp and 0.3 million pounds of white shrimp were landed by vessels that returned to Texas ports. A total of 1,142 trips was recorded for Texas vessels fishing in Louisiana waters with 2,122 days of fishing effort expended. About 29%, 13%, and 58% of the shrimp caught in statistical subareas 15-17, respectively, were landed in Texas. The total catch in June from Statistical areas 15, 16, and 17 was 2.6 million pounds 'of which 1.5 million pounds were caught by vessels that returned to Texas ports to unload. Therefore, 56% of the offshore catch in those areas was caught by Texas fishermen.

The July fishery in statistical subareas 13-17 produced 3.8 million pounds of brown shrimp with 6,400 fishing days. 'Relative abundance averaged 598 pounds/day, with the highest CPUE observed off statistical subareas 13 and 17 (Fig 13) and the lowest CPUE in Statistical subareas 14 and 15. The maximum production occurred inside of 10 fathoms.

In August, the Louisiana offshore fishery produced approximately 2.7 million pounds of brown shrimp with an average CPUE of 513 pounds/day. Similar values were observed in the amount caught, fishing effort and CPUE among all statistical subareas except 15 (Fig 14).

Texas

Average annual brown shrimp yield from May to April in Texas offshore waters from 1960 to 1983 is 26.9 million pounds + 7.8 standard deviation (Fig 15). Peak production occurred in 1967 and 1981 with a yield of 48 and 41 million pounds, respectively.

The 1984 production from May through August amounted to 16.1 million pounds with 15.3 million pounds being produced in July and August. Production in July and August was 24.9, 13.1 and 9.8 million pounds in 1981, 1982, and 1983, respectively. The increase

in the July-August 1984 yield over 1983 is attributed to improved recruitment to the offshore from Texas bays and more fishing effort being expended in 1984 than 1983 (Table 1). In July through August 1984, a total of 18,600 days of effort was expended, compared to 14,800, 15,700 and 10,300 days in 1981, 1982 and 1983, respectively (Table 1). The average CPUE during July-August was 819 pounds/day in 1984, down from the 1,095, 922, and 962, pounds/day in 1981, 1982, and 1983, respectively.

The May fishery off the Texas coast was concentrated on brown shrimp and 574,000 pounds were landed. Only 69,000 pounds were small shrimp (>41 count). The modal group was 21-25 count. In 1983, over 522,000 pounds of brown shrimp were landed, but over 204,000 pounds were >41 count shrimp. Major brown shrimp fishing zones were in statistical subareas 20 and 21, which produced over 74% of the catch (Fig 16). In addition to the brown shrimp fishery, only 59,000 pounds of white shrimp were landed.

No fishing for brown shrimp was permitted from 16 May to 6 July 1984. A daytime fishery from the beach to 4 fathoms for white shrimp was permitted along the entire coast during this period. The total landed catch in June for the daytime fishery was about 221,000 lbs of brown shrimp and 118,000 lbs of white shrimp. Over 144,000 lbs of brown shrimp and no white shrimp were caught in Statistical area 21.

The white shrimp fishery off Texas was not very productive in May and June, with catches of 58,000 and 118,000 lbs, respectively. The July fishery amounted to almost 300,000 lbs of predominantly 15-20 and under count shrimp, taken primarily in statistical subarea 18. Few white shrimp were caught in statistical subareas 19, 20 and 21 during July. The August white shrimp fishery was substantial with approximately 680,000 lbs being landed of predominantly 31-50 count shrimp. The fishery was concentrated in statistical subarea 18. Total landings for Texas were 387,000 lbs in July and 752,000 lbs in August.

With the opening of the offshore brown shrimp season on 6 July, 8.0 million pounds were taken in July off Texas, with 8,100 days of effort giving a CPUE of about 1,909 pounds/day. The highest CPUE (1,275 lbs/day) was observed in statistical subarea 20 (Fig 14). Peak production came from the 11-15 fathom depth zone in statistical subarea 19 (Fig 16). Production from subareas 18-21 amounted to 1.4, 2.7, 2.0 and 1.9 million pounds, respectively.

In August, the Texas catch was 6.5 million pounds, with a fishing effort of 9,000 days. CPUE was 723 pounds/day, ranging from a high of 844 pounds/day in subarea 20 to a low of 638 pounds/day in subarea 21 (Fig 14). The August peak production expanded to 11-25 fathoms in subarea 19 (Fig 16). High production also occurred in subareas 18, 20, and 21 from 16 fathoms seaward. Limited production occurred in all areas inside 10 fathoms.

A comparison of the July catch between 1981, 1982 and 1983 indicates a similar fishing pattern except fewer brown shrimp were caught in waters deeper than 16 fathoms in 1982 and 1983 compared to 1981. August 1981, 1982 and 1983 production appeared to be similar in statistical subarea 18 but was drastically different in statistical subareas 19-21, as lower production was realized in these three areas because smaller quantities of shrimp were caught seaward of 16 fathoms in 1983 compared to 1981. The data indicate that in 1981 there were large quantities of shrimp out to 35 fathoms. This was not the case in 1982 or 1983, as only small quantities of shrimp were found seaward of 20 fathoms along the Texas coast in July and August. In 1984, good quantities of shrimp were caught out to 30 fathoms in July and August in most statistical areas.

In comparing the fishing effort and CPUE between 1981 (July-August) and 1984 for statistical subareas 18-21, it is obvious there were large differences. The 1981 CPUE was more than double that of 1984. Fishing effort was about the same in July-August 1981, 1982 and 1983 periods. In July 1984, effort was

higher than all other years but about the same level in August.

The resultant catch from the 1981 (July-Aug) fishing effort was far greater than that observed in 1982, 1983, and 1984: 24.9 million pounds versus 13.1 million pounds and was greater than the 9.9 million lbs landed in 1983 but was less than the 15.3 million lbs landed in 1984. There is no question that the fishery in 1981 produced more shrimp from the Texas coast than it did in 1982, 1983 and 1984. CPUE was far greater in 1981 than 1982, 1983 and 1984 resulting in record production in 1981. CPUE was similar between 1982 and 1983, but lower in 1984 in both July and August. The higher productionin 1984 is attributed to a better recruitment in 1984 than in 1982 and 1983, and an increased fishing effort over those of 1982 and 1983.

Size Distribution

The size composition (measured by the number of shrimp/lb) of the 1984 commercial offshore catch of brown shrimp from statistical subareas 13-17 from May to August 1984 was dominated by 68-count and smaller shrimp in May, June and July (Fig 17). In August, the catch was more uniformly distributed among the size groups ranging between 31-40's and large size groups. The average number of brown shrimp/pound caught in statistical subareas 13-17 in Louisiana from May-August decreased from about 91-count to approximately 46-count and little or no difference was observed between 1983 and 1984 (Klima et al., 1983 and 1984) (Fig 18).

The monthly size distribution for the catch of brown shrimp from subareas 18-21 from May to August 1982 was significantly different from that observed off Louisiana. In May, the catch was composed of nearly equal amounts of size categories larger than 31-40's. In June, a considerable amount of shrimp (200,000 lbs) of 68-count or smaller off the Texas coast. In July, the 31-40 count was the predominant modal group, as it was in August (Fig 18). The 31-40 size class was the dominant modal group

of brown shrimp caught in July-August 1981, 1982 and 1983 off Texas (Klima et al., 1982, 1983 and 1984). No difference was observed between the May, July and August 1981, 1982, 1983 and 1984 average number of shrimp/pound caught off Texas.

In western Louisiana, the average size count for the offshore fishery was 91 in May, 70 in June, 58 in July and 45 in August, whereas for the Texas coast, the average size count was 30 in May, 56 in June, 39 in July and 32 in August (Fig 17). The average size count was appreciably smaller in 1984 than 1983. Major differences in size composition between Texas and Louisiana offshore catches occurred from May through August.

In addition to describing the pounds landed by size count, we have converted the size category into numbers of shrimp caught in Texas and Louisiana, both for offshore and inshore waters. Large numbers of shrimp were caught in Louisiana inshore waters in May and June but the catch decreased drastically in July and August (Fig 19). The Louisiana inshore and offshore fisheries caught about 1.8 billion shrimp in May and June, with the catch dropping to slightly less than 400 million in July and less than 160 million in August. Less than 580 million shrimp were caught in Texas waters in May and June 1984; however, production was approximately 479 million and 225 million in July and August, respectively (Fig 19).

In comparing the two states for the total number of shrimp landed, it is evident that in 1984, Louisiana produced more shrimp in numbers than did Texas (2.4 billion versus 1.3 billion, respectively) (Fig 19). However, total production in Texas was 23.5 million pounds compared to 28.5 million pounds in Louisiana for the May-August period. Texas offshore production during this period was more than off Louisiana (16.1 and 13.6 million pounds, respectively). Louisiana inshore waters produced 14.9 million pounds, whereas Texas only produced 7.1 million pounds, which accounts for the large difference in total catch between these two

areas.

The inshore fisheries of both Louisiana and Texas accounted for the majority of the number of shrimp landed from May to August. In Louisiana, 1.5 billion shrimp were caught in inshore waters and almost 0.7 billion shrimp were caught in Texas inshore waters. Almost 67% of the shrimp caught by the inshore fisheries of Louisiana and Texas were shrimp 100 count size or larger.

DISCUSSION

1983 FISHERY

Recruitment to Texas offshore waters in 1983 was much lower than that observed since 1960 (Klima et al., 1984). The catch from July 1983 through June 1984 amounted to 18.1 million pounds, the third lowest since 1960. The National Marine Fisheries Service recruitment model predicted a catch of 17.8 million pounds. Maximum production obviously occurred from July through September when approximately 66% of the annual catch was recorded. Lower CPUE's were also observed when compared with 1981. The 1983 catch and CPUE in Texas offshore waters in July through September were at least half that observed in 1981. Total catch in 1983 was much less than in 1982, but CPUE was about the same. Average CPUE per day was 1,414, 714 and 508 for July, August and September, respectively. The combined catch for July, August and September was 30.7, 15.8, and 11.9 million pounds in 1981, 1982 and 1983, respectively. Comparing the remaining portion of the year from September 1983 through April 1984, we observed no differences in the catch, but some differences in CPUE and effort when comparing either Texas with Louisiana or comparing Texas to the historical data base. Obviously, the major portion of the offshore shrimp fishery occurs from July through September and this is the time when one can expect vast changes in production and relative abundance.

The fishery in 1983 appeared to achieve the Fishery Management Plan's goals and objectives, that of protecting juvenile shrimp emigrating from the estuaries and allowing the fishery to concentrate on 31-40 count shrimp during the peak period of the season and thereby minimizing discards. We observed little or no discard during the July-September period. The fishery off Texas caught predominately 31-40 count size shrimp or larger. The catch and the relative abundance, as measured by CPUE, were higher off Texas than off Louisiana. This we attributed to the Texas Closure

management measure. The prevention of trawling protected juvenile shrimp while they were emigrating and allowed them to grow to a larger size, predominantly 31-40 count or larger off Texas. The Texas inshore and Louisiana inshore and offshore fisheries in May and June were open to trawling and these fisheries concentrated on shrimp that were available,, and consequently caught large numbers of small juvenile shrimp (Klima et al., 1984).

1984 FISHERY

Recruitment to the offshore stocks in Texas as well as in Louisiana appeared to be much higher than that observed in 1982 and 1983 and significantly lower than that observed in 1981. Mr. Phil Bowman' indicated there would be an increase in the brown shrimp catch due to a number of indicators as measured by Louisiana Wildlife and Fisheries. We predicted an average catch off Texas of 22.9 million pounds with a range of 18 to 29 million pounds, significantly below the historical average for Texas offshore waters. We attributed the poor recruitment to a number of environmental factors that adversely affected juvenile shrimp in the upper Texas bay systems. July offshore production was best in statistical area 19. In previous years, area 19 usually produced the most brown shrimp in July and August, this was again the case.

Overall, the offshore fishery yield was much greater in 1984 than it was in 1983 and 1982. This was true for both Texas and Louisiana; however, the 1981 fishery far surpassed the 1982, 1983, and 1984 fisheries of both states. The measures of relative abundance for offshore Texas waters were lower in 1984 compared with 1983, 1982, and significantly lower than 1981. Offshore Texas waters were more productive than offshore Louisiana waters and CPUE was approximately 28% greater off Texas than off Louisiana. The major difference in 1984 was appreciably more fishing effort was expended than in the previous Texas Closure years. Approximately

18.6 thousand hours were expended in the July-August period off Texas compared to 14.8, 15.7, and 10.3 in 1981, 1982, and 1983 respectively. This was anticipated since the season opened on 6 July as compared to a normal opening on or about 15 July in the three previous openings.

The Texas inshore catch is-composed primarily of shrimp ranging in count size from 84 to 109 in May, June and July, whereas the offshore average size ranged from 39 to 32 in July and August, respectively. About 700 million shrimp were caught in Texas inshore waters from May to August, with only about 580 million shrimp caught offshore. Therefore, the inshore catch comprised over 66% in numbers of the total brown shrimp catch. We feel that the increasing take of small juvenile shrimp in Texas inshore waters will have a significant impact on the offshore fishery in future years unless this fishery is limited. The Fishery Management Plan attempts to regulate the shrimp fishery through maximizing the size of shrimp at harvest, yet the inshore fisheries of both Texas and Louisiana have no restrictions on the size or amount of shrimp harvested. Juvenile shrimp of a small size are available to these fisheries in May, June and to some extent, July and the average size of these shrimp, as has been pointed out by Klima et al. (1983) is extremely small. There is some variation from year to year, but one can expect the size of these shrimp to range between 80 and 116 count during the peak months. Large numbers of shrimp harvested at a small size are not fully utilized since they would have the opportunity to grow to a larger size if protected. This could result in a greater potential yield to the offshore fisheries. Nichols (1983) has indicated that inshore fishing mortality may impact total production.

After four years of the Texas Closure management measure being in effect, several problems have been identified by shrimp fishermen throughout the Gulf. This year one of the major problems was the lack of adequate notice of the opening date for fishermen

who fished other parts of the Gulf. This problem was caused by the early opening on 6 July instead of the 15 July scheduled opening. Fishermen were notified three days in advance of the opening of the season. Many felt this time frame was inadequate, especially fishermen from Florida and Alabama and even some Texas fishermen who were fishing off Louisiana.

Other problems associated with the Texas Closure were voiced by resident fishermen of Texas who felt that (1) the number of out-of-state vessels fishing in offshore Texas water created many problems, namely that there was less of the resource for resident fishermen and that the out-of-state fishermen were benefiting from the closure, whereas the local fishermen were unable to fish in local waters during the closure, out-of-state fishermen could fish in their local waters and travel to Texas when the season opened and reap the benefits of this management measure; and (2) local fishermen also complained that the inshore fishery that is permitted to catch small shrimp is increasing significantly and that their offshore share was becoming less and less each year. Many fishermen question why the state does not control and limit the inshore fishery. Another problem is that the closure prevents fishermen from fishing pink shrimp in a 10-15 fathom zone in statistical areas 18 and 19. Some felt they could fish this area without capturing small brown shrimp. Others felt that they were not permitted to fish adequately on the white shrimp stock in the 0-4 fathom range. Presently, they are limited to a daytime fishery utilizing a single trawl not larger than 25 feet between the trawl doors. Many of these fishermen would like to use double rigs so that they could concentrate on the big spawning white shrimp during this period and felt it was not fair to be limited by small nets.

Another problem identified was a potential loss of shrimp migrating from south Texas into Mexico. During the closed period these shrimp are believed to migrate and have no opportunity to be caught by U.S. fishermen. Many fishermen questioned why the entire

Gulf was not closed, not just Texas waters. Lack of enforcement is also listed as one of the major problems.

We think that the objectives of the Fishery Management Plan have been realized this year, as they have been since 1981, through implementation of the closed fishing season (Nichols 1984, Nichols 1984a, Poffenberger 1984). The average size of shrimp caught in the offshore waters was again predominated by the shrimp in the 31-40 count size categories. It was also our observation that little or no discarding occurred after the season was open, except at the opening due to heavy catches of fish in areas 18 and 19. Therefore, the closed area has protected emigrating juvenile shrimp until they grow to a larger size, thereby optimizing for a larger size shrimp. Without the closure, there is no question that small juvenile shrimp would be exploited and that the average size of shrimp anticipated to be caught in June and part of July would be similar to that encountered off the Louisiana coast this year, namely 95-100 count shrimp, thereby increasing the take of small shrimp at the cost of harvesting larger shrimp at a later time. We believe that the Texas Closure has indeed been a benefit to the fishery by allowing them to harvest larger shrimp even though the 1984 season has been below average, due to below average recruitment.

Considerable concern has been expressed about the amount of imported aquaculture shrimp coming into the United States from various countries. We have taken the opportunity to collect information on the size classes of shrimp imported from Ecuador; we presume that the majority of the shrimp that we have monitored from 13 September 1984 through 31 January 1985 are predominantly from culture sources. We conclude that the predominant modal groups being imported are 33-40, 26-30 and 41-50, with approximately 35, is the 31-40 count size group. Overall, the predominant size grouping are from 26-50 count, composing approximately 66% of all the imported shrimp from Ecuador.

Ecuador has apparently experienced severe difficulties this year with obtaining adequate numbers of postlarvae (Weidner)[8] and that total imports to the United States are down about 10% in 1984 from 1983. It is anticipated within the next five years, Ecuador will resolve their problems and their production may increase over that of 1983 and 1984. If they are gearing for the 26-50 size count shrimp, then the Council may want to consider alternate management measures for domestic shrimp fisheries. However, the conditions for culturing and marketing are extremely fluid. At the present time, there is a big differential between the price of 31-40 and 26-30 count shrimp. We also understand that many culture farms in Ecuador are experiencing decreasing profit margins because of the scarcity of postlarvae and the difficulty of bringing production hatcheries on-line.

[8]Dennis W. Weidner personal communication, Foreign Affairs Officer, NMFS, Washington, D.C.

SUMMARY

Brown shrimp production in statistical subareas 18-21 from May 1983 to April 1984 amounted to 18.1 million pounds. Over 9.9 million pounds were produced in July and August 1983 compared with 25.0 and 13.1 million pounds produced in July and August of 1981 and 1983, respectively. Peak production occurred from July to September and accounted for 66% (11.7 million pounds) of the total landings. Fair catches and fair levels of relative abundance occurred off the Texas coast in July and August. A peak in CPUE of almost 1,414 pounds/day occurred in July but dropped to 714 pounds/day in August. Production of brown shrimp from September to December 1982 amounted to 6.6 million pounds with an average CPUE of around 452 pounds/day. In the January-April period, production amounted to only 900 thousand pounds with the CPUE falling to an average of approximately 224 pounds/day.

The offshore brown shrimp production in statistical subareas 13-17 from May 1983 to April 1984 amounted to 12.7 million pounds. The 4.9 million-pound brown shrimp catch in Louisiana offshore waters during the July-August 1983 period was much lower than the 9.9 million lbs produced in Texas waters. The CPUE averaged 439 pounds/day. The September-December Louisiana offshore catch amounted to 2.5 million pounds, down from 4.3 lbs in 1981 and 2.8 lbs in 1982. This time period's overall CPUE of 526 pounds/day, was about 14% higher than in Texas offshore waters. The catch in January-April amounted to only 1.3 million pounds with an average CPUE of 395 pounds/day, or about 43% higher than in Texas.

In comparing the catch, fishing effort and CPUE for offshore waters of Texas from September 1983 to April 1984 with those for the same period in the historical data set (1960-1979), we found no significant differences in catch. Fishing effort was significantly greater and CPUE was significantly lower off Texas than Louisiana. The major differences, however, that were observed

were the catches and CPUEs that occurred in July and August.

Recruitment to the Texas brown shrimp fishery in 1983 was below average. Our predicted annual production of 17.8 million pounds from July 1983-June 1984 was very close to the actual catch of 18.1 million pounds, and was well below the average 26.9 million pounds for offshore production covering the past 24 years.

Recruitment in 1984 appeared to be much greater than in 1982 and 1983 but less than 1981. We estimated an annual yield of 22.9 million pounds with a range from 18 to 29 million pounds for Texas offshore waters. The offshore catch in July-August 1984 from Subareas 18-21 amounted to 15.3 million pounds or an estimated annual yield of 32.3 or 25.3 million pounds depending on the percent caught during July-August. Louisiana Wildlife and Fisheries also indicated that brown shrimp recruitment to Louisiana fisheries would be higher in 1984 than in 1982 and 1983.

The catch off Texas in July-August 1984 amounted to 15.3 million pounds compared to 9.9, 13.1 and 25.0 million pounds in 1983, 1982 and 1981, respectively. The average CPUE for this period was 819 pounds/day compared to almost 962 pounds/day in 1983, 922 pounds/day in 1982 and 1,895 pounds/day in 1981. The main difference was the higher effort expended in 1984, because of the early opening of the Texas closure season, than in 1983-1981 (effort was 18.6, 10.3, 15.7 and 14.8 thousand days from 1984 through 1981).

The July-August 1984 catch off Louisiana amounted to 6.6 million pounds with an -average CPUE of 587 pounds/day, whereas the July-August 1983 catch was 4.9 million pounds with an average CPUE of 439 pounds/day. The July-August 1984 Texas offshore brown shrimp catch and CPUE were 2.3 and 1.4 times greater than the respective catch and CPUE off Louisiana. The difference in the offshore catches is assumed to be attributed to more larger shrimp being present which we believe is due to the Texas closure management measure. The lower catch and CPUE off Louisiana may be due to

the extensive Louisiana inshore and offshore fisheries, which harvest predominantly small shrimp in May and June.

In 1984 the total Louisiana May-August catch was 27% greater than in 1983 and in Texas the total catch was 30% greater than in 1983. Both states recorded higher landings in 1984 thru 1983. The inshore fisheries shares of the total landings was 52% in Louisiana and 30% in Texas.

The Louisiana inshore brown shrimp fishery produced approximately 14.9 million pounds in 1984 compared with 12.1 million pounds in 1983. The inshore catch was predominated by shrimp in the 116-count or larger size category. Texas inshore fisheries accounted for approximately 7.1 million pounds of brown shrimp in 1983 and 5.9 million pounds in 1983, but only 4.1 million pounds in 1982. The inshore catch in 1984 was predominated also by shrimp of 116-count or larger size groups. The increased inshore Texas catch may seriously impact the Texas offshore shrimp fishery if not limited (Nichols 1984).

The size composition of the 1984 offshore brown shrimp catch in Texas waters was approximately the same as in 1981, 1982 and 1983, dominated by the 31-40 count size category.

Prior to the 1981 Texas Closure, most of the landings were off Texas during the closure period. Since 1981, during the closure periods, over 90% of the Texas landings were off Louisiana. An extremely small amount of shrimp caught by Texas vessels is landed in Louisiana ports during the closure. Texas home port vessels are taking a smaller share of the brown shrimp crop each year. In 1981 Texas vessel harvested over 50% of the brown shrimp caught off Texas from July 16 through December, but in 1982 it decreased to 36% and 20% in 1983.

Several problems were identified by fishermen throughout the Gulf. They are:

1. Inadequate notice for early openings to fishermen fishing out of Florida, Mississippi, and Alabama.

2. Too many out-of-state vessels fishing during the opening season leaving few shrimp during the remainder.

3. Unable to fish for pink shrimp in 10-15 fathoms depth zones in areas 18 and 19 during the closed period.

4. Unable to catch adequate white shrimp because of restrictions on gear size and depth during the Texas Closure.

5. Loss of migrating shrimp to Mexico during the closure period.

6. Questions as to why there was not a closure throughout the entire northern Gulf.

7. Inadequate enforcement of the Texas Closure regulations by the Coast Guard.

The goals of the Fishery Management Plan were achieved in 1984 as they were in 1983, 1982 and 1981. Small emigrating brown shrimp were protected and allowed to grow to an average size of 31-40 count and discarding was not prevalent. Without a prohibition on trawling during the period of brown shrimp emigration, it is anticipated that large quantities of small shrimp would have been caught resulting in wastage and a lower yield to the fishery.

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LIST OF TABLES

Table 1. Monthly summary of total offshore brown shrimp catch in millions of pounds, total fishing effort in 1000's of days and CPUE for Louisiana statistical subareas 13-17, and Texas statistical subareas 18-21 for 1972-1984 (1980 not included).

	Jan.		Feb.		Mar.		Apr.	
Area	13-17	18-21	13-17	18-21	13-17	18-21	13-17	18-21
1972								
Catch	0.5	0.9	0.5	0.5	0.7	0.4	0.2	0.3
Effort	0.9	2.0	1.1	1.6	1.8	1.2	0.6	1.3
CPUE	541	451	469	304	368	349	274	212
1973								
Catch	1.1	0.4	0.8	0.3	0.8	0.4	0.5	0.4
Effort	1.6	1.4	2.0	0.7	2.0	1.0	1.2	1.7
CPUE	695	272	414	439	400	350	411	222
1974								
Catch	0.5	1.1	0.4	0.6	0.3	0.5	0.2	0.4
Effort	1.1	1.7	1.0	1.5	0.8	1.5	0.6	1.9
CPUE	448	653	408	427	385	301	308	202
1975								
Catch	0.4	0.7	0.4	0.6	0.4	0.3	0.2	0.2
Effort	0.5	1.8	1.1	1.7	1.0	1.0	0.6	0.0
CPUE	754	407	376	327	388	293	324	0.0
1976								
Catch	0.8	0.5	0.6	0.6	0.4	0.4	0.5	0.5
Effort	1.4	1.3	1.3	2.0	1.0	1.7	1.2	2.1
CPUE	534	384	501	289	401	245	370	227
1977								
Catch	0.5	0.2	0.4	0.2	0.5	0.1	0.4	0.3
Effort	1.8	1.0	1.6	0.9	1.8	0.7	1.8	1.5
CPUE	296	193	249	163	274	149	232	201
1978								
Catch	0.9	0.7	1.1	0.5	1.4	1.2	0.5	0.4
Effort	1.1	2.0	2.1	1.3	3.4	0.9	1.2	1.6
CPUE	836	353	531	371	413	174	438	247
1979								
Catch	0.7	0.7	1.0	0.6	0.8	0.5	0.6	0.4
Effort	1.9	2.3	2.0	2.4	2.3	2.1	2.0	1.5
CPUE	374	312	524	266	361	235	312	293
1981								
Catch	0.2	0.3	0.1	0.1	0.2	0.06	0.08	0.06
Effort	0.6	1.0	0.4	0.4	0.4	0.3	.04	0.2
CPUE	319	253	329	296	387	228	195	301
1982								
Catch	0.5	0.6	0.6	0.6	0.4	0.2	0.2	0.2
Effort	0.9	1.4	1.2	1.9	1.1	0.6	0.7	0.8
CPUE	549	454	446	317	370	276	281	271
1983								
Catch	0.4	0.3	0.3	0.2	0.4	0.1	0.3	0.2
Effort	1.2	1.0	1.2	1.0	1.1	0.5	0.8	0.8
CPUE	373	261	281	206	331	255	346	215
1984								
Catch	0.4	0.2	0.4	0.2	0.3	0.1	0.3	0.3
Effort	0.8	1.2	0.9	0.9	0.8	0.6	0.8	1.2
CPUE	502	196	382	236	326	227	366	74

Table 1. cont. Monthly summary of total offshore brown shrimp catch in millions of pounds, total fishing effort in 1000's of days and average CPUE for Louisiana statistical subareas 13-17, and Texas statistical subareas 18-21 for 1972-1984 (1980 not included).

	May		June		July		Aug.	
Area	13-17	18-21	13-17	18-21	13-17	18-21	13-17	18-21
1972								
Catch	1.1	0.8	1.3	3.1	2.9	7.9	4.6	9.5
Effort	1.7	1.2	2.0	4.3	3.1	6.9	5.0	9.6
CPUE	637	612	667	724	940	1155	924	989
1973								
Catch	0.8	0.7	2.5	2.8	1.1	7.2	1.3	4.0
Effort	1.9	2.9	3.7	3.0	2.8	7.3	3.2	10.2
CPUE	423	261	673	925	402	989	406	392
1974								
Catch	0.8	0.6	1.1	1.8	2.1	5.9	1.9	7.1
Effort	2.2	2.9	2.3	3.9	3.3	7.3	3.0	10.8
CPUE	374	219	480	455	628	806	637	657
1975								
Catch	1.0	0.5	0.7	2.7	1.5	6.1	1.4	5.4
Effort	1.4	2.2	1.4	3.4	2.0	6.8	2.3	8.2
CPUE	724	208	529	797	723	891	620	651
1976								
Catch	1.4	0.8	3.8	1.2	4.8	6.2	3.1	5.3
Effort	3.2	3.1	5.0	2.5	5.4	7.4	3.6	8.8
CPUE	456	246	770	497	880	839	866	607
1977								
Catch	3.6	0.5	6.4	2.1	5.9	8.6	5.9	8.1
Effort	4.3	3.6	7.7	2.8	6.3	7.5	6.3	9.0
CPUE	839	150	835	771	935	1147	943	891
1978								
Catch	5.3	0.8	5.6	2.6	8.5	5.4	5.1	6.3
Effort	7.7	3.8	8.0	3.8	9.0	5.5	7.2	8.4
CPUE	685	217	708	677	941	982	713	746
1979								
Catch	4.1	0.9	5.7	1.9	4.2	3.9	5.3	3.5
Effort	7.6	3.2	10.4	3.3	14.7	5.6	9.6	6.3
CPUE	536	271	554	582	285	685	555	548
1981								
Catch	5.0	0.4	7.6	-	7.5	10.4	3.0	14.6
Effort	5.8	1.1	9.0	-	8.1	4.4	3.8	10.4
CPUE	861	308	842	-	927	2382	799	1408
1982								
Catch	3.3	0.8	5.3	-*	3.3	6.6	1.8	6.4
Effort	5.4	2.6	8.8	-	6.4	5.2	3.4	10.2
CPUE	609	295	604	-	525	1279	522	629
1983								
Catch	1.0	0.5	2.9	0.2	2.6	5.2	2.3	4.8
Effort	2.5	1.8	6.6	0.5	4.2	3.7	4.9	6.7
CPUE	417	294	441	163	415	1414	470	714
1984								
Catch	2.6	0.6	4.5	0.2	3.8	8.8	2.7	6.5
Effort	3.3	2.1	6.5	0.3	6.4	8.2	4.7	9.0
CPUE	769	275	691	748	598	1074	573	723

Table 1. cont. Monthly-summary of total offshore brown shrimp catch in millions of pounds, total fishing effort in 1000's of days and CPUE for Louisiana statistical subareas 13-17, and Texas statistical subareas 18-21 for 1972-1984 (1980 not included).

	Totals and Averages for Jan-Apr.		Totals and Averages for May-June		Totals and Averages for July-Aug.		Totals and Averages for Sept.-Dec.	
Area	13-17	18-21	13-17	18-21	13-17	18-21	13-17	18-21
1972								
Catch	1.9	2.1	2.4	3.9	7.5	17.4	5.1	13.1
Effort	4.4	6.1	3.7	5.5	8.1	16.5	6.3	21.1
CPUE	413	329	652	668	932	1072	950	588
1973								
Catch	3.2	1.5	3.3	3.5	2.4	11.2	1.8	7.1
Effort	6.8	4.8	5.6	5.9	6.0	17.5	3.5	15.1
CPUE	480	321	548	593	404	691	590	506
1974								
Catch	1.4	2.6	1.9	2.4	4.0	13.0	3.5	8.4
Effort	3.5	6.6	4.5	6.8	6.3	18.1	4.8	13.5
CPUE	387	396	427	337	633	732	807	575
1975								
Catch	1.4	1.8	1.7	3.2	2.9	11.5	3.1	8.3
Effort	3.2	4.5	2.8	5.6	4.3	15.0	4.1	16.5
CPUE	461	257	627	503	671	771	940	497
1976								
Catch	2.3	2.0	5.2	2.0	7.9	11.5	5.7	10.7
Effort	4.9	7.1	8.2	5.6	9.0	16.5	9.6	19.1
CPUE	452	286	613	372	873	723	590	504
1977								
Catch	1.8	0.8	10.0	2.6	11.8	16.7	5.8	12.6
Effort	7.0	4.1	12.0	6.5	12.6	16.5	8.1	20.7
CPUE	263	177	837	461	939	1019	765	586
1978								
Catch	3.9	1.8	10.9	3.4	13.6	11.7	4.1	10.9
Effort	7.8	5.8	15.7	7.6	16.2	13.9	8.9	24.4
CPUE	555	286	697	447	827	864	451	436
1979								
Catch	3.1	2.2	9.8	2.8	9.5	7.4	4.1	6.4
Effort	8.2	8.3	18.0	6.5	24.3	11.9	11.2	15.0
CPUE	393	277	545	427	420	617	387	420
1981								
Catch	0.6	0.5	12.6	0.4	10.5	25.0	4.3	14.1
Effort	1.8	1.9	14.8	1.1	11.9	14.8	6.6	21.1
CPUE	308	269	852	308	863	1895	654	648
1982								
Catch	1.7	1.6	8.6	0.8	5.1	13.1	2.8	7.3
Effort	3.9	4.7	14.2	2.6	9.8	15.7	6.2	18.0
CPUE	412	330	607	295	524	922	447	403
1983								
Catch	1.4	0.8	3.9	0.7	4.9	9.9	2.5	6.6
Effort	4.3	3.3	9.1	2.3	11.2	10.3	4.7	14.6
CPUE	326	242	43	310	439	962	526	452
1984								
Catch	1.3	0.9	7.1	0.8	6.6	15.3	-	-
Effort	3.4	3.9	9.8	2.4	11.2	18.6	-	-
CPUE	395	224	718	295	587	819	-	-

Table 2. Results of paired comparisons test of landings data, Sept 1983-Apr. 1984 from statistical subareas 13-17 and 18-21.

Source	Degrees of Freedom	F
Areas	1	0.878 n.s.
Months	7	2.903 n.s.
Error	7	
Total	15	

n.s. = not significant
*F.0.5(1,7) = 5.59
**F.0.5(7,7) = 3.77

Table 3. Results of paired comparisons test of fishing effort data, Sept. 1983-Apr. 1984 from statistical subareas 13-17 and 18-21.

Source	Degrees of Freedom	F
Areas	1	7.350 *
Months	7	1.607 n.s.
Error	7	
Total	15	

ns = not significant
*$F_{.0.5(1,7)} = 5.59$
**$F_{.0.5(7,7)} = 3.77$

Table 4.. Results of paired comparisons test of CPUE data, Sept. 1983-Apr. 1984 from statistical subareas 13-17 and 18-21.

Source	Degrees of Freedom	Mean Square	F
Areas	1		17.123 **
Months	7		4.682 *
Error	7		
Total	15		

ns = not significant
*F.0.5(1,7) = 5.59
**F.0.5(7,7) = 3.77

Table 5. Results of t-tests of monthly catch, effort and CPUE for statistical subareas 18-21 combined for Sept. 1983-April 1984, versus the means for these months based on the historical data set, 1960-1979.

Month	df	Catches	df	Effort	df	CPUE[2]
Sept	19	-1.563[A]	19	-1.554	19	-1.171
Oct	19	-0.832	19	-0.444	19	-0.895
Nov	19	-0.353	19	-0.225	19	-0.971
Dec	19	-0.181	19	-0.515	19	-1.016
Jan	19	-1.042	19	-0.296	19	-1.602
Feb	19	-0.715	19	-1.157	19	-0.632
Mar	19	-1.103	19	-0.829	19	-0.727
Apr	19	-0.498	18	-0.419	18	-0.262

2-tailed $t_{0.05(19)} = 2.093$

2-tailed $t_{0.05(18)} = 2.101$

[A]Negative sign on these t-values indicates the historical mean was larger than this current month's value.

Table 6. Results of t-tests of monthly catch, effort and CPUE for statistical subareas 18-21 combined for September 1983-April 1984, versus the means for these months based on the data from 1975 to 1979.

Month	df	Catches	df	Effort	df	CPUE[2]
Sept	4	-1.563[A]	4	-1.149	4	-0.937
Oct	4	-1.027	4	-1.425	4	-0.086
Nov	4	-0.967	4	-0.489	4	-0.503
Dec	4	-0.038	4	-0.609	4	-0.148
Jan	4	-1.321	4	-0.872	4	-1.436
Feb	4	-1.210	4	-1.156	4	-0.493
Mar	4	-0.839	4	-1.003	4	-0.130
Apr	4	-0.879	3[B]	-1.725	3[B]	-0.000

2-tailed $t_{0.05(4)} = 2.776$

2-tailed $t_{0.05(3)} = 3.182$

[A]Negative sign-means the current value was less than the mean for 1975-79.

[B]1975 effort and CPUE are missing.

Table 7. Percent of Texas,, Louisiana, Mississippi, Alabama and Florida landings caught off each state from 1979 to 1983 June-December.

PERCENT OF 1979 TEXAS LANDINGS OFF EACH STATE

State Caught	Time Periods June	July	August	Sep-Dec
TX	64.9	82.0	68.2	77.5
LA	34.8	17.8	31.8	22.5
MS	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0
FL	0.3	0.1	0.0	0.0
Lbs Millions	3.098	4.856	5.024	12.079

PERCENT OF 1979 LOUISIANA LANDINGS OFF EACH STATE

State Caught	Time Periods June	July	August	Sep-Dec
TX	0.0	0.9	1.4	0.0
LA	100.0	99.1	98.6	99.8
MS	0.0	0.0	0.0	0.1
AL	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.1
Lbs Millions	4.566	2.781	3.778	14.526

Table 7. continued

PERCENT OF 1979 MISSISSIPPI LANDINGS OFF EACH STATE

State Caught	Time Periods June	July	August	Sep-Dec
TX	0.0	0.0	0.0	0.0
LA	79.6	0.0	39.1	58.0
MS	20.4	100.0	60.9	42.0
AL	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0
Lbs Millions	.051	.075	.041	.324

PERCENT OF 1979 ALABAMA LANDINGS OFF EACH STATE

State Caught	Time Periods June	July	August	Sep-Dec
TX	0.0	0.0	5.2	0.0
LA	53.6	52.3	64.6	73.0
MS	45.0	47.7	30.3	26.4
AL	1.4	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.6
Lbs Millions	1.612	1.442	1.613	3.608

Table 7. continued

PERCENT OF 1979 FLORIDA LANDINGS OFF EACH STATE

State Caught	Time Periods June	July	August	Sep-Dec
TX	0.0	0.0	0.0	1.3
LA	6.5	1.1	4.1	2.1
MS	7.7	3.5	2.5	1.9
AL	0.4	0.0	0.1	0.1
FL	85.4	95.4	93.3	94.6
Lbs Millions	849.	.637	.700	4.914

PERCENT OF 1980 TEXAS LANDINGS OFF EACH STATE

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	75.7	90.7	90.1	94.1	88.6
LA	16.9	6.7	8.2	5.9	11.4
MS	0.0	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	7.4	2.6	1.7	0.0	0.0
Lbs Millions	1.797	2.603	2.313	7.621	18.978

Table 7. continued

PERCENT OF 1980 LOUISIANA LANDINGS OFF EACH STATE

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.1	3.6	1.8	2.0
LA	94.9	95.3	91.5	97.2	97.9
MS	5.1	4.5	4.9	1.0	0.1
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	5.252	1.830	1.999	4.254	23.605

PERCENT OF 1980 MISSISSIPPI LANDINGS OFF EACH STATE

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.0	0.0
LA	7.8	12.1	17.4	29.3	61.3
MS	87.6	87.9	82.6	63.2	29.2
AL	0.0	0.0	0.0	0.0	0.0
FL	4.6	0.0	0.0	7.5	9.5
Lbs Millions	.151	.043	.044	.103	.395

Table 7. continued

PERCENT OF 1980 ALABAMA LANDINGS OFF EACH STATE

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.0	0.0
LA	57.5	40.7	17.8	51.1	71.3
MS	40.1	59.1	82.2	48.9	25.9
AL	0.0	0.0	0.0	0.0	0.0
FL	2.4	0.2	0.0	0.0	2.8
Lbs Millions	1.237	.538	.144	1.243	3.841

PERCENT OF 1980 FLORIDA LANDINGS OFF EACH STATE

State Caught	Time Periods June	July	August	Sep-Dec
TX	0.0	0.0	0.0	1.1
LA	0.0	0.0	2.1	2.7
MS	2.3	1.1	0.7	0.3
AL	0.0	0.2	0.0	0.5
FL	97.7	98.7	97.3	95.5
Lbs Millions	1.128	.972	1.059	5.002

Table 7. continued

PERCENT OF 1981 TEXAS LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	1.2	1.2	92.9	97.6	91.7
LA	98.5	98.8	7.0	2.4	8.3
MS	0.2	0.0	0.1	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.1	0.0	0.0	0.0	0.0
Lbs Millions	2.508	2.602	10.128	13.626	19.673

PERCENT OF 1981 LOUISIANA LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.1	0.0	30.6	27.1	0.6
LA	99.8	100.0	69.3	72.9	98.4
MS	0.1	0.0	0.1	0.0	1.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	6.357	1.618	3.729	4.485	15.274

Table 7. continued

PERCENT OF 1981 MISSISSIPPI LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	17.7	0.0
LA	3.8	8.9	4.4	40.9	89.7
MS	96.2	91.1	95.6	41.4	10.3
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	.843	.151	.139	.199	.260

PERCENT OF 1981 ALABAMA LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	14.8	20.88	0.4
LA	42.7	50.3	52.6	57.34	69.3
MS	57.0	49.7	32.6	21.78	30.3
AL	0.0	0.0	0.0	0.0	0.0
FL	0.3	0.0	0.0	0.0	0.0
Lbs Millions	1.859	.738	.915	1.440	4.106

Table 7. continued

PERCENT OF 1981 FLORIDA LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	8.3	2.1
LA	3.6	0.0	11.7	15.7	9.5
MS	8.2	8.8	1.0	0.0	0.7
AL	0.0	0.0	0.0	0.0	0.0
FL	88.2	91.2	87.3	76.0	87.7
Lbs Millions	1.829	.436	.509	.720	4.429

PERCENT OF 1982 TEXAS LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	13.1	7.4	97.8	91.6	83.6
LA	86.1	91.7	2.2	8.4	16.4
MS	0.8	0.6	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.3	0.0	0.0	0.0
Lbs Millions	1.500	1.098	6.313	5.961	12.911

Table 7. continued

PERCENT OF 1982 LOUISIANA LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	27.9	36.3	1.6
LA	99.3	99.4	72.0	62.9	97.9
MS	0.7	0.6	0.1	0.8	0.5
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	4.659	1.310	1.805	2.464	12.382

PERCENT OF 1982 MISSISSIPPI LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	2.3	0.0	0.0
LA	0.0	0.0	7.1	11.8	70.1
MS	100.0	100.0	90.6	88.2	29.9
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	.125	.061	.078	.131	.287

Table 7. continued

PERCENT OF 1982 ALABAMA LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	17.3	12.6	0.2
LA	17.6	2.8	0.0	38.2	56.6
MS	82.4	97.2	82.7	49.2	42.9
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	1.313	.592	.447	1.198	3.045

PERCENT OF 1982 FLORIDA LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	10.0	17.1	0.6
LA	7.6	0.0	5.5	5.6	10.4
MS	9.2	0.0	0.5	0.1	0.0
AL	3.6	0.0	0.0	0.0	0.1
FL	79.6	100.0	84.0	77.2	89.0
Lbs Millions	.943	.320	.357	.649	3.506

Table 7. continued

PERCENT OF 1983 TEXAS LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	36.3	8.6	97.8	93.1	81.3
LA	63.7	91.4	2.2	6.9	18.7
MS	0.0	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	.890	.930	5.587	4.649	12.280

PERCENT OF 1983 LOUISIANA LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.2	10.7	13.6	0.3
LA	99.7	98.3	79.3	81.6	97.8
MS	0.3	1.5	10.0	4.8	1.9
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	3.681	.808	1.914	3.324	11.607

Table 7. continued

PERCENT OF 1983 MISSISSIPPI LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	24.1	0.7
LA	20.3	0.0	8.4	44.1	84.6
MS	79.7	100.0	91.6	31.8	14.7
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	.085	.029	.010	.073	.301

PERCENT OF 1983 ALABAMA LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	9.1	13.7	0.0
LA	14.9	10.7	17.5	16.3	27.0
MS	74.1	30.0	72.2	70.0	73.0
AL	8.5	59.3	1.2	0.0	0.0
FL	2.5	0.0	0.0	0.0	0.0
Lbs Millions	.925	.631	.170	1.059	3.645

Table 7. continued

PERCENT OF 1983 FLORIDA LANDINGS OFF EACH STATE PERCENT OF TOTAL POUNDS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	1.0	23.6	2.0
LA	0.1	0.0	0.0	0.0	6.2
MS	1.2	5.9	0.5	0.1	2.0
AL	1.0	3.6	0.1	4.3	0.1
FL	97.7	90.5	98.4	72.1	89.7
Lbs Millions	1.235	.360	.388	.560	2.949

Table 7. continued

PERCENT OF 1984 TEXAS LANDINGS OFF EACH STATE

State Caught	Time Periods June 1-30	July 1-15	July 16-31	August 1-31	Sep-Dec
TX	19.2	83.3	91.4	92.4	75.7
LA	80.8	16.4	8.5	7.6	24.3
MS	0.0	0.1	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.2	0.1	0.0	0.0
Lbs Millions	1.814	3.063	6.248	7.449	9.115

PERCENT OF 1984 LOUISIANA LANDINGS OFF EACH STATE

State Caught	Time Periods June 1-30	July 1-15	July 16-31	August 1-31	Sep-Dec
TX	0.0	1.1	20.2	6.2	6.3
LA	98.3	98.9	79.0	92.9	92.2
MS	1.7	0.1	0.8	0.9	1.4
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	4.558	1.063	3.005	3.621	3.465

Table 7. continued

PERCENT OF 1984 MISSISSIPPI LANDINGS OFF EACH STATE

State Caught	Time Periods June 1-30	July 1-15	July 16-31	August 1-31	Sep-Dec
TX	0.0	0.0	0.0	7.2	0.0
LA	7.8	20.1	0.0	40.4	41.2
MS	82.6	79.9	100.0	52.4	58.8
AL	0.0	0.0	0.0	0.0	0.0
FL	9.6	0.0	0.0	0.0	0.0
Lbs Millions	.085	.011	.008	.107	.052

PERCENT OF 1984 ALABAMA LANDINGS OFF EACH STATE

State Caught	Time Periods June 1-30	July 1-15	July 16-31	August 1-31	Sep-Dec
TX	0.0	2.2	45.7	5.7	0.8
LA	30.3	28.3	15.7	7.4	15.1
MS	65.8	69.5	38.6	86.0	84.1
AL	0.7	0.0	0.0	1.0	0.0
FL	3.2	0.0	0.0	0.0	0.0
Lbs Millions	1.098	.225	.462	1.162	.654

Table 7. continued

PERCENT OF 1984 FLORIDA LANDINGS OFF EACH STATE

State Caught	Time Periods June 1-30	July 1-15	July 16-31	August 1-31	Sep-Dec
TX	0.0	0.0	17.7	9.0	2.4
LA	0.0	0.0	0.0	0.0	0.5
MS	0.6	0.0	0.0	0.0	0.0
AL	0.0	0.1	0.7	0.0	0.4
FL	99.4	99.9	81.6	91.0	96.7
Lbs Millions	1.649	.441	.439	.662	2.202

Table 8. Percent of Texas, Louisiana, Mississippi, Alabama and Florida catch caught by Texas vessels from June-December in 1981, 1982 and 1983.

PERCENT OF 1981 TEXAS LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.6	0.1	53.2	59.6	52.5
LA	60.3	65.4	3.5	1.8	5.2
MS	0.0	0.0	0.1	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.1	0.0	0.0	0.0	0.0
Lbs Millions	2.508	2.602	10.128	13.626	19.672

PERCENT OF 1981 LOUISIANA LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.2	0.9	0.1
LA	0.8	2.8	0.6	1.0	0.6
MS	0.0	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	6.357	1.618	3.729	4.485	15.274

Table 8. continued

PERCENT OF 1981 MISSISSIPPI LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	4.6	0.0
LA	0.0	0.0	0.0	0.0	0.0
MS	0.9	0.0	0.0	0.0	0.2
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	.843	.151	.139	.199	.260

PERCENT OF 1981 ALABAMA LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.0	0.0
LA	0.0	0.0	0.0	0.0	0.2
MS	0.2	0.0	0.0	0.0	0.1
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	1.859	.738	.915	1.440	4.106

Table 8. continued

PERCENT OF 1981 FLORIDA LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.0	0.1
LA	0.0	0.0	0.0	0.0	0.0
MS	0.0	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.5	0.0	0.0	0.0	0.1
Lbs Millions	1.829	.436	.509	.720	4.429

PERCENT OF 1982 TEXAS LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	1.0	3.7	40.4	44.7	28.9
LA	54.7	50.6	1.3	3.2	4.2
MS	0.7	0.3	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	1.500	1.098	6.313	5.961	12.911

Table 8. continued

PERCENT OF 1982 LOUISIANA LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.7	0.0
LA	2.1	1.7	0.1	0.2	0.6
MS	0.0	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	4.659	1.310	1.805	2.464	12.382

PERCENT OF 1982 MISSISSIPPI LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.0	0.0
LA	0.0	0.0	0.0	0.0	0.0
MS	3.1	0.0	0.0	0.0	0.4
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	.125	.061	.078	.131	.287

Table 8. continued

PERCENT OF 1982 ALABAMA LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.0	0.0
LA	1.1	0.0	0.0	0.0	1.2
MS	1.2	1.6	0.0	1.1	0.1
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	1.313	.592	.447	1.198	3.045

PERCENT OF 1982 FLORIDA LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.0	0.0
LA	0.3	0.0	0.0	0.0	0.0
MS	0.0	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	1.7	0.5	0.0	0.6	4.3
Lbs Millions	.943	.320	.357	.649	3.506

Table 8. continued

PERCENT OF 1983 TEXAS LANDINGS OFF EACH STATE
BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	1.4	3.4	23.4	19.9	18.1
LA	17.8	28.5	0.4	1.7	3.5
MS	0.0	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	.890	.930	5.587	4.649	12.280

PERCENT OF 1983 LOUISIANA LANDINGS OFF EACH STATE
BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.1	0.0
LA	0.7	0.8	0.1	0.4	0.3
MS	0.0	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	3.681	.808	1.914	3.324	11.607

Table 8. -continued

PERCENT OF 1983 MISSISSIPPI LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.0	0.0
LA	0.0	0.0	0.0	0.0	0.0
MS	0.0	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	.085	.029	.010	.073	.301

PERCENT OF 1983 ALABAMA LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.0	0.0
LA	0.0	0.0	0.0	0.0	0.0
MS	0.0	0.0	0.0	0.0	0.1
AL	0.0	0.0	0.0	0.0	0.0
FL	0.0	0.0	0.0	0.0	0.0
Lbs Millions	.925	.631	.197	1.059	3.645

Table 8. continued

PERCENT OF 1983 FLORIDA LANDINGS OFF EACH STATE BY TEXAS VESSELS

State Caught	Time Periods June	July 1-15	July 16-31	August	Sep-Dec
TX	0.0	0.0	0.0	0.0	0.4
LA	0.0	0.0	0.0	0.0	0.0
MS	0.0	0.0	0.0	0.0	0.0
AL	0.0	0.0	0.0	0.0	0.0
FL	4.9	1.4	1.1	0.5	1.0
Lbs Millions	1.235	.360	.388	.560	2.949

Table 9. Galveston Bay Bait shrimp index from 1960 through 1984.

Year	Bait Index	Predicted catch	Actual Texas Offshore catch July-June in millions of lbs	Difference in million of lbs
1960	53.6	29.1	34.5	+ 5.4
1961	20.8	20.0	13.2	- 6.8
1962	26.1	21.5	17.3	- 4.2
1963	53.0	29.0	24.6	- 4.4
1964	30.2	22.6	18.6	- 3.9
1965	41.0	25.6	26.5	+ 0.9
1967	89.4	39.0	42.7	+ 3.7
1968	28.0	22.0	27.9	+ 5.9
1969	43.5	26.3	24.7	- 1.6
1970	70.0	33.7	30.7	- 3.0
1971	82.3	37.1	34.5	- 2.6
1972	85.6	38.0	35.5	- 2.5
1973	18.7	19.4	23.3	+ 3.9
1974	34.3	23.8	26.4	+ 2.6
1976	34.1	23.6	25.7	+ 2.1
1977	58.1	30.3	34.4	+ 4.0
1978	40.5	25.5	27.7	+ 2.2
1980	45.0	26.7	25.7	- 1.0
1981	54.3	29.3	40.0	+10.7
1982	26.3	21.5	21.8	+ 0.3
1983	12.7	17.8	18.1	+ 0.3
1984	31.2	22.9		

Table 10. Inshore brown shrimp catch 1984, in 1,000 of pounds - Louisiana from the Mississippi River to Texas.

Size Count	May	June	July	Aug.	Total
15				1.4	1.4
16-20				0.3	0.3
21-25				0.3	0.3
26-30			0.8	12.9	13.7
31-40		15.9	4.4	63.9	84.2
41-50	1.4	43.9	27.4	96.0	168.7
51-67	50.5	544.7	270.4	197.9	1,063.5
68-80	25.7	510.1	400.5	66.8	1,003.1
81-100	304.2	1,258.0	401.0	35.3	1,998.5
101-115	773.4	1,759.0	283.2	46.1	2,861.7
>116	3,182.4	3,923.0	412.7	20.8	7,538.9
Total	4,337.9	8,054.4	1,800.3	541.7	14,734.3

Table 11. Texas inshore brown shrimp catch 1984, in 1,000 of pounds.

Size Count	May	June	July	Aug.	Total
15					
16-20		3.0	2.5	0.3	5.8
21-25		3.5	0.2	0.5	4.2
26-30	2.5	3.2	2.4	1.9	10.0
31-40	1.1	34.6	41.5	21.7	98.9
41-50	3.9	65.2	66.7	28.7	164.5
51-67	31.0	176.7	303.4	65.9	577.0
68-80	81.9	436.3	332.6	69.1	919.9
81-100	255.2	509.0	320.1	32.3	1,116.6
101-115	400.3	571.7	290.5	10.7	1,273.2
>116	1,253.7	1,427.3	244.2	12.6	2,937.8
Total	2,029.6	3,230.5	1,604.1	232.7	7,107.9

Table 12. May-Aug catch of brown shrimp in millions of pounds from inshore and offshore Louisiana- waters in statistical subareas 13-17 and in Texas waters in statistical subareas 18-21.

Area	Years						
	1984	1983	1982	1981	1980	1979	1978
Louisiana:							
Inshore	14.9	12.1	15.1	15.2	7.3	10.6	14.1
Offshore	13.6	8.8	13.7	23.1	11.7	19.3	24.5
Total	28.5	20.9	28.8	38.3	19.0	29.9	38.6
Texas:							
Inshore	7.1	5.9	4.1	4.2	4.5	2.0	2.0
Offshore	16.1	10.5	13.9	25.3	12.6	10.1	15.1
Total	23.5	16.4	18.0	29.5	17.1	14.2	17.1

Table 13. Percent by size class of shrimp imported from Ecuador from Sept 13, 1984-Jan 31, 1985.

Size Class	Percent
<15	3
15-20	3
21-25	9
26-30	19
31-40	35
41-50	12
51-60	6
61-70	3
>70	7
Others	3
Total lbs	16,872,000

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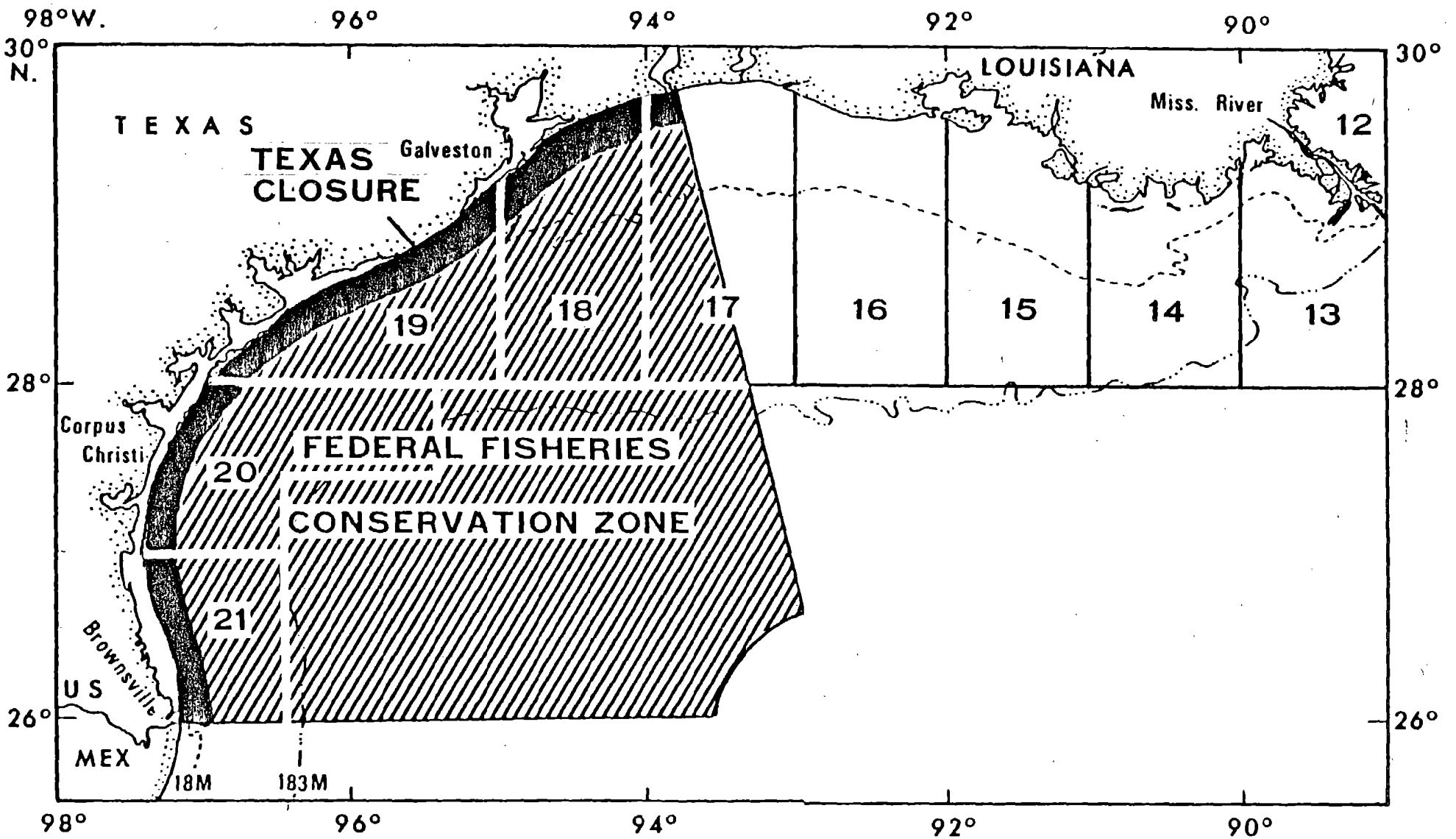

Figure 1. Location of statistical subareas and the Texas Closure area.

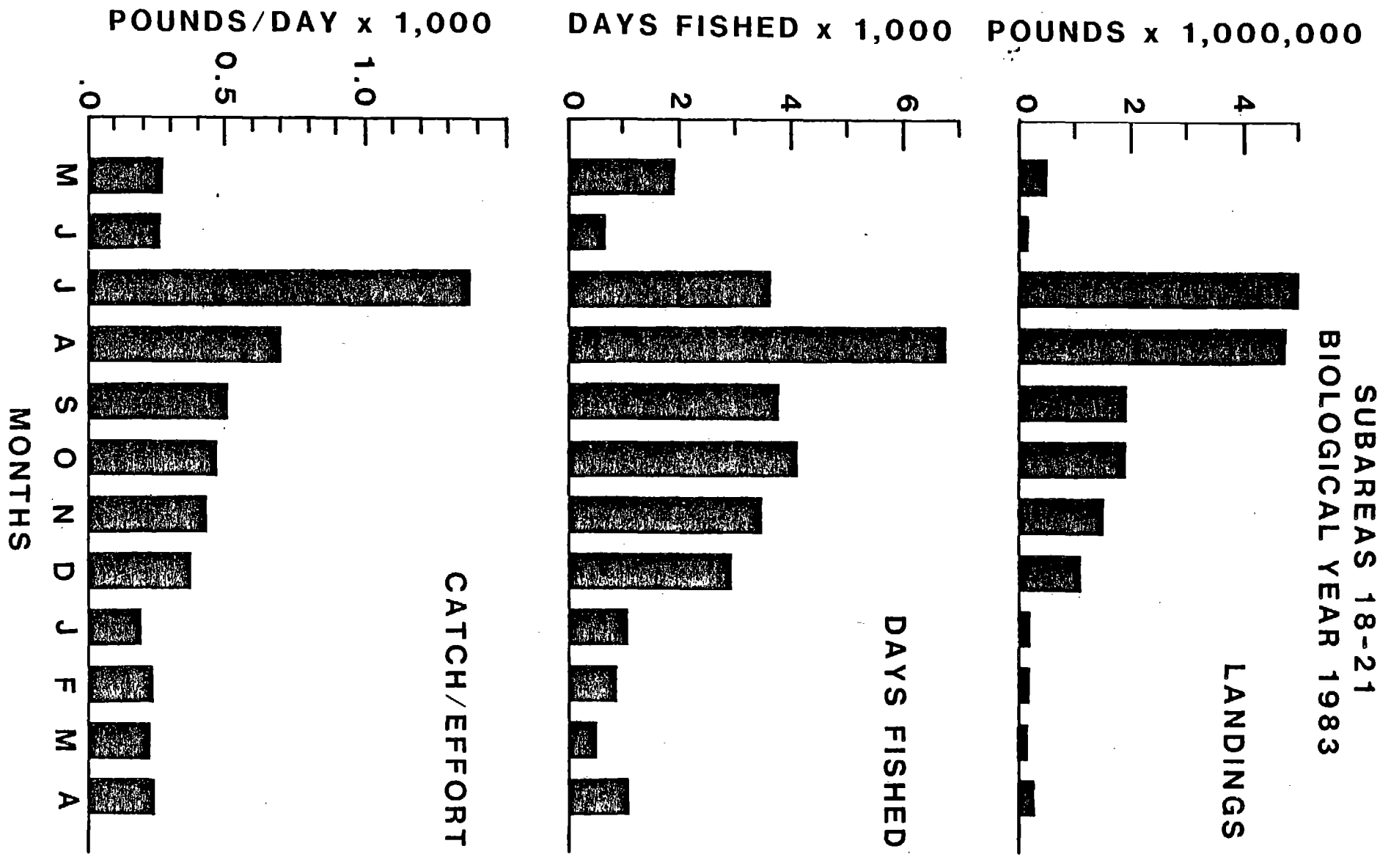

Figure 2. Commercial catch statistics from May 1983 to April 1984 for statistical subareas 18-21 a) catch in millions of pounds, b) fishing effort in thousands of days fished and c) CPUE.

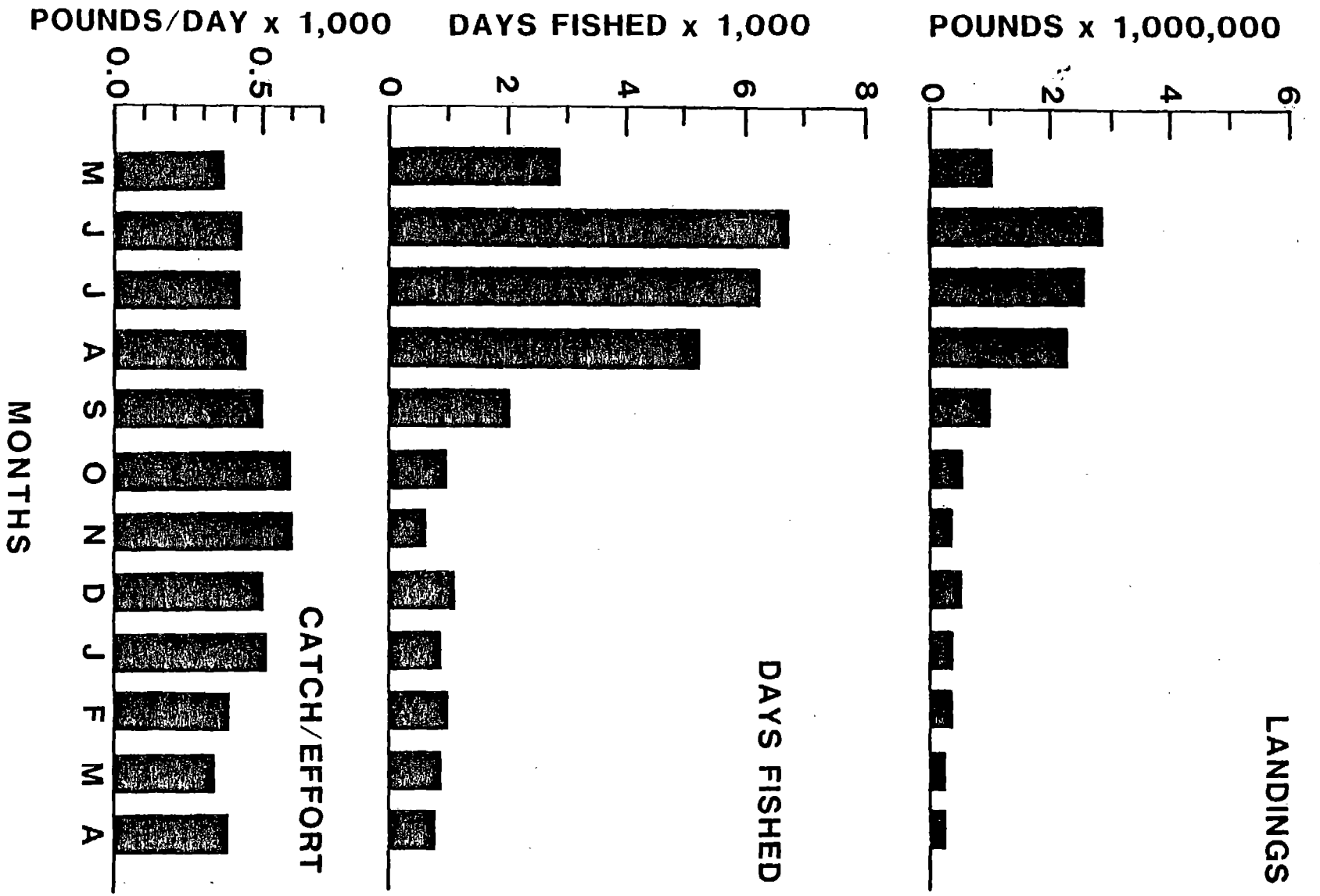

Figure 3. Commercial catch statistics from May 1983 to April 1984 for statistical subareas 13-17 a) catch in millions of pounds, b) fishing efforts in thousands of days and c) CPUE.

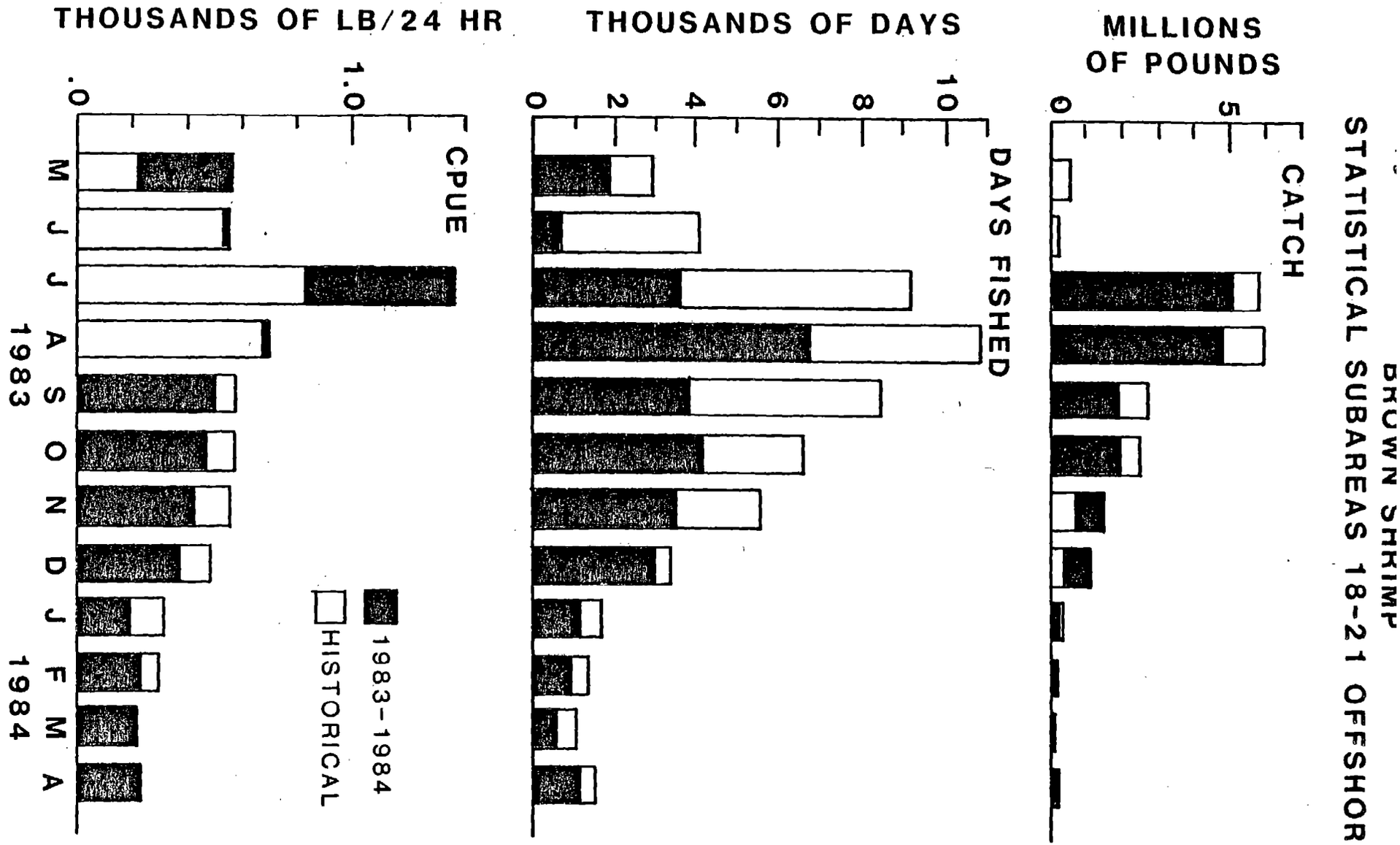

Figure 4. Average monthly historical commercial catch statistics with standard deviation (±) 1960-1981 and catch statistics from May 1983 to April 1984 for statistical subareas 10-21 a) catch in millions of pounds, b) fishing effort in 1,000s of days fished and c) CPUE.

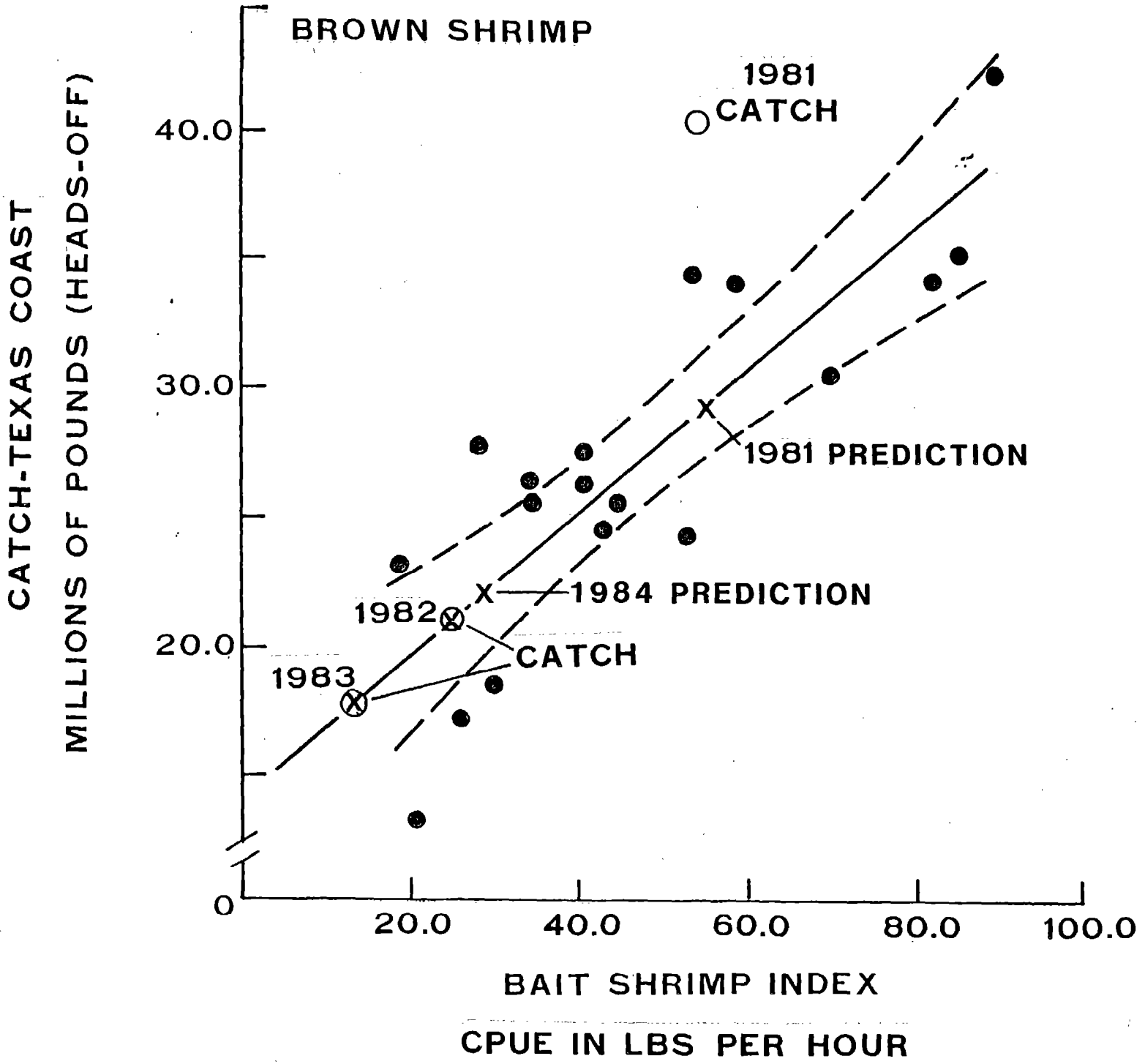

Figure 5. Predicted annual July-June brown shrimp offshore catch in Texas, 1960-1984.

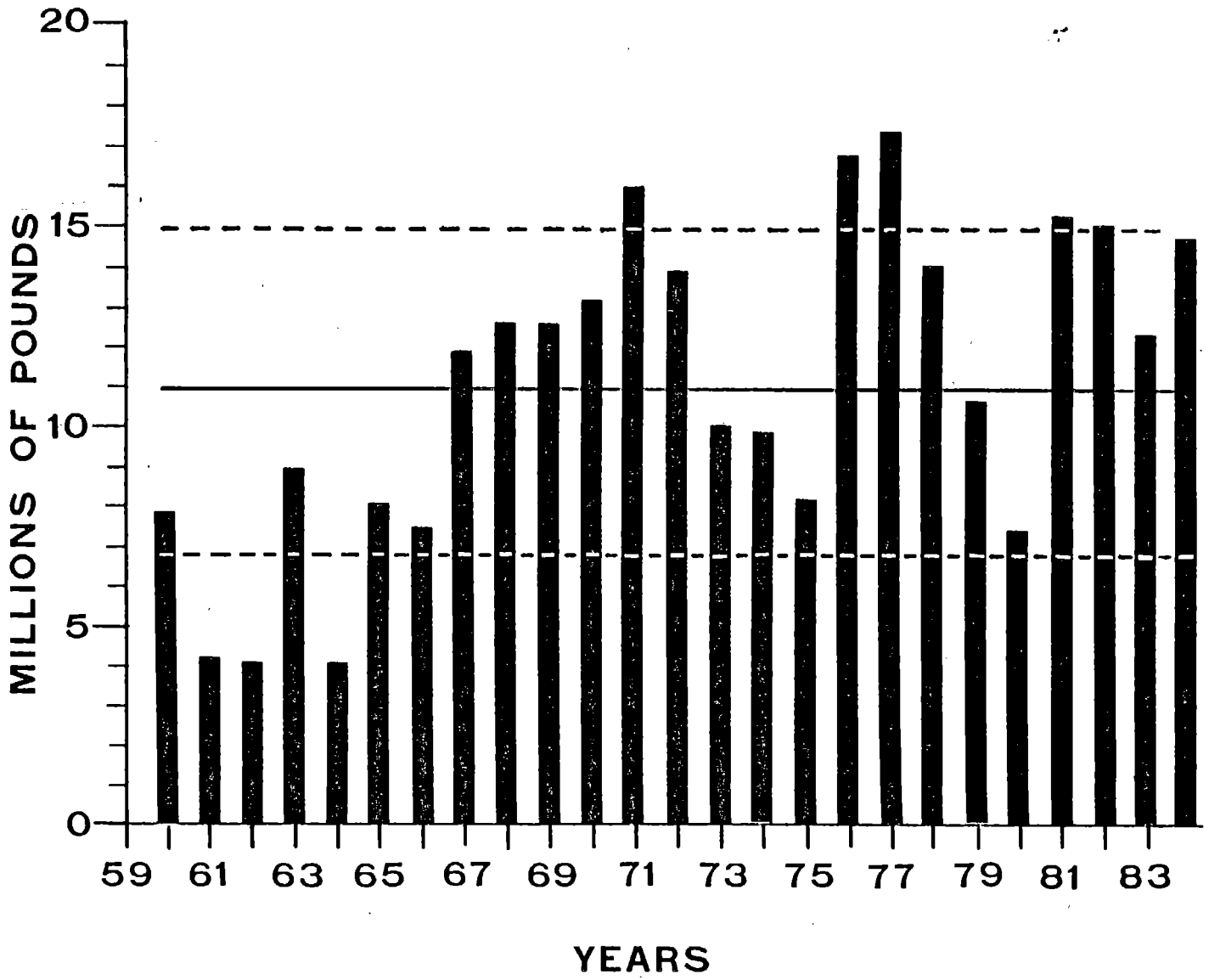

Figure 6. Annual inshore brown shrimp landings in Louisiana, most of the Mississippi River (solid, line is average 1960-1983 and broken line is standard deviation).

SUBAREAS 18-21 INSHORE BROWN SHRIMP LANDINGS MAY-APRIL

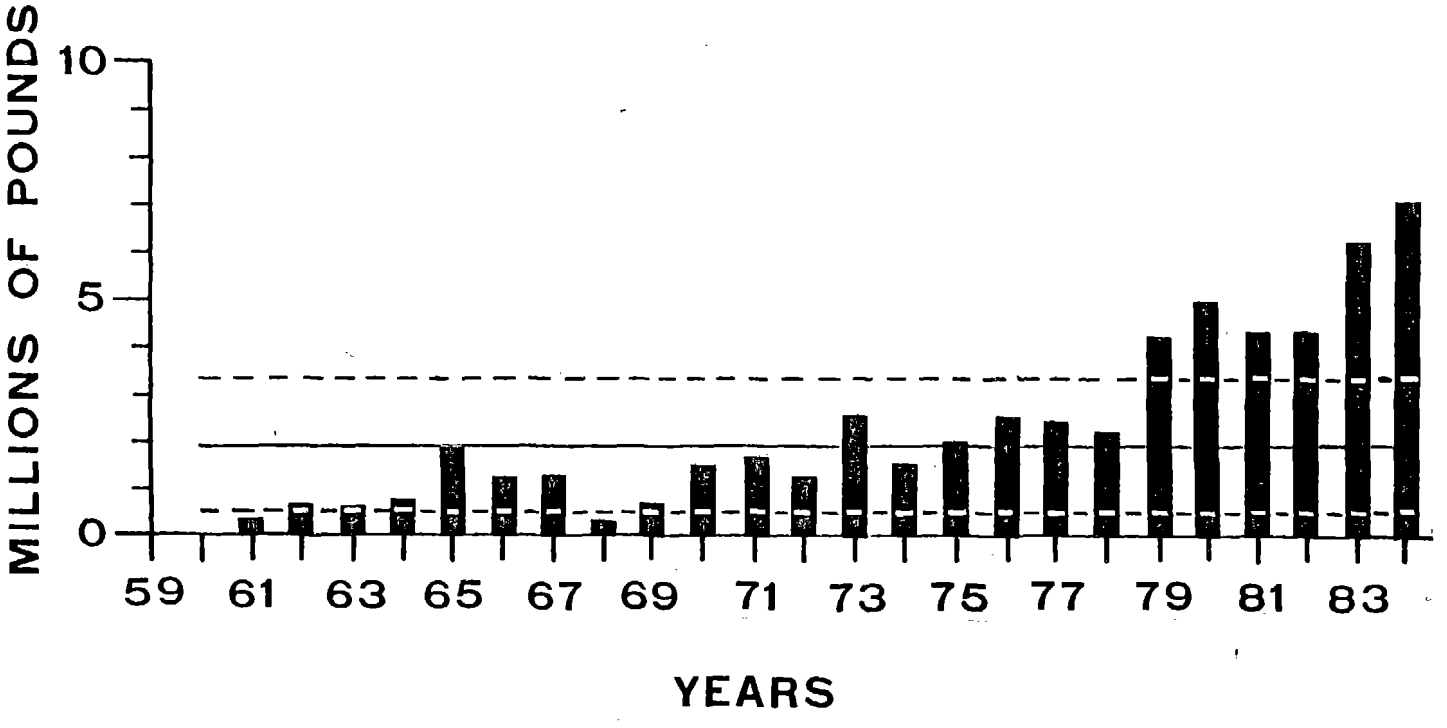

Figure 7. Annual inshore brown shrimp landings in Texas (solid line is average 1960-1983 and broken line is one standard deviation).

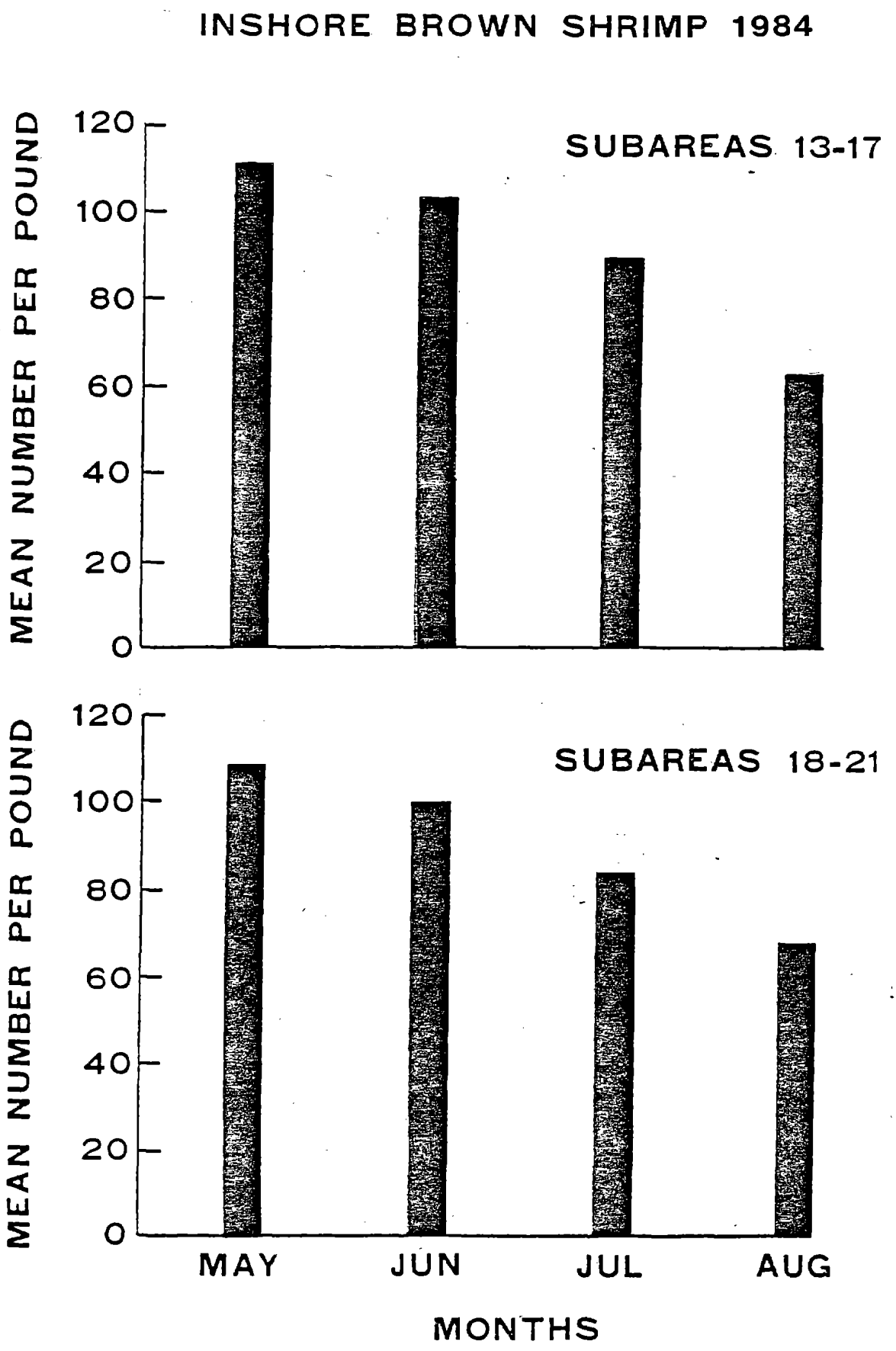

Figure 8. Average number of shrimp per pound caught in the inshore waters of a) Louisiana and b) Texas using size categories 15/116.

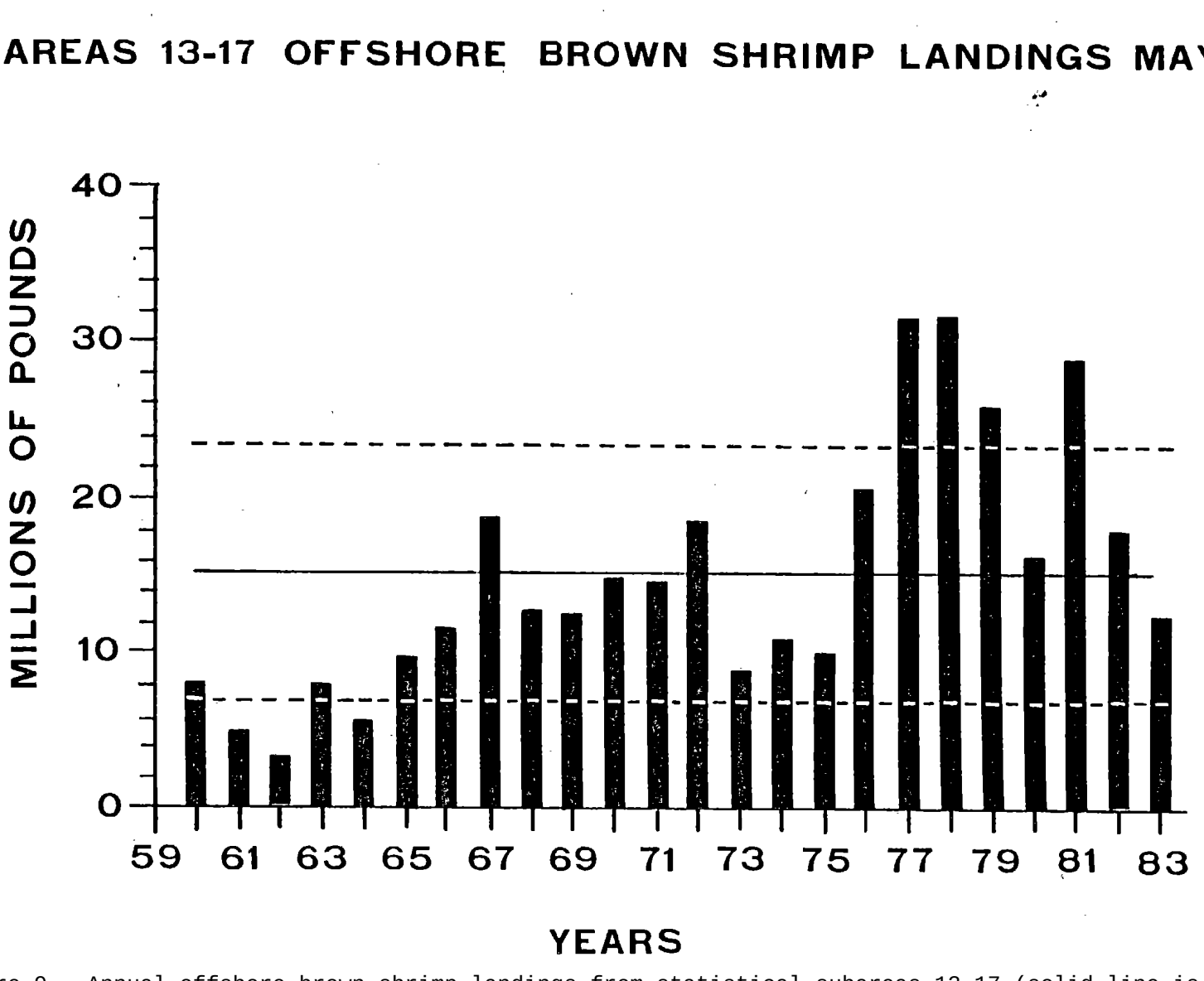

Figure 9. Annual offshore brown shrimp landings from statistical subareas 13-17 (solid line is average 1960-1983 and broken line is one standard deviation).

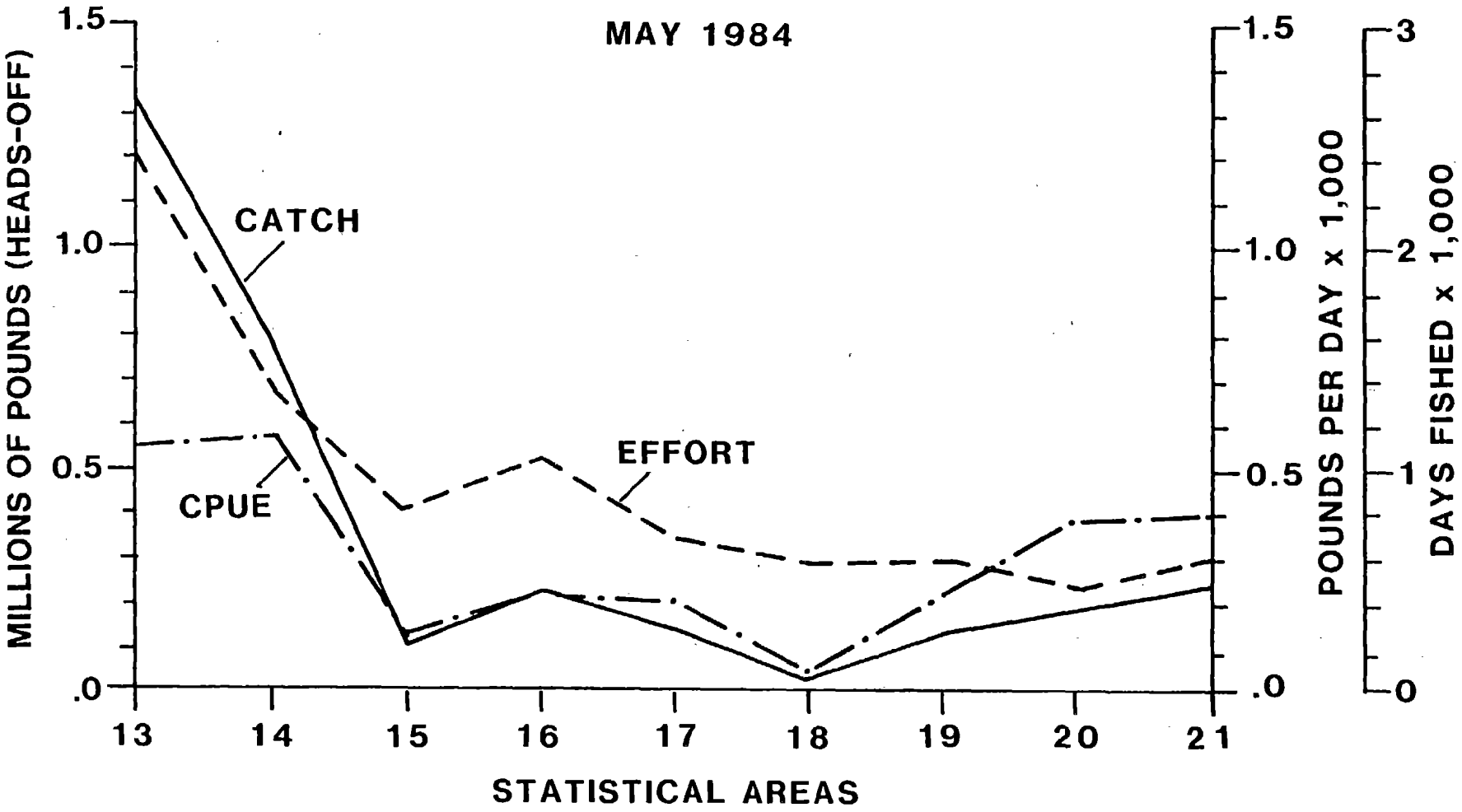

Figure 10. Offshore brown shrimp catch fishing effort in trips and CPUE in statistical subareas 13-21 in May 1984.

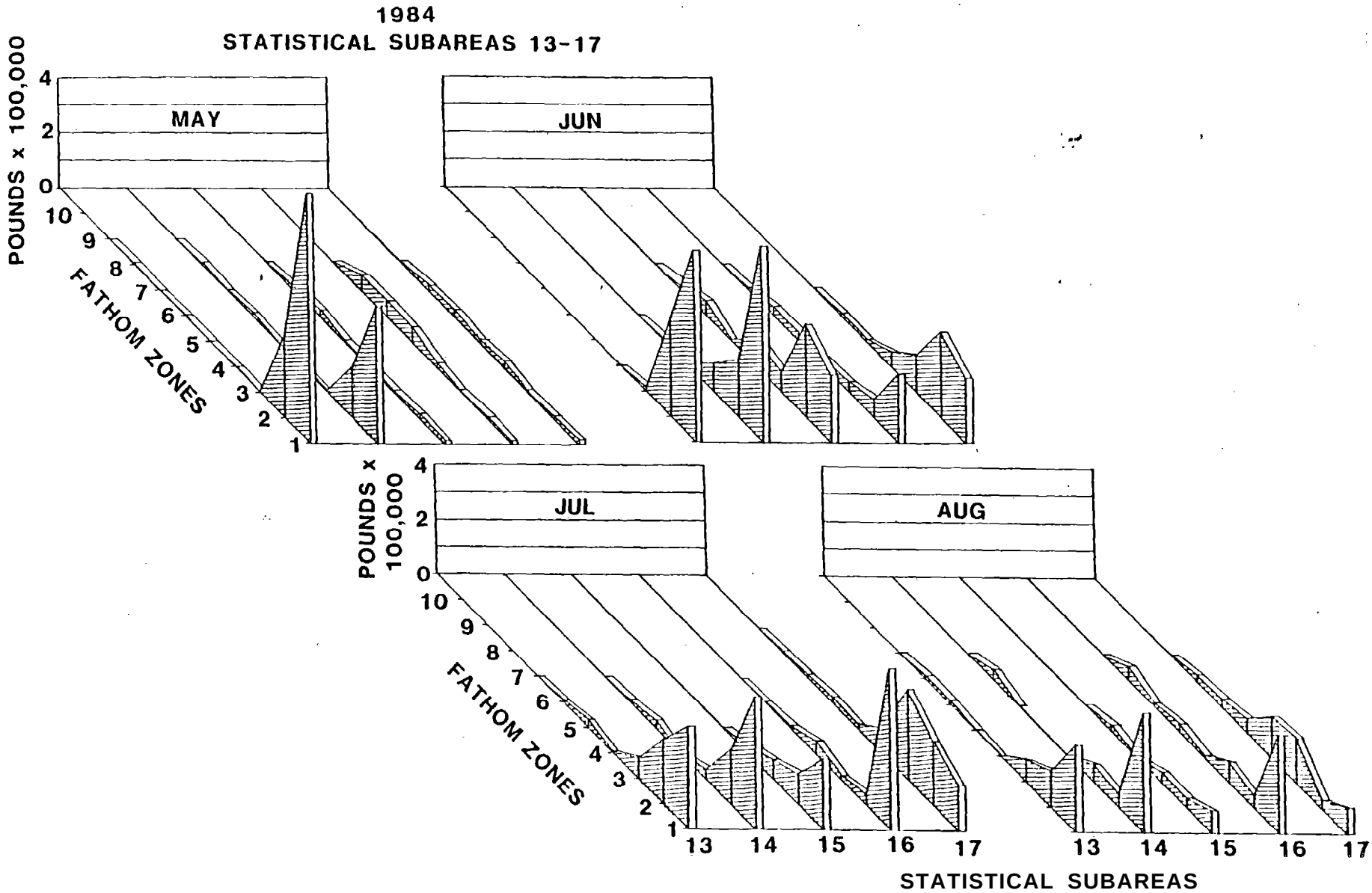

Figure 11. Offshore brown shrimp catch in statistical subareas 13-17 in May, June, July, and August 1984.

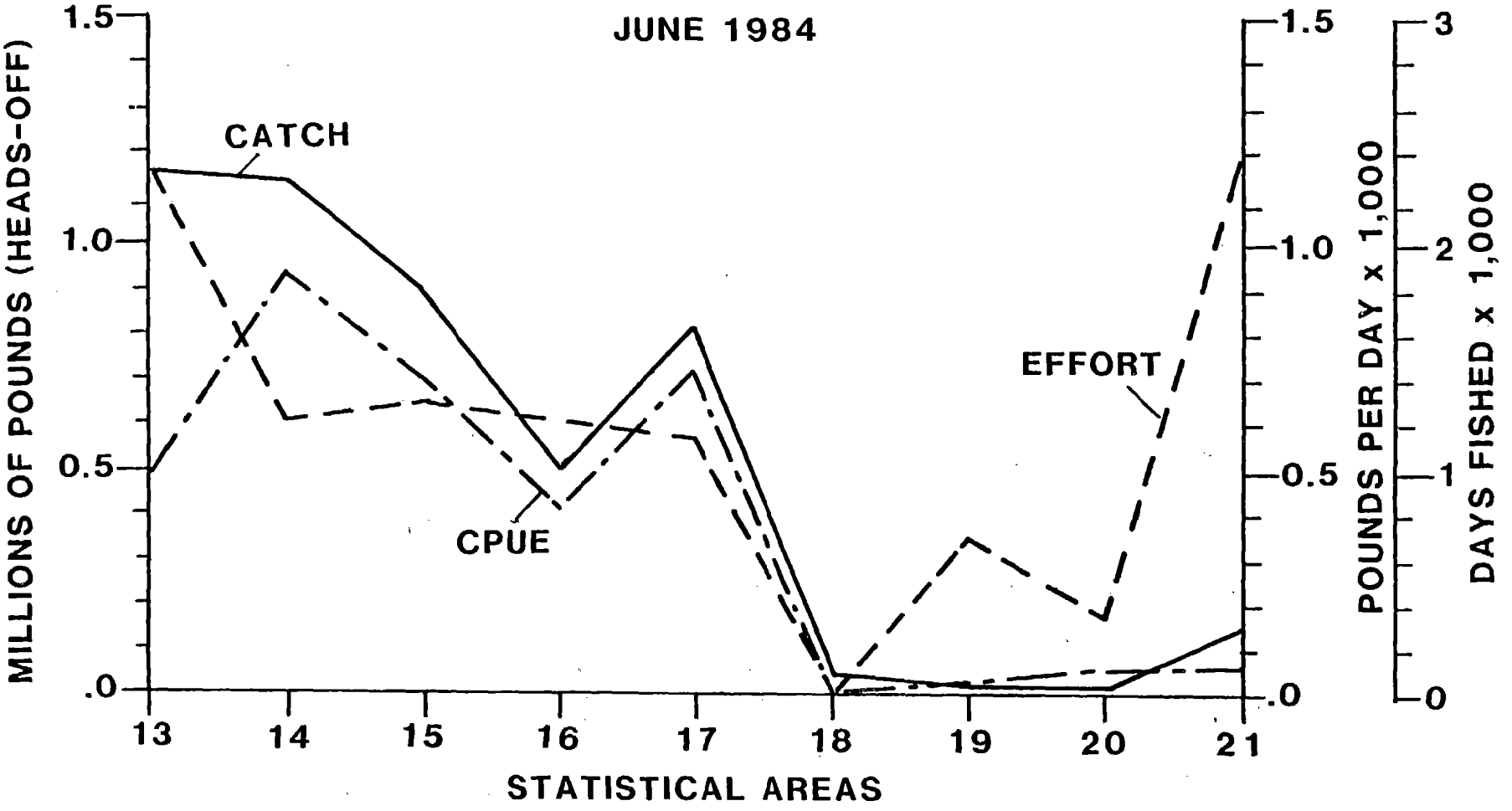

Figure 12. Offshore brown shrimp catch fishing effort in trips and CPUE in statistical subareas 13-21 in June 1984.

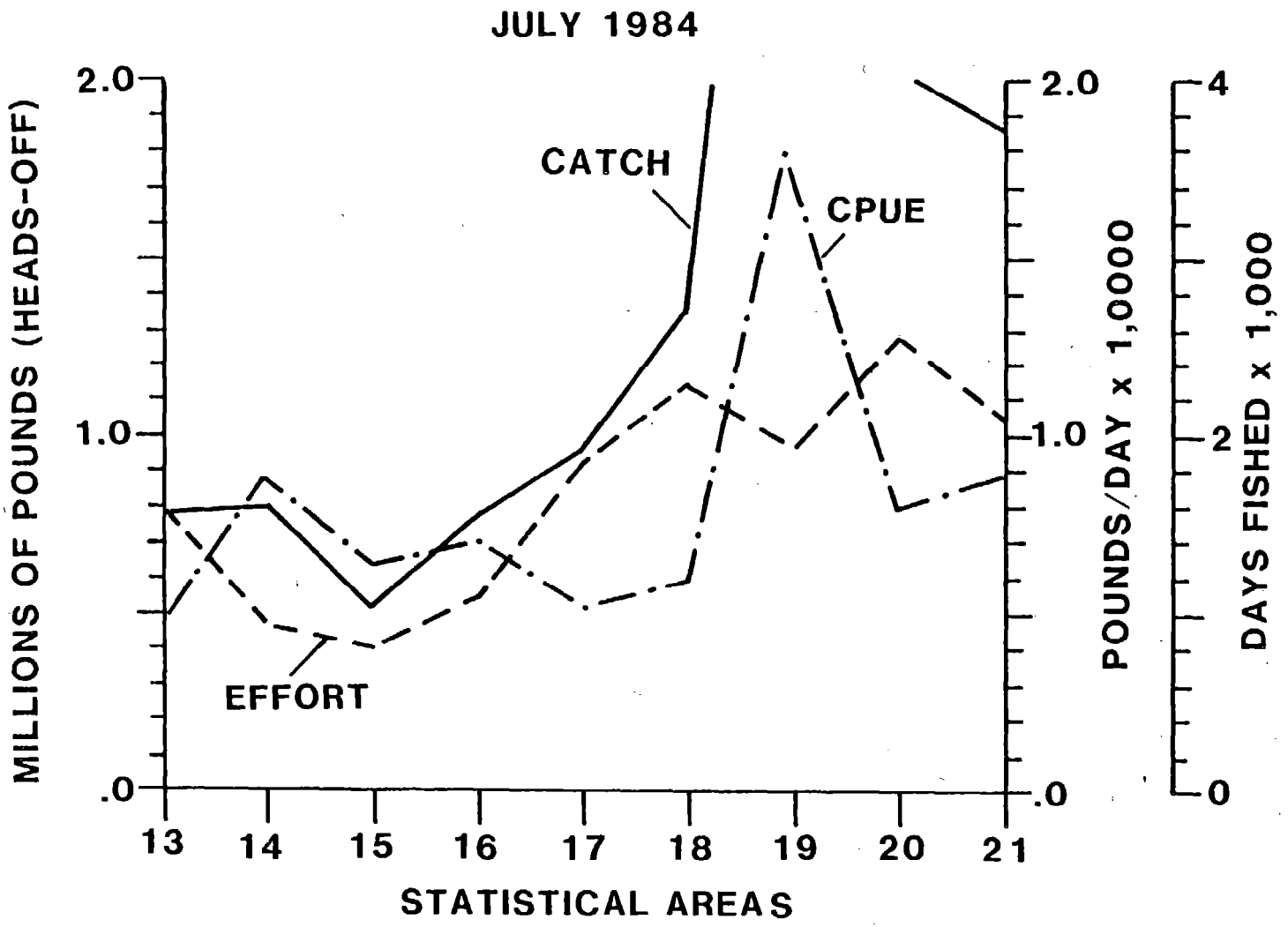

Figure 13.. Offshore brown shrimp catch, fishing effort in trips and CPUE in statistical subareas 13-21 in July 1984.

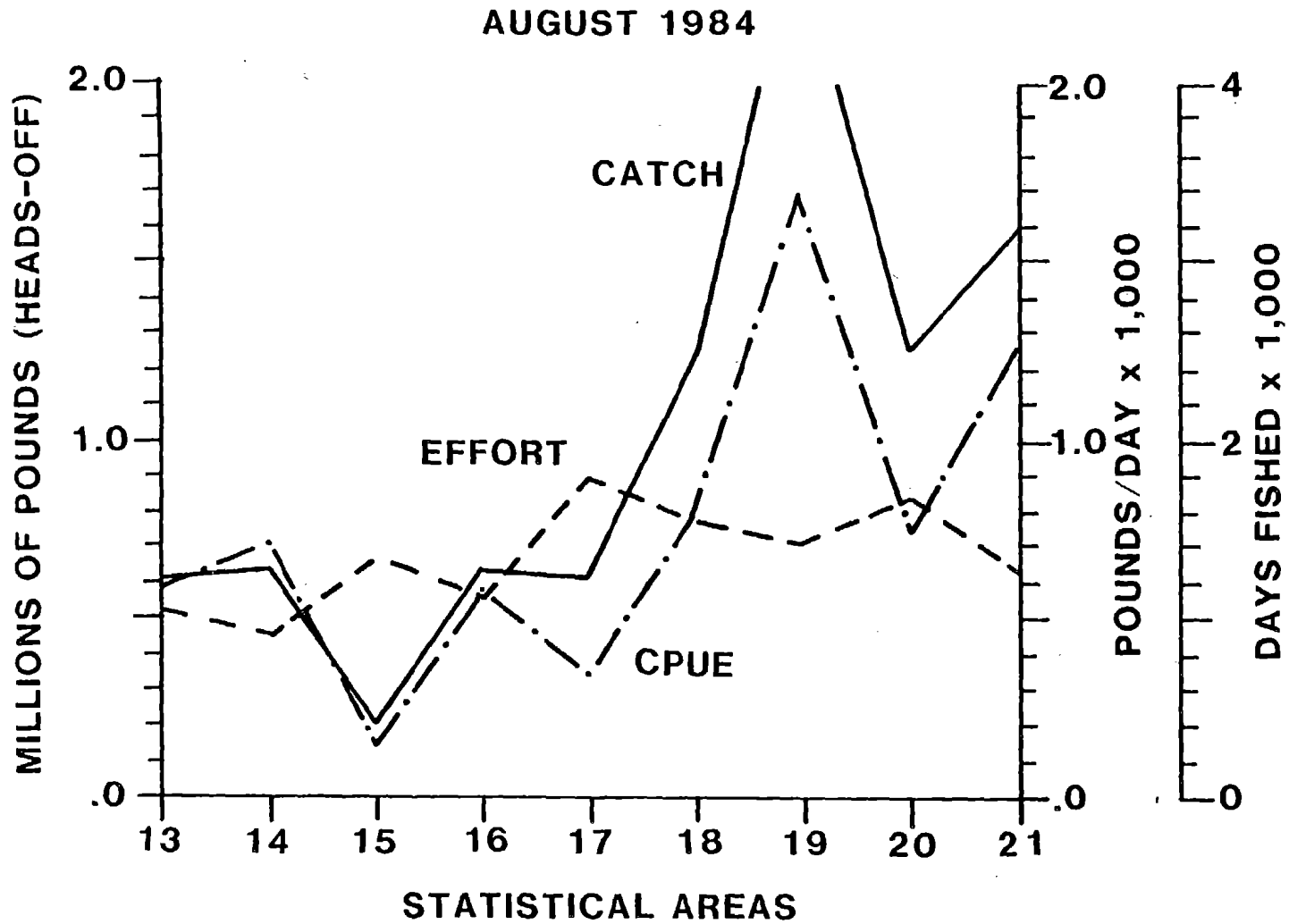

Figure 14. Offshore brown shrimp catch, fishing effort in trips and CPUE in statistical subareas 13-21 in August 1984.

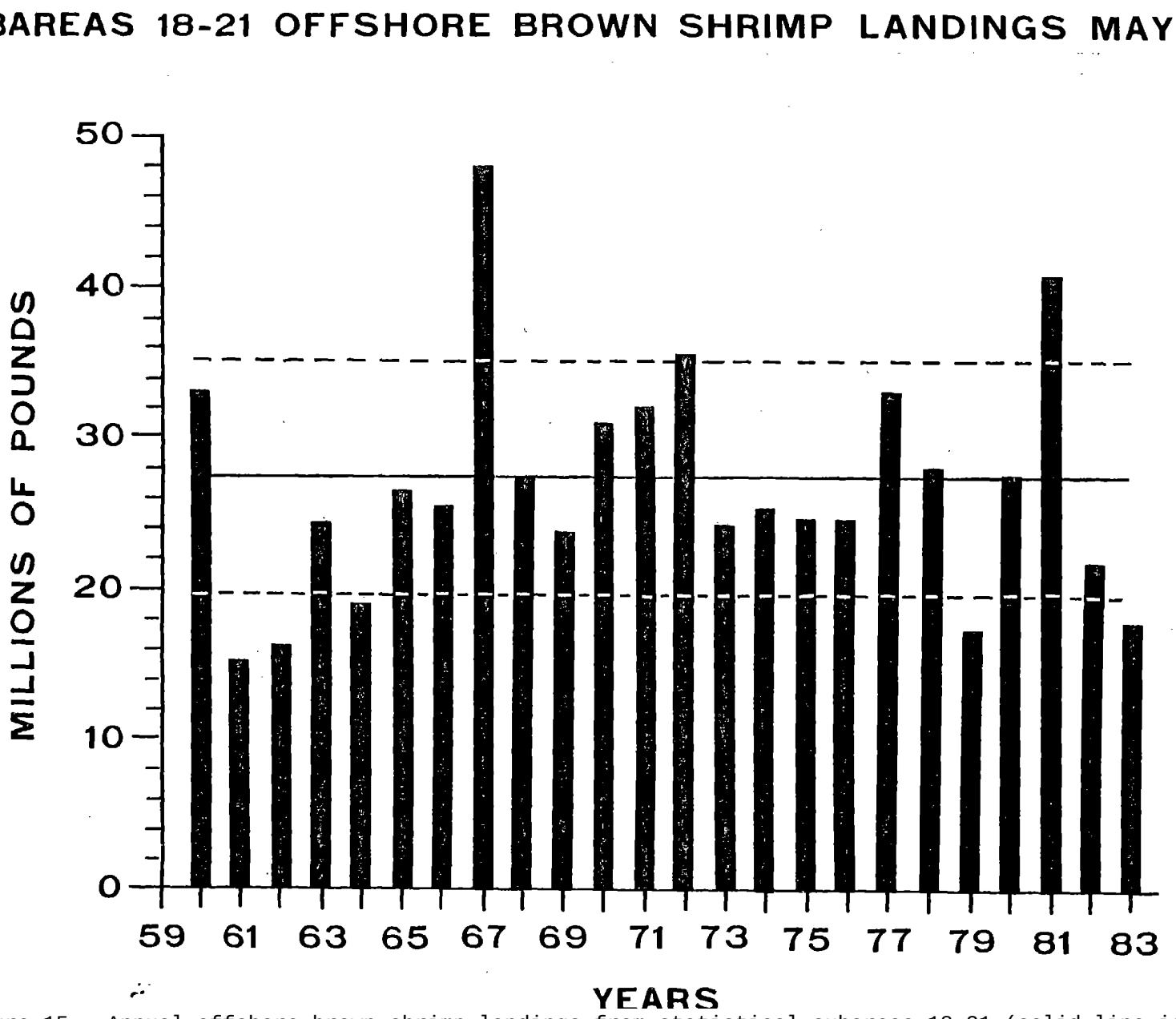

Figure 15. Annual offshore brown shrimp landings from statistical subareas 18-21 (solid line is average 1960-1983 and broken line is oe standard deviation).

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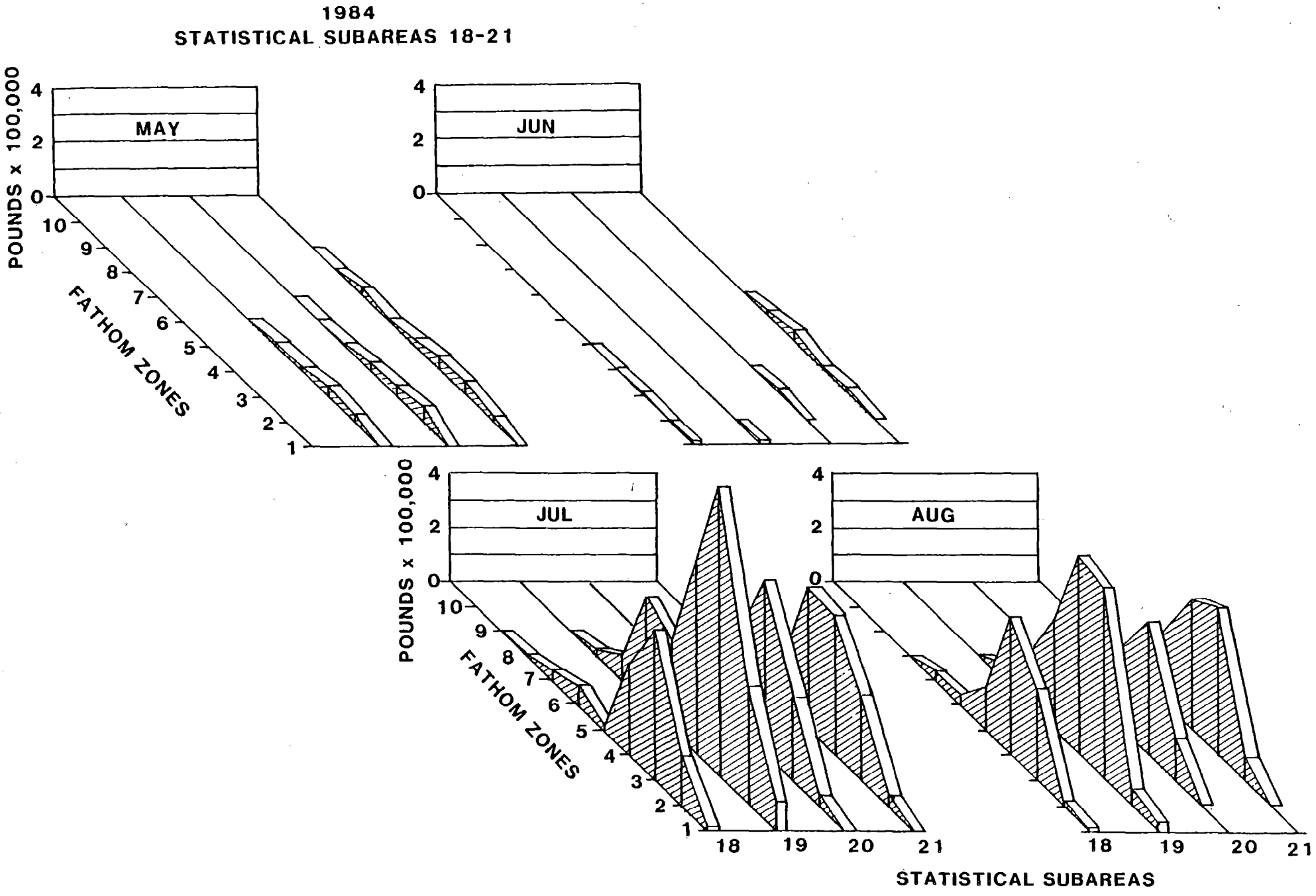

Figure 16. Offshore brown shrimp catch from statistical subareas 18-21 in May, July, and August 1984.

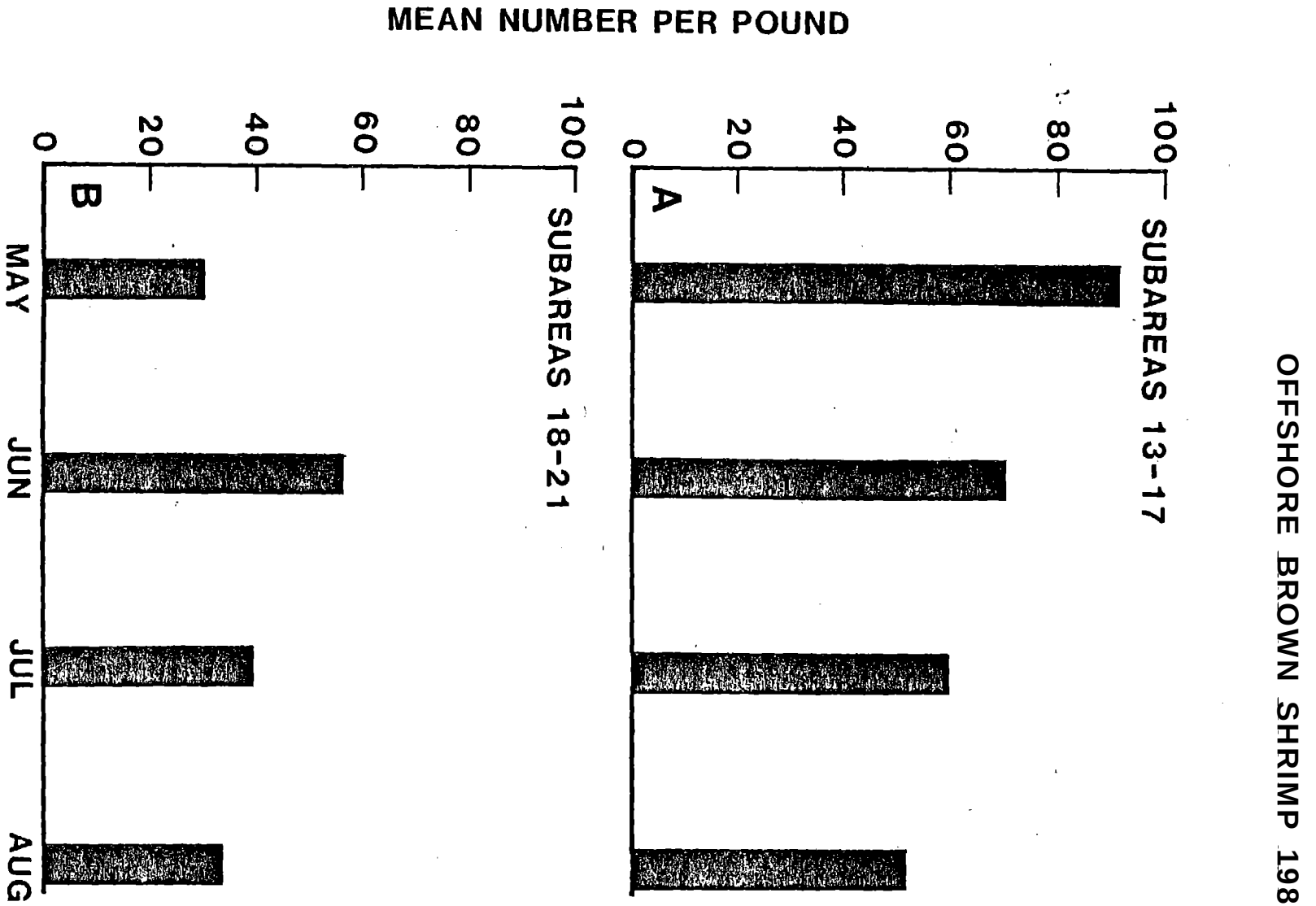

Figure 17. Mean umber per pound of brown shrimp caught in a) 13-17 May-August 1984 and b) 18-21 May-August 1984.

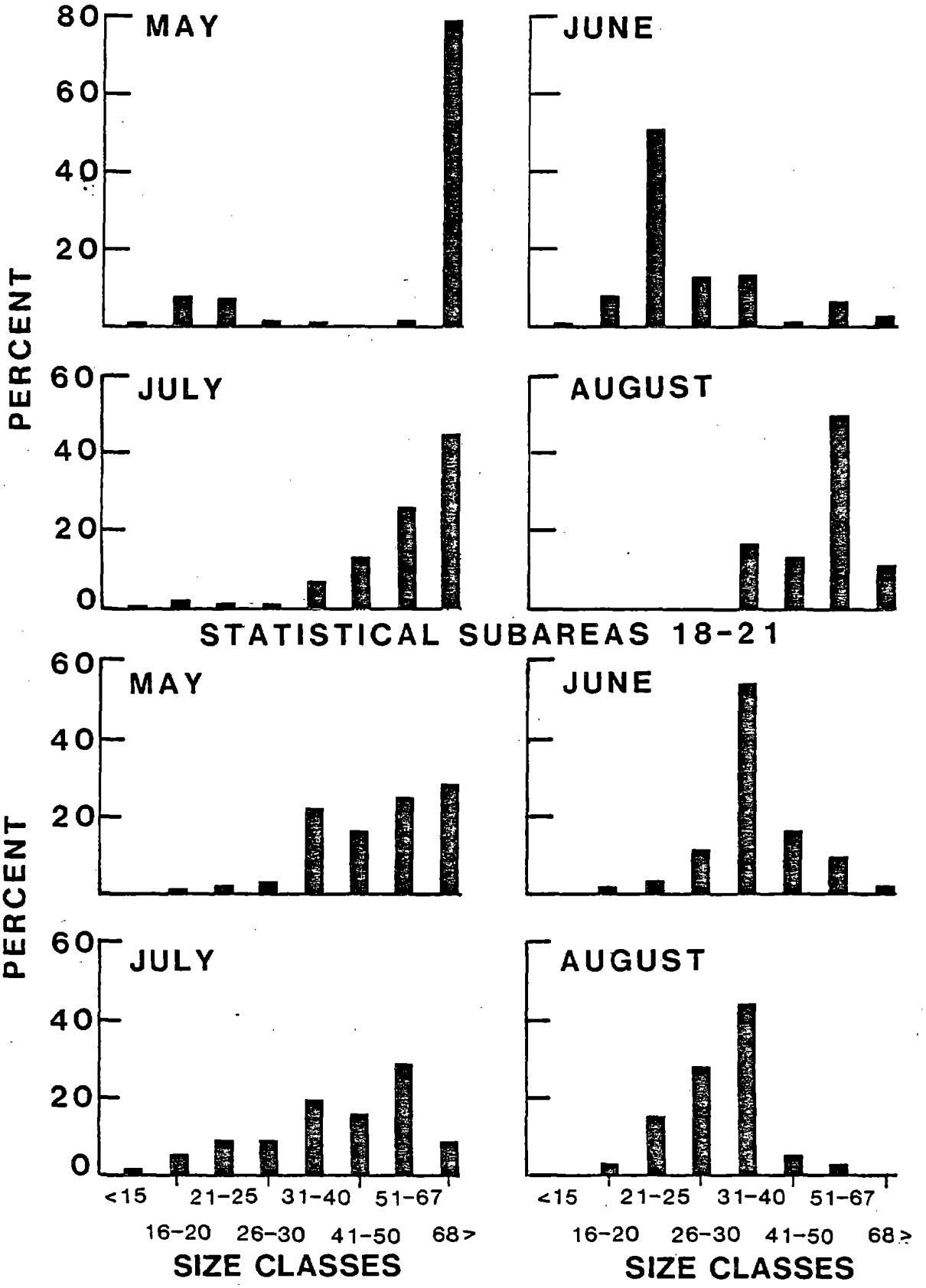

Figure 18. Percent size distribution of brown shrimp caught in a) statistical subareas 13-17 and b) statistical subareas 18-21 using size categories 15/116 count.

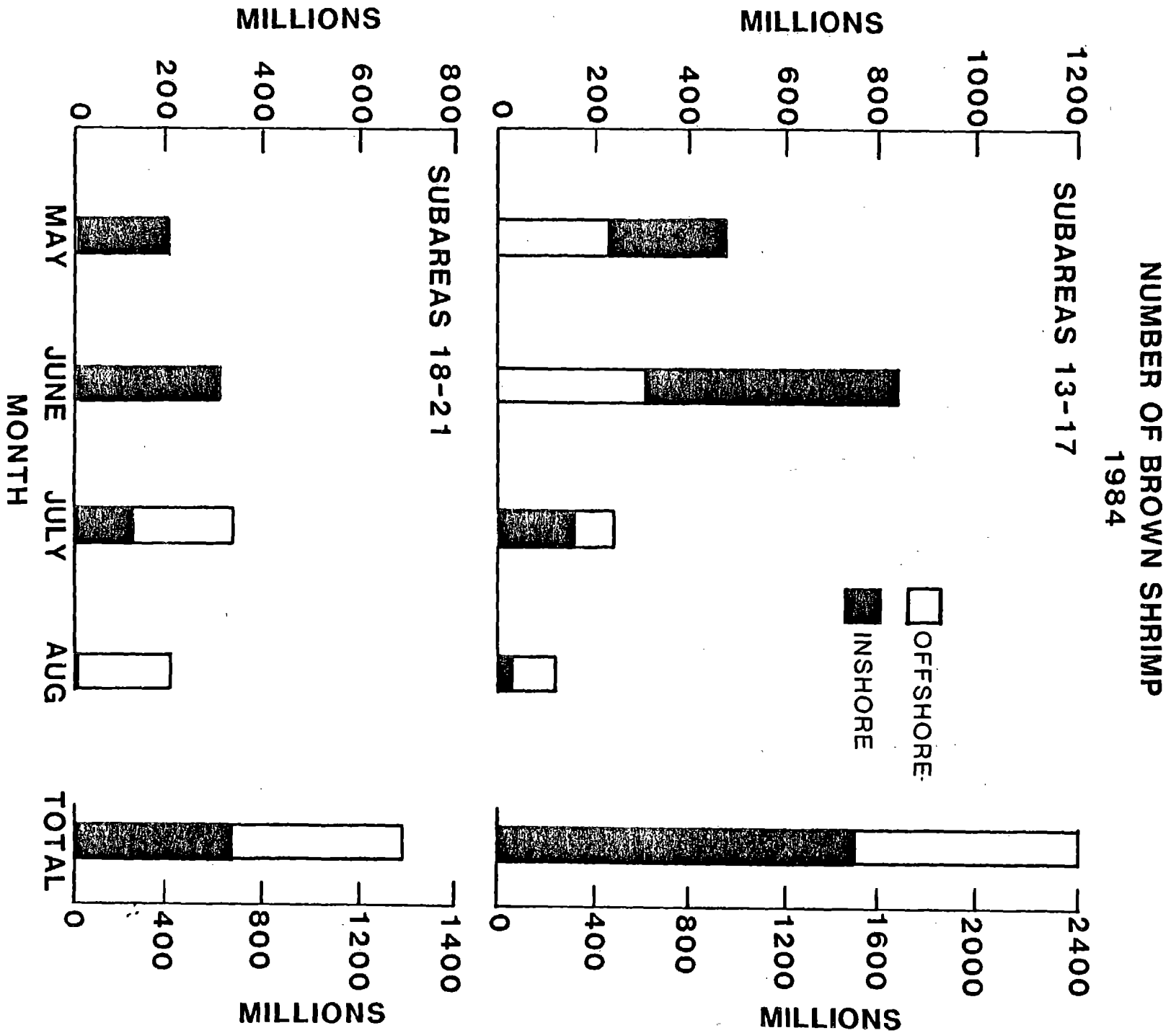

Figure 19. Number of brown shrimp in a) Louisiana inshore and offshore water west of the Mississippi River and b) Texas inshore ad offshore waters.