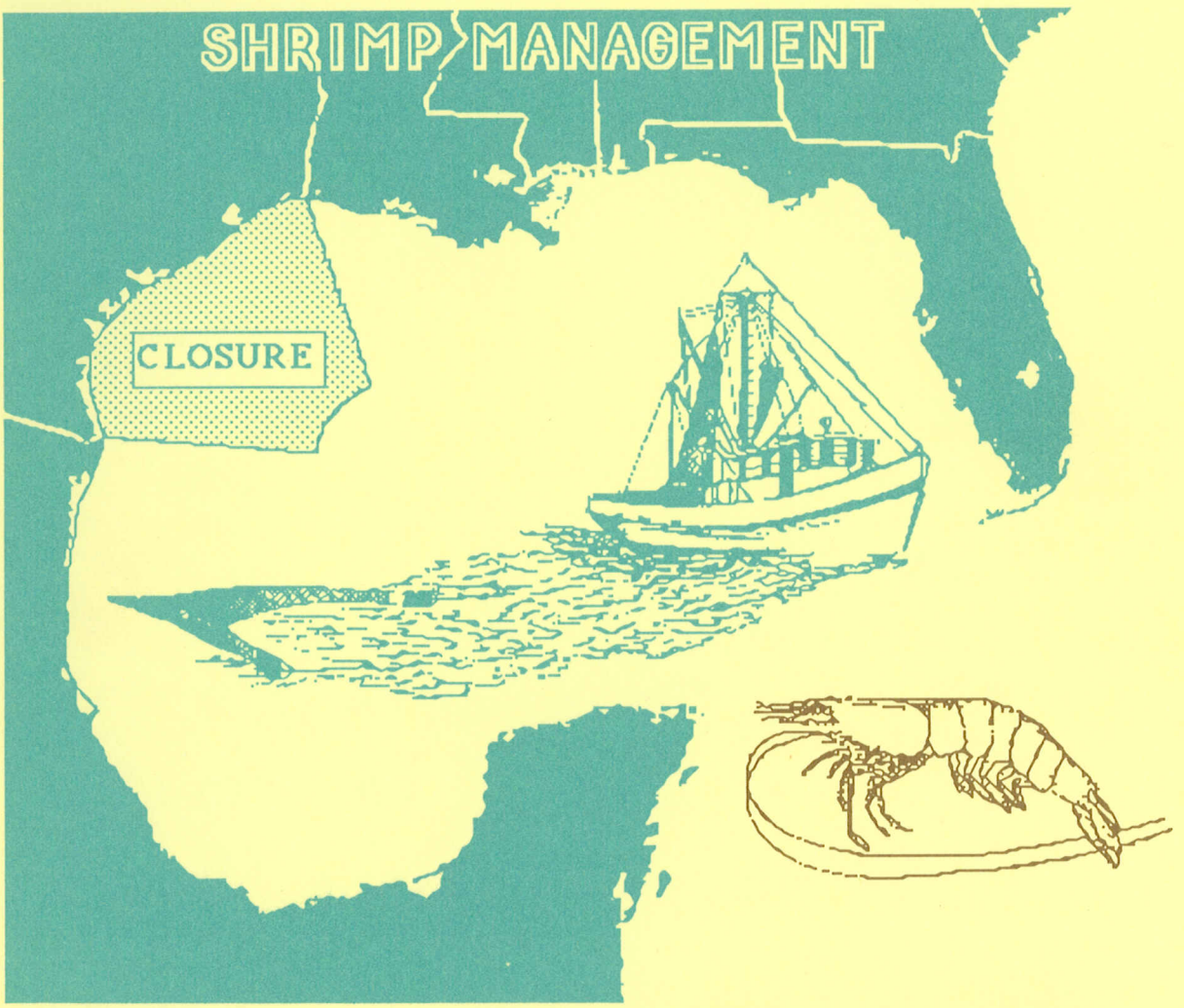
NOAA Technical Memorandum NMFS - SEFC - 218

REVIEW OF THE 1988 TEXAS CLOSURE FOR THE SHRIMP FISHERY OFF TEXAS AND LOUISIANA



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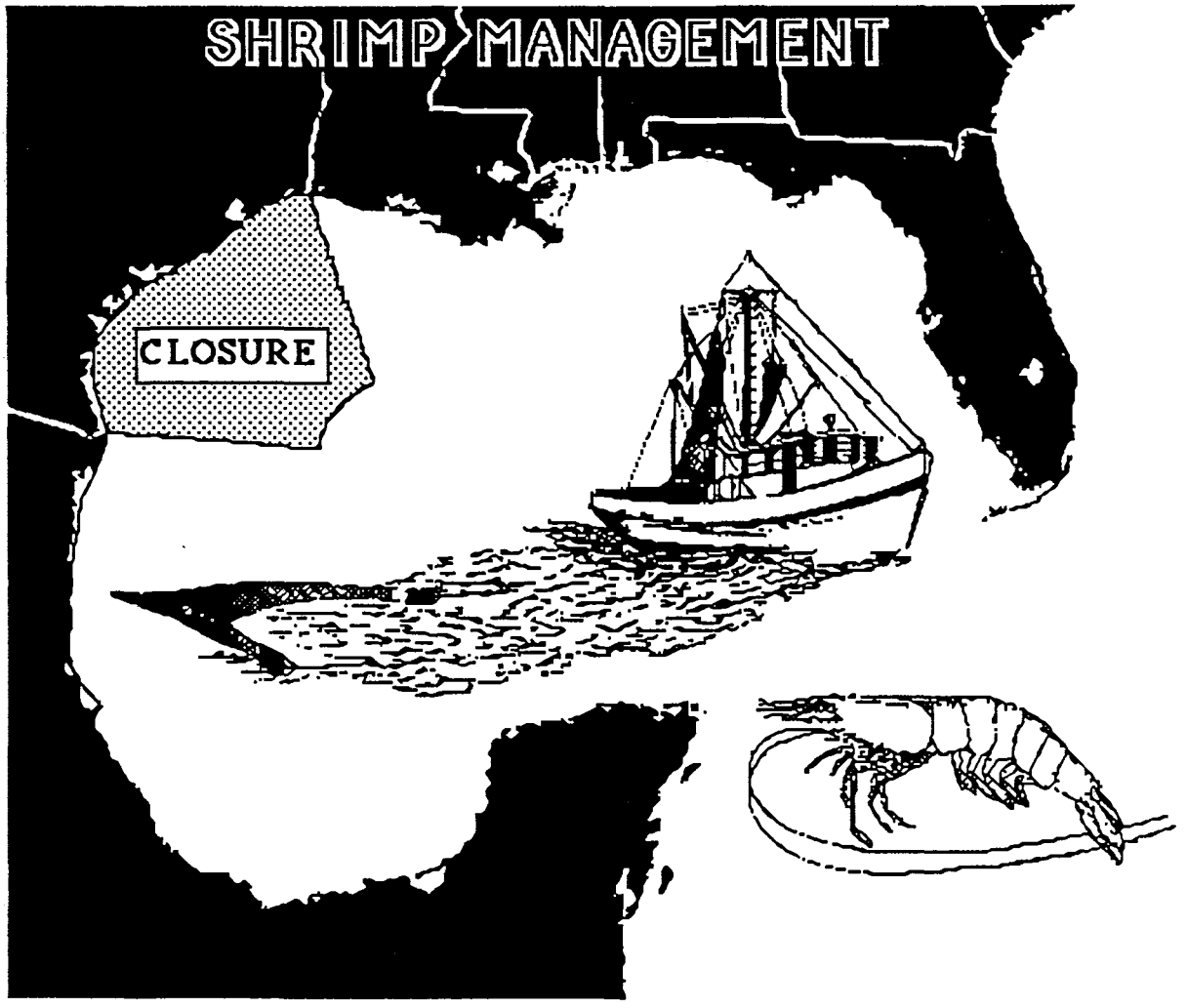

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Frank J. Patella and Dennis B. Koi**

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1988 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 nautical miles off the Texas coast. The objectives of the Texas Closure Management Measure were to increase the yield of shrimp and to eliminate waste caused by discard of undersized shrimp in the exclusive economic zone (EEZ). According to the FMP, shrimp yield would be increased by protecting brown shrimp from fishing during the period when they were predominantly small and were rapidly growing. Discards would be reduced by eliminating the count restriction in order to allow all shrimp caught to be landed. For the past eight years the Gulf of Mexico Fishery Management Council (GMFMC) has agreed to continue this seasonal closure of the brown shrimp fishery off the Texas coast. The 1988 Texas closure was implemented from 1 June to 15 July 1987, and like 1986 and 1987, but unlike the other five years, the area closed was only from the coastline to 15 nautical miles off the Texas coast. The GMFMC determined that this type of closure would still allow small brown shrimp to be protected from harvest but would also allow the taking of larger brown shrimp by fishermen in deeper waters.

The Texas Parks and Wildlife Department sets the closing and opening dates for the fishery by assessing abundance, size, and growth rate of shrimp in Texas waters during April and June (Bryan, 1985). Prior to the FMP, Texas law closed the territorial sea from the shoreline out 9 nautical miles for 45 days during mid-May to mid-July 1960-1980 (60 days in 1976). Texas's objective was to insure that a substantial proportion ($\geq$50%) of shrimp in Gulf waters had reached 65 tails/lb or 112 mm total length by season's opening. With the present FMP, the regulated portion of the EEZ is closed and opened in conjunction with the Texas territorial sea closure. The 1981-1986 closures have all exceeded the historical 45-day closure by 5-10 days, but both the 1987 and 1988 closures were only 45 days in length (Table 1).

The purposes of this report are to provide information to determine how well the objectives of the Texas Closure Regulation were

achieved in 1987 and 1988 and to determine if a 15 nautical mile closure meets all the objectives of the Closure Regulation as effectively as a 200 nautical mile closure. 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 May 1987 to August 1988. The report also discusses the social and economic impacts experienced by not only the shrimp fishermen, but the shrimp industry in general along the Gulf of Mexico coasts during the closure period.

MATERIALS AND METHODS

Fisheries Statistics

A collection of detailed catch statistics describing the U.S. Gulf of Mexico shrimp fishery (since 1956) is compiled by and available from the Southeast Fisheries Center (SEFC), Economics and Statistics Office (ESO). The procedures used to collect them are described by Klima (1980). The statistics consist of catch, recorded as pounds of shrimp (heads-off); fishing effort, recorded as either 24 hours of actual fishing time or numbers of trips; and size composition of catch, expressed in eight "count" or size categories representing number of shrimp tails per pound (<15, 15-20, 21-25, 26-30, 31-40, 41-50, 51-67 and >67). Starting in May 1982, ESO recorded pounds caught in size categories larger than 68 count as follows: 68-80, 81-100, 101-115 and >115 count.

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 (Fig. 1). These data were used to compute catch per unit effort (CPUE) as pounds per 24 hours of fishing or 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 >115 categories, by 15 and 116, respectively. Margo Hightower[1] and Lee Usie[2] 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

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the fishing area during 1986 and 1987.

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. The tests 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 in this report using 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 (biological year 1960) and May 1987-April 1988 (biological year 1987).

Historical mean monthly catch, mean monthly fishing effort and mean monthly CPUE for the 1960-1986 period[3] were compared with the May 1987-April 1988 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 (1960-1986) were compared with the 1988 monthly data from May-August, using paired observations in a 2-way ANOVA and in t-tests. The shrimp size distributions for each month in 1987 and 1988 were compared with the historical data set. Unless otherwise stated, tests of significance were performed at the 95% level ($P = 0.05$).

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

Social Survey

Interviews of shrimp vessel captains were conducted by NMFS port agents to determine the social impact of the Texas closure on the shrimp industry in the Gulf of Mexico and to provide a comparison set of information to the data gathered in 1986 and 1987, Attempts were made to interview at least thirty captains from each of 13 port areas along the coast during the last week of July and the first week of August. The selected port areas included six Texas areas (Port Isabel, Brownsville, Port Aransas, Freeport, Galveston/Bolivar and Sabine/Port Arthur), three Louisiana areas (Cameron, Delcambre and Houma), one Mississippi port (Pascagoula), one Alabama port (Bayou LaBatre), and two Florida ports (Fort Myers and Key West). Interviews were conducted with the first thirty captains who would talk to the port agent. Questions were asked (read) directly from the form (Table 2), and the captains' responses were written exactly as stated. These open ended questions allowed for great flexibility in the responses offered to the port agents.

RESULTS - BACKGROUND

BIOLOGICAL YEAR COMPARISONS

Louisiana

Brown Shrimp Inshore Fishery

The inshore Louisiana brown shrimp fishery averaged 11.2 million pounds ± 3.8 million pounds standard deviation from 1960-1987 (Fig. 2). Peak production in Louisiana appears to be cyclic, with low production from 1960 to 1966 and above average production in all other years except 1973 to 1975 and 1979 to 1980. Historically, the Louisiana inshore fishery is active from May through August, with peak production in May and June.

During biological year 1987, the inshore Louisiana brown shrimp fishery had a total production of 12.7 million pounds, with 11.2 million pounds (88%) being taken in the May through June period. Thus, the inshore fishery experienced an above average year with regards to pounds caught, but it was not significantly above the historical average. Unlike the below average catch experienced during 1985, the 1987 production was comparable to other closure years.

During May-August 1988 production was 14.0 million pounds. Thus, biological year 1988 also appears slightly above average with regards to catch.

Brown Shrimp Offshore Fishery

Annual production of brown shrimp from May to April in Louisiana offshore waters averaged 16.4 million pounds ± 8.4 million pounds standard deviation from 1960 to 1987. Annual yield was low in the early 1960's, increased to about 18 million pounds by 1967 and remained near this level through 1972 (Fig. 3). Yield dropped to about 10 million pounds from 1973 through 1975. Thereafter, yield has been in most cases above the historical average of 16.4 million pounds, with yields around 30 million pounds in 1977, 1978, and 1986.

In biological year 1987, the Louisiana offshore brown shrimp fishery produced 27.3 million pounds of shrimp. This production level represents an above average catch when compared to the 28 year average

(1960-1987), and is the fourth greatest catch recorded for this area (only exceeded by catch during 1977, 1978, 1981 and 1986).

The monthly pattern of shrimp production in Louisiana for biological year 1987 and the first four months of biological year 1988 was compared with the historical monthly average pattern (Fig. 4). Only February through April exhibited catch values that were below average. Yet, of those that showed above average catch, none were significantly greater than their historical counterpart. It is interesting to note, that unlike 1985 and 1986, most fall and winter months (October-April) in 1987 showed below average production for brown shrimp. This is easily observed when monthly comparisons were made between comparable months during the 1975-1988 period (Table 3). Peak production months were, as in the past, still May-August in both 1987 and 1988.

Biological year 1987 also exhibited an above average amount of effort (days fished). During the year about 55,000 days of fishing were recorded for the brown shrimp fishery in Louisiana. This is over twice the historical average of 23,900 days fished.

The monthly pattern of effort during biological year 1987 and the first 4 months of biological year 1988 was compared with the historical monthly average pattern (Fig. 5). All months had greater than average effort values, but only May 1987, June 1987, and May 1988 were significantly different from their historical counterparts. When monthly comparisons were made between comparable months and periods, effort values during the 16 month period under investigation (May 1987-August 1988) were either the greatest or near the greatest value observed during the 1975-1988 period (Table 3).

An average CPUE value of 497 pounds per day was observed in biological year 1987. This value is below the historical average for the offshore waters of Louisiana. Only May 1987 had an above average CPUE value in biological year 1987 (Fig. 6). Even with the average landings experienced during the 16 month period, the record levels of effort exerted in the offshore fishery produced poorer than average CPUE values for most months. As far as pounds landed, the 1988 biological year thus far appears to be above the historical average, but

fisherman will probably perceive it as a poor year because of the low CPUE values and catches below 1987 values.

Texas

Brown Shrimp Inshore Fishery

Landings for the Texas inshore brown shrimp fishery have been increasing for the past several years. The average catch over the 28 year period (1960-1987)was 2.7 million pounds ± 2.3 million ponds standard deviation (Fig. 7). The catch during biological year 1987 was 8.4 million pounds. This value is above the historical average, and more than has occurred during any previous year.

The Texas inshore brown shrimp fishery takes place from late April through August. Peak production usually occurs in May and June. In biological year 1987, 76% of the total catch occurred during May and June. The month of July accounted for 14% of the total catch during 1987. This is above the normal July catch level of <10%of the total.

During the May-August 1988 period, inshore production was 6.9 million pounds. This will probably make the inshore catch total for biological year 1988 above the historical average.

Brown Shrimp Offshore Fishery

The average annual brown shrimp yield from May to April in Texas offshore waters from 1960 to 1987 was 26.9 million pounds ± 7.2 million pounds standard deviation. Peak production occurred in 1967 and 1981 with a yield of 48 and 41 million pounds, respectively (Fig. 8). Annual production during biological year 1987 was 27.8 million pounds. This production value was above average, but not significantly greater than the historical mean. This level of catch was similar to the 27.7 million pounds taken during biological year 1985, and is the second largest catch since the closure started.

The monthly pattern of shrimp production off Texas for biological year 1987 and the first four months of biological year 1988 was compared with the historical monthly average pattern (Fig. 9). During biological year 1987, both May and June experienced above average catches. This was the second June since the combined Texas closure

began that had near normal landings. This catch level was similar to to 1986 levels and occurred because the EEZ was opened to brown shrimp fishing beyond the 15 nautical mile line. After the entire closure was opened to fishing on July 16, 1987, above average landings occurred during July, with below average catches from August through October. During 200 mile closure years, this fall period usually experienced better than average landings (Table 3). Unlike 1985 and 1986, winter production levels in 1987 were only slightly above average. This trend is clearly seen when months and periods are compared for the last 14 years (Table 3). May 1988 catch values were similar to 1987 values, but June experienced reduced landings as compared to 1987. July 1988 was above average, with August again showing less catch than has been historically observed.

An annual effort value of about 54,400 fishing days was expended off the Texas coast during biological year 1987. Monthly effort values followed nearly the same trends as those shown for landings (Fig. 10). All months had greater than average levels of effort, except August 1987 which experienced reduced effort. None of the effort values experienced during this 16 month period were significantly different from their historical averages counterpart.

It should be recalled that record production was occurring off Louisiana during the 1986 summer period and some of the effort normally expended off Texas was shifted to Louisiana. This shift in effort from Texas to Louisiana did not occur during either the summer of 1987 or 1988, since catch was only slightly above average off Louisiana and average off Texas (Table 3).

An average CPUE value of 511 pounds per day was experienced during biological year 1987. All monthly averages were below historical averages (Fig. 11). None of the values during the 16 month period were significantly below their historical counterparts.

Overview of 1987 Season

Biological year 1987 had slightly greater than average landings for brown shrimp for the entire area from west of the Mississippi River Delta to the Texas-Mexico border. Total brown shrimp production (inshore and offshore) in Louisiana was 40.0 million pounds (12.7 inshore and 27.3 offshore), while in Texas landings totaled 36.2 million pounds (8.4 inshore and 27.8 offshore). This produced a total of 76.2 million pounds (21.1 inshore and 55.1 offshore). This value represents the second largest brown shrimp catch since the record landings in 1981 (89.7 million pounds) and is much greater than the 57.2 million pound historical average for the area (1960-1987).

RECRUITMENT - FORECAST 1988

Data used in this forecast were provided by Louisiana Department of Wildlife and Fisheries, the Office of Economic and Statistics of the Southeast Fisheries Center and the Galveston Laboratory of the Southeast Fisheries Center. Collections of immigrating postlarval brown shrimp from the Galveston Bay jetty entrance yield the earliest indications of the future harvest. Juvenile brown shrimp stocks are later assessed using drop-sampler techniques in salt marsh habitats to check growth and abundance of the new-year-class shrimp. Finally, juvenile and subadult brown shrimp are monitored in the bait shrimp fishery during late April through mid-June to give a final account of stock strength before offshore migration.

Weather during the late winter and spring of 1988 was atypical and may have impacted the recruitment survival of brown shrimp this year. The first five months of 1988 were very dry and cool; rainfall was well below normal for eastern Texas and western Louisiana. Further, during a four to five day period in early April unusually strong northerly winds, with accompanying very low tides in the bays, and cold temperatures was experienced from as far south as Brownsville, Texas and as far east as Pensacola, Florida. The low water prevented the juvenile shrimp from utilizing marsh habitats and exposed them to additional predation.

In Texas, all the indices pointed to a below average season (July 1988-June 1989) for the offshore waters of the state. Using a

regression model based on bait shrimp catch per hour from 1960 through 1980, we estimated harvest off the Texas coast to be 25.9 million pounds. This value is 1 million pounds below the average catch of 26.9 million pounds experienced during the 1960 through 1987 period. This model has proved to be quite accurate since its creation (Table 4a).

Preliminary catch information from Louisiana inshore and offshore fisheries in May of 6.5 million pounds, when used in a regression model, indicated a potential total annual production of about 28.3 million pounds during this season (May 1988-April 1989). Historically, the estimated May catch has usually been about 10-15% below what is actually taken from these water during May, which has caused us to underestimate our forecast of the annual catch (Table 4b). Our current information points to a 10% under estimation of the actual May catch. Therefore, we used the value of 7.2 million pounds (6.5 million pounds +10%) for the May catch input into the regression model. We predicted a total inshore and offshore harvest of 30.2 million pounds for Louisiana west of the Mississippi River, which is above the average of 27.6 million pounds for the area. This prediction is supported by Louisiana Wildlife and Fisheries data which estimated about 1.35 million acres of prime nursery for brown shrimp available this year. This Louisiana regression model has also proved to be accurate in its estimation of total annual catch.

1988 CLOSURE PERIOD

In 1988, the territorial sea of the state of Texas and a six nautical mile wide band of the EEZ adjacent to those territorial seas were closed to all shrimp fishing from June 1 to July 15, except for a daytime nearshore fishery directed at white shrimp. This section of the report represents an analysis of the shrimp statistics taken during the May-August period of 1988 from statistical subareas 13-21, inclusive.

Louisiana

Brown Shrimp Inshore Fishery

The May through August 1988 catch in Louisiana for inshore waters

amounted to 14.0 million pounds, with 91% of the total catch in May and June. This year's inshore production was higher than the 12.1, 9.5 and 12.4 million pounds produced during the 1983, 1985 and 1987 May through August periods, respectively, but lower than the other years since 1981. Inshore production was 14.0, 14.9, 15.1 and 15.2 million pounds for 1986, 1984, 1982 and 1981, respectively.

In 1988, May inshore production was 5.8 million pounds with June production at 7.0 million pounds. Catch values dropped quickly after June, with a July catch of 0.9 million pounds and an August catch of only 0.4 million pounds. Similar to last year, there were no early migration of small brown shrimp from inshore waters to offshore waters.

The proportion of the catch in the 116 and greater count size group was greatly reduced this year compared to other years. As in the past, large numbers of very small shrimp were caught in the May period, but unlike most other years, large numbers of medium sized shrimp were landed later in the season, thus reducing the overall percentage of small shrimp. This year only 44% of the shrimp landed were in the smallest size group (Table 5). The greater than 68 count size group accounted for 89% of the shrimp landed in the inshore fishery this year and not the usual 95% of the catch.

Brown Shrimp Offshore Fishery

In May 1988, the fishery off Louisiana produced only 2.2 million pounds of brown shrimp, with over 8,600 days of fishing effort, for an average CPUE value of only 259 pounds per day. While the effort value represents one of the highest levels achieved off Louisiana since at least 1974, the catch is one of the lowest experienced (Table 3). The 1988 May catch level is only above three other years since 1975. The CPUE value is the worst ever calculated since at least 1975 (Table 3). Similar to most years, but unlike last year, the majority of the catch (92%) and effort (91%) occurred in the shallow waters of statistical subareas 13-15, with subarea 13 alone accounting for 48% of the total May catch and 58% of the total May effort (Fig. 12). Very little

catch or effort was experienced in either statistical subarea 16 or 17 during May. With the tremendous amount of effort expended in subarea 13, CPUE values averaged only 212 pounds per day in this area. Catch rates (CPUE) were 444 pounds per day in statistical subarea 14, and averaged around 178 pounds per day for subareas 15-17. All CPUE values were greatly reduced from what was experienced last year (Nance, et al., 1988).

In June, the fishery off Louisiana produced 4.4 million pounds of brown shrimp with a fishing effort of over 10,200 days. The average CPUE was 431 pounds per day. This June effort was the second greatest ever experienced since 1975, (only below the 1987 value), with the catch being at only a moderate level (Table 3). The record amount of effort exerted with average catches, created a CPUE value of 431 pounds per day which was the lowest June value recorded (Table 3). As in past years, over 95% of the production took place within 15 fm of water in each of the five statistical subareas (13-17). CPUE values were moderate (500 pounds per day) in statistical subareas 13 and 14, but low (below 400 pounds per day) in subareas 15 and 17 (Figure 13). This trend is similar to what has occurred during most other years, except the levels are greatly reduced by comparison.

The July offshore fishery in statistical subareas 13-17 produced 4.2 million pounds of brown shrimp with an effort of about 7,500 days of fishing. This effort value was moderate, with the catch level also being near the average value experienced over the years (Table 3). Average CPUE was 556 pounds per day, which was near mid-range of other CPUE values during the 14 year period (Table 3). CPUE values were lowest in subareas 13-15 and highest in subareas 16-17 (Texas subareas not included in this discussion) (Fig. 14). Effort and catch were greatest in subarea 13. Most of the catch was in water shallower than 15 fm in all statistical subareas.

In August, the Louisiana offshore fishery produced approximately 4.2 million pounds of brown shrimp with an effort of about 8,000 days. Average CPUE was only 521 pounds per day. Both the catch and effort values were the greatest since the Texas Closure began in 1981, but

CPUE was slightly below average (Table 3). Highest CPUE values were found in statistical subareas 15-17 (Fig. 15). Greatest catches were from subarea 16, while effort was similar in all subareas, except subareas 14 and 15 which were low.

Thus, during the May-August 1988 period, 14.9 million pounds of brown shrimp were landed from the offshore fishery. This catch level is moderate when compared to other values since 1979. Values from 1981, 1985, 1986 and 1987 are above this level, while values from 1979, 1980, 1982, 1983 and 1984 are below it (Table 3). Yet, this average catch came from a near record expenditure of effort. A total of nearly 34,200 days of fishing occurred during this four month period off Louisiana. Since 1974, only the effort exerted in the May-August 1979 and 1987 period (42,300 days and 34,800 days, respectively) exceeds this 1988 value (Table 3). With this high level of effort, CPUE values during this period averaged only 436 pounds per day. This is the lowest average CPUE value since the Texas Closure began, with the exception of the 1983 average (435 pounds per day) (Table 3).

Texas

Brown Shrimp Inshore Fishery

Thus far in biological year 1988, 6.9 million pounds of brown shrimp have been landed from Texas bays. This is the third greatest catch ever recorded from Texas inshore waters. Monthly catches during 1988 were greatest in May and June with 2.4 million pounds in May and 2.9 million pounds in June. These two months accounted for 77% of the catch during the four month period. Landings were still quite high in July with 1.0 million pounds landed, and remained unusually high in August with about 542.7 thousand pounds landed.

Unlike all other years, Matagorda Bay did not have the greatest inshore production this year during the May-August period, with a catch level of only 1.5 million pounds. This is a 25% decrease over last year's catch for the bay system. Galveston Bay recorded the greatest inshore catch with 2.1 million pounds (nearly a 2 fold

increase over 1986 and similar to 1987), while Aransas bay had 1.6 million pounds of brown shrimp landed. This year San Antonio Bay had catches again exceeding the one million pound level (1.2 million pounds), while Corpus Christi Bay only experienced 0.5 million pounds landed. Most of the increases in landings this year occurred during the June period in all bay systems. As in past years, Galveston Bay had significant inshore production in August, but this year so did Aransas Bay. About 331 thousand pounds were landed in Galveston Bay and 136 thousands were landed from Aransas Bay.

The size composition of the inshore catch during the 1988 season was different than last year, but similar to all previous years since the time ESO agents began to collect data on the specific size categories larger than 68-count (Table 6). Last year 73% of the total inshore catch during the May-June period was in the greater than 116 count size group. This year only 45% of the catch during the same two month period was in this size group. Last year 64% of the entire May-August catch was composed of shrimp larger than 116 count, while this year the figure was similar to other years at 36% (Table 6).

Brown Shrimp Offshore Fishery

The 1988 offshore production from May through August amounted to 15.2 million pounds with 12.5 million pound (82%) of the catch produced in the July through August period. This is similar to the last two year's July through August percentage (76% in 1986, 81% in 1987), but markedly different than most other years since 1981, which had 97% of the May through August total being taken in the July through August period (200 mile closure years). The four month catch total experienced this year was the fourth largest since the record catch noted in 1981 (25.3 million pounds) (Table 3).

In May 1987, a little under 1.1 million pounds of brown shrimp were landed with an effort of around 3,400 days fished. This produced a CPUE value of only 319 pounds per day. This is an above average catch, associated with the greatest effort observed since 1979 (Table 3). Most of the landings were in statistical subareas 19-21, while

most of the effort was in subareas 20-21. Similar to last year, subarea 19 had the largest CPUE (Fig. 12).

With the EEZ open beyond 15 nautical miles, June production was 1.6 million pounds. This value is less than most other June levels during pre-closure years and even reduced from catches experienced during the other 15 mile closure June periods (2.3 million pounds in 1986 and 2.4 million pounds in 1987) (Table 3). Effort decreased under last years value of 4,600 days fished, with a value of about 3,700 days fished. This effort value was similar to most non-200 mile closure years for the month of June (Table 3). Average CPUE was only 431 pounds per day this year in June. Catch and effort were both low in statistical subareas 18 and 20, with higher levels in subareas 19 and 21 (Fig. 13). The greatest CPUE values were in subareas 18, 19 and 21 with around 450 pounds per day, while subarea 20 had only 360 pounds per day (Fig. 13).

Total catch in July was 7.5 million pounds with over 9,600 days fished. This is a moderate catch for the month of July (Table 3). The effort value is the second greatest since at least 1974, only below the 9,900 days recorded for 1987 (Table 3). About 2.8 million pounds (37% of the total) were caught before the closure opened on July 16th, with 4,100 days fished (45% of the total). After the opening about 4.7 million pounds (63% of total) were caught with 5,100 days fished (55% of total). Thus, closure and post-closure periods in July seemed to have nearly equal amounts of total effort, but landings were higher following the opening of the closure. CPUE during the closure period averaged 665 pounds per day, while during the post-closure July period it averaged 928 pounds per day. Both catch and effort were high in subarea 19, moderate in subareas 20 and 21 and low in subarea 18 (Fig. 14). CPUE values were highest in subareas 20 and 21 (Fig. 14).

In August, the offshore Texas catch was 5.0 million pounds of brown shrimp with an effort of about 8,700 days of fishing. CPUE was around 578 pounds per day. Catch and effort values were mid-range when compared to other August values, but CPUE was the lowest on

record (Table 3). As in years past, most production was concentrated in subarea 19, but all subareas off Texas experienced similar CPUE values (Fig. 15).

With only a 15 mile closure off Texas, many more small (greater than 67 count) shrimp are taken than during a 200 mile closure (Fig. 16). May values have increased each year since 1985, with June values peaking in 1987 and then dropping back down this year. July values have remained quite comparable during the 4 year analysis period.

Texas-Louisiana Comparisons

Size of Shrimp

Smaller sized shrimp were caught in Texas inshore waters during both June and August when compared to inshore Louisiana waters during the May through August period (Table 7). The average size count in May was 120 and 128 shrimp per pound in Texas and Louisiana, respectively, whereas in June the counts were 103 and 94 shrimp per pound. Count size dropped in both states in July, with an average of 74 shrimp per pound in Texas and 76 shrimp per pound in Louisiana. In August, values were 62 and 50 shrimp per pound for Texas and Louisiana, respectively. These are among the smallest average sized shrimp in Texas in many years, but were about average for Louisiana. Figures 17 and 18 show percent composition of total for each size class by month for Louisiana and Texas, respectively.

The size composition of the commercial offshore catch of brown shrimp from statistical subareas 13-17 from May to August 1988 was dominated by greater than 116-count shrimp in May, 51-100 count shrimp in June and 41-67 count in July (Fig. 19). In August, the catch was more uniformly distributed among the size groups ranging from 31-67 count shrimp (Fig. 19).

In statistical subareas 18-21 the commercial offshore catch from May to August 1988 was distributed equally over most size categories in May, but was centered around 41-67 count in June (Fig. 20). In July, the 31-67 count group range was the predominant modal group, with large numbers of medium shrimp landed (Fig. 20). The dominant

modal group in August was 31-40 count with a secondary peak in the 51-67 count range. Count sizes experienced this July and August were similar to previous years.

In comparing the mean number of shrimp per pound from offshore waters in Texas and Louisiana, Texas always had larger sized shrimp landed (Table 8).

Number of Shrimp

In addition to describing the pounds landed by size count, we have converted the size category information into estimated numbers of shrimp caught in Texas and Louisiana, both for offshore and inshore waters. Large numbers of shrimp were caught in Louisiana waters in May and June (about three times more inshore than offshore), with numbers decreasing drastically in July and August (Table 9). Overall, Louisiana caught over 2.3 billion shrimp in the four month period, with 81% being caught in the first 2 months.

Texas had around 200-400 million shrimp caught from its waters each month during the May through August period (Table 9). During the first 2 months, 82% were caught from inshore waters, while during July, 81% of the shrimp were taken from offshore waters. During August, numbers dropped off quickly compared to July, but again most (86%) of the shrimp were from offshore waters.

Total Catch

May through August catches in 1988 from Louisiana and Texas were compared over the last 8 years (Table 10). Offshore Louisiana had slightly below average catches, with offshore Texas experiencing the third best catch since the record year of 1981. Inshore catches were about average in Louisiana during the period (only 14.0 million pounds), while inshore Texas had the largest inshore catch ever recorded at 6.9 million pounds. Overall, Texas had a total of 22.1 million pounds for the four month period which was only below the values obtained in 1987, 1984 and 1981. Louisiana had only a moderate catch at 28.9 million pounds, with about equal numbers of years below and above this level.

RESULTS - ANALYSIS

Impact of Closure

Catch per Unit Effort Analysis

Changes in CPUE over several years before and after closure incorporate both recruitment variation and possible closure effects. However, as a first approximation, a "good year" in one area tends to be a "good year" throughout the Gulf. Therefore, examining the ratio of CPUE off Texas versus CPUE elsewhere will eliminate some of the effects of variation due to recruitment. In July the CPUE ratio has been near the mean value of 1.3 during most years, with the exception of the early 1970's and the initial closure years (Fig. 21). During the 200 nautical mile EEZ closure period (1981-1985) the increase in CPUE (biomass build up with closure) was an advantage to those individuals fishing in Texas offshore waters. This Texas advantage with higher than average CPUE, lasted until September in 1981, but only until August in most other 200 nautical mile closure years. This indicated a more rapid utilization of the stock build-up in later years. With the opening of the EEZ from 200 nautical miles to 15 nautical miles in 1986, 1987, and 1988, the Texas advantage (biomass build up because of the closure) was lost (Fig. 21). This was also evident when August CPUE ratios were calculated (Fig. 22). Values during all three 15 mile closure years (1986, 1987 and 1988) were very near the pre-closure average of 1.1 during the August period. Thus, the potential increase in harvests of larger shrimp has been exchanged for access to offshore waters in May and June during the last three seasons.

Gulf-Wide Yields - EEZ Closure

During 1987 and 1988 the EEZ was closed only out to 15 nautical miles. For all analysis purposes, we have treated both years as if the entire EEZ was opened (i.e., only state waters closed). June catch and effort data from both years support this assumption, since these values are similar to other June values during pre-closure years (Table 3).

The major difficulty in evaluating the effect of the Closure of the EEZ on the fishery is due to variations in recruitment from year to year. The most direct and effective way to account for variation in recruitment is to estimate recruitment strength via virtual population analysis (VPA). Once this has been done the estimated recruitment can be fished through computer simulation as if the 200 nautical mile closure was in effect and these results compared with yields with the EEZ opened to fishing.

The underlying VPA assessment (Nance and Nichols, 1987) was updated through August 1988. Procedures for estimating "starting F" were identical to those used in previous analysis. The same procedures used last year for assessing what fishing mortality would have been with a total closure of the EEZ was repeated (Nichols, 1987). July effort was used as the maximum available effort estimate in a given year when compared to baseline years. It has become apparent over the last few years that maximum Gulf effort has shifted from August to July in the brown shrimp fishery.

To determine the effect of a 200 nautical mile EEZ closure during the 1987 biological year, a 1984 baseline was chosen to simulate the fishing mortality rates during the closure period. This baseline year had similar effort and recruitment when compared to the analysis year. Starting F values in 1984 were adjusted by a July multiplier of 1.029. Analysis indicated that in the May-April period 3.63 million pounds of small shrimp (>67 count) would be passed up with the closure, but a gain of 1.15 million pounds of medium shrimp (31-67 count) and a gain of 2.54 million pounds of large shrimp ($\leq$30 count) would occur (Fig. 23). Thus, an overall increase of 0.06 million pounds would result in the May-April period with the total closure.

For the 1988 biological year, a baseline of 1984 was used and average fishing mortality rates were multiplied by the July multiplier of 1.034 (ratio of July effort in 1988 compared to 1984). Fishing mortality off Louisiana was not held constant, since both baseline and current year had similar fishing patterns in the 5 fathom area near the Mississippi River. Analysis indicated that in the May-August

period 1.56 million pounds of small shrimp (>67 count) would be passed up with the closure, 0.95 million pounds of medium shrimp (31-67 count) would be lost, and a gain of 0.68 million pounds of large shrimp (≤30 count) would be experienced (Fig. 24). Thus, a decrease of 1.83 million pounds would result in the May-August period with the total closure. Projections for the May-April period are shown in Figure 25. An increase of 0.30 million pounds is the indicated gain with a complete closure of the EEZ. A loss of 1.56 million pounds of small shrimp (>67 count) would occur, along with a loss of medium shrimp of 0.72 million pounds. A gain in large shrimp of 2.57 million pounds would offset this loss in the larger count sizes.

Effort Displacement

The Texas share of the June offshore effort fell to all time low levels during the 200 nautical mile EEZ closure (1981-1985), but this basically continued a decreasing trend that began several years before (Fig. 26). Effort off Texas averaged only 23% of the Gulf-wide June effort from 1976-1980. Quite likely then, 23% of the Gulf-wide effort was subject to displacement by the total EEZ closure. With reopening of the EEZ beyond 15 nautical miles in 1986, 1987 and 1988, the fraction of effort off Texas has rebounded to levels above the 1976-1980 average.

VESSEL MOBILITY/ACTIVITY

State Landings

Commercial shrimp statistics are recorded with a given state and can be traced to the location of capture. We have utilized these data to depict the percent of each state's landings and its location of capture from June through August 1988 (Table 11).

Shrimp landings in the state of Texas that were from offshore production totaled 3.0 million pounds in June, 7.9 million pounds in July and 5.8 million pounds in August. In the June period 77% of the shrimp landed in Texas were caught off Texas, with 23% of the shrimp being caught off Louisiana. A greater percentage was caught off Texas this June when compared to the last two Junes (53% off Texas in 1986, 64% off Texas in 1987) (Klima et al., 1987; Nance et al., 1988). During July about 93% of the shrimp landed in Texas were from Texas waters and only 7% were from Louisiana waters. During August the percentage of shrimp landed in Texas that was caught off Texas dropped to 83% and the percentage caught off Louisiana raised to 17%. Again, percentages of shrimp taken off Louisiana during July and August 1988 were lower when compared to values from the July-August period in 1986 and 1987.

Percentages of 1988 Texas landings caught off each state during the June-August period were compared to percentage values obtained over the previous three years (Fig. 27). During June 1985, when the total EEZ was closed off Texas, only a small percentage (11%) of the brown shrimp landed in Texas were from Texas waters, while the majority (89%) were from Louisiana waters. During June of each of the recent 15 mile closure periods, the percentage of shrimp landing in Texas that were caught off Texas has increased (55% in 1986, 64% in 1987 and 77% in 1988). During all the July-August periods, with the exception of 1986) greater than 80% of the shrimp landed in Texas were caught off Texas. The reason for the decrease in 1986 values was because of the record catches that were occurring off the state of Louisiana and only average catches off Texas.

Shrimp landings in the state of Louisiana that were from offshore production totaled 3.6 million pounds in June, 4.0 million pounds in July, and 6.1 million pounds in August (Table 11). During June about 99% of the shrimp landed in Louisiana were caught in Louisiana waters. During July the percent of Louisiana landings caught off Louisiana decrease to about 92%, but increase in August to around 94%.

When 1988 Louisiana landing values were compared to 1985, 1986, and 1987 values, no detectable differences were seen. During all three June-August periods most of the shrimp landed in Louisiana were caught from Louisiana waters.

Shrimp landings in Mississippi from offshore production were mainly caught off Mississippi except in June when the majority were taken off Louisiana (Table 10). Shrimp landings in Alabama, on the other hand, were caught in greatest numbers off both Mississippi and Louisiana with about 10% of the catches from Texas waters during the July-August period. Florida landings were similar to those shown for Mississippi. Most of the shrimp landed in Florida during the June-August period were caught off Florida.

Home Port

We have further been able to identify the home port of most vessels from each of the Gulf coast states and have made a determination of the percent and pounds landed from June 1 through August 31, 1988 by each selected group (Texas, Louisiana and other) (Table 12). The unknown category is a conglomerate of information from consolidated schedules and, as a result, most probably comprises catches from boats and vessels fishing in their respective states.

During June 1988, about 89% of the 2.98 million pounds of shrimp landed in Texas were caught by vessels with Texas home ports. About 69% of the catch came from Texas waters, while 20% came from Louisiana waters. On the other hand, only 30% of the 3.55 million pounds of shrimp landed in Louisiana were caught by known Louisiana home port vessels. The "unknown" category accounted for 62% of the catch. This category was rather large this year, but is most likely composed

mainly of Louisiana vessels and maybe a few from states other than Texas. If true, then around 92% of the catch landed in Louisiana was from Louisiana home port vessels. This is consistent with data from most other years.

Landings of shrimp increased in Texas during July with 7.9 million pounds landed. This was a 20% decrease from landings last year. Around 78% of the shrimp landed in Texas were from Texas vessels, while 4% were from Louisiana vessels and 8% from vessels from other Gulf states.

In Louisiana during July, about 4 million pounds of shrimp were landed, which was 38% below last years July value. Texas vessels accounted for 5% of the catch, while Louisiana vessels probably accounted for 94% (52% unknown). Other Gulf state vessels only landed about 1% of the months landings.

Landings dropped off in both states during August. In Texas only 5.8 million pounds of shrimp were landed. However, this represented only a 10% decrease over landings from last August. About 84% of the landings came from Texas vessels, with 69% from Texas waters and 15% from Louisiana waters. Louisiana vessels accounted for only 2% of the Texas landings and other Gulf state vessels landed about 8% of the total. In Louisiana a little over 6 million pounds were landed, with Texas vessels landing only around 5% of the total. Louisiana vessels probably accounted for 94% of the landings (56% unknown), with other Gulf states landing about 2% of the total.

Percentage data from the June-August 1988 period was similar to 1987 data in most cases. One difference was that Texas vessels took less of their June-July Texas landings form Louisiana waters this year compared to last year (June, 8% less; July, 3% less), but more during the August period (2% more). In general, as shown last year, less and less of the shrimp landed in the State of Texas are harvested off the State of Louisiana. The majority of the landings in Louisiana are, as shown in past years, taken off Louisiana.

SOCIAL SURVEY

Vessel Captain Interviews

Following the 1988 Texas closure, the third annual offshore social survey was conducted by the National Marine Fishery Service to ascertain the sociological impact of the Texas closure on the shrimp industry along the Gulf coast. Thirteen areas were selected for interviews. Only responses and opinions about the closure of the EEZ closure will be discussed in this report.

The EEZ closure aspect was analyzed by vessel home port. This year each captain was asked his home port and this made it very easy to determine the home port of each vessel in the survey.

Results showed that 348 vessel captains were interviewed this year with the following break down by home port: 11 from Key West, 20 from Fort Myers (31 total from Florida), 37 from Alabama, 29 from Mississippi, 37 from the Houma area, 31 from the Delcambre area, 19 from Cameron (87 from Louisiana), 42 from the Sabine area, 13 from Galveston, 14 from Freeport (69 from upper Texas coast), 28 from Port Aransas area, 31 from Port Isabel, 36 from Brownsville (95 from lower Texas coast).

Chi-squared analysis revealed that responses to questions about the EEZ closure were independent of the date the survey was conducted. Thus, from each port no detectable difference was found when responses from the first week were compared to responses from the second week.

Opinions about whether or not to have a closure of the EEZ of Texas were solicited from the vessel captains. Alabama, Florida and lower Texas ports had the most captains in favor of a closure (68%, 87% and 95%, respectively), (Fig. 28). Most (54%) of the Alabama captains in favor of a closure wanted a 15 mile closure, while most (80%) of the lower Texas port captains wanted a 200 mile closure. Florida based captains in favor of the closure were almost equally split between those wanting a 15 mile closure and those favoring a 200 mile closure (45% and 42%, respectively). Overall, the positive responses about the Texas closure showed similar patterns on a state by state bases when values from all three social surveys were compared (Fig.

29). Florida, Alabama and lower Texas ports showed the largest positive values during all three years. However, popularity of the closure among captains from Florida, Louisiana and lower Texas port continued an increasing trend, while popularity of the closure decreased in Alabama and Mississippi when this year was compared to 1987.

Louisiana and upper Texas coast ports had the majority of their captains respond against the closure again this year (46% and 61%, respectively) (Fig. 28). About 31% of the captains from Mississippi were against the closure in 1988. Thus, plots of the percentage of negative responses to the closure have similar peaks and valleys during each of the three interview years (Fig. 30). However, all states showed less captains against the closure this year when compared to 1987. Largest decreases were observed in Florida and lower Texas ports.

Analysis of responses about the closure sorted by the type of vessel (ice or freezer) the captain was using showed results comparable to last year. Both groups had more captains favoring a closure than against it this year (Fig. 31). Freezer bout captains again showed a clear majority in favor of the closure. Ice boat captains who favored the closure were equally split between the 15 mile and 200 mile closure, while most of the freezer boat captains wanted a 200 mile closure.

Captains were next asked what they felt could be done to improve the closure. Florida and lower Texas port captains felt better enforcement would improve the closure, while the majority of captains from the other states generally had no opinion about improvements (Fig. 32). Although several other improvements were mentioned, (close inshore, open earlier, close earlier, and close my state also), they were mentioned by only a small percentage of the captains around the Gulf (Fig. 32).

The other questions on the survey this year dealt with the enforcement issue during the closure (Table 2). Most of the captains from Florida and the lower Texas ports (77% and 91%, respectively) stated

that there were problems with the enforcement of the closure this past year (Fig. 33). Less of the captains from Louisiana and the upper Texas (43% and 46%, respectively) seemed to see problems in enforcement of the closure. When captains were asked how they would improve the enforcement of the closure, captains from Florida wanted either more agents or a 200 mile closure, while captains from lower Texas ports wanted either more agents, a 200 mile closure again, or stiffer punishment of those caught (Fig. 33). Most of the captains from the other four states had no opinion about improvements.

DISCUSSION

The current FMP lists four criteria that are to be considered by the GMFMC in reaching a decision about whether or not to recommend an EEZ closure in cooperation with the closure of state waters off Texas. These criteria are:

1. Benefits in increased pounds of shrimp caught and/or gross and/or net ex-vessel value to the industry resulting from the closure.

2. Adverse effects from an increase in fishing pressure as a result of the closure which causes a decrease in catch per unit effort.

3. Adverse effects from stress on support facilities for the shrimp fleet because of fleet migration resulting from the closure.

4. Any other information determined by the Regional Director to be relevant.

The discussion of results in this report will be formatted in such a way that relevant material will be placed under sub-areas which in most cases correspond to each of the listed criteria.

HISTORICAL PERSPECTIVE

The 1987 and 1988 abundance levels of brown shrimp differed when values were compared with values from other closure years during the summer period. The Louisiana brown shrimp catch from May-August 1987 for the inshore and offshore areas was around 33.2 million pounds (12.4 inshore and 20.8 offshore), whereas in 1988 the total catch of brown shrimp for the same period was 28.9 million pounds (14.0 inshore and 14.9 offshore) (Table 10). Both years had above average total catches but, in 1987 inshore catches were below average and offshore were above average, while in 1988

inshore catches were above average and offshore catches were slightly below average.

In Texas during the May-August 1987 summer period, a record total catch of 25.1 million pounds occurred (7.6 inshore and 17.5 million offshore), whereas in 1988 the total dropped down to slightly above average with about 22.1 million pounds taken (6.9 inshore and 15.2 offshore) (Table 10)., Catches from inshore waters during both years were very high when compared with other years.

In both 1987 and 1988 between 7 and 8 million pounds more shrimp were harvested from Louisiana waters than from Texas waters during the summer period. The difference between offshore landings from the two states was about 3.3 million pounds in 1987 and only 0.3 million pounds in 1988. Inshore harvest from Louisiana again caused the major difference in landings between the two states. In 1987 the difference was only 4.8 million pounds, but in 1988 it was 7.1 million pounds.

Effort in the brown shrimp offshore fishery this year (1988) were very similar to 1987 levels, but far exceeded levels usually experienced during the summer period (Table 13). Yet, it was not the closure that caused the increase, since similar to last year, both offshore Louisiana and offshore Texas experienced an increase. A steady increase in fishing effort has been observed in the brown shrimp fishery for several years (Nance and Nichols, 1987). This increase in effort has greatly impacted the benefits of the Texas closure regulations. This is easily observed when CPUE values were computed for the offshore brown shrimp fisheries in Louisiana and Texas (Table 13). Note the reduction in CPUE experienced for the past two years, even with the average to above average shrimp landings (Table 10). Notice the decrease in CPUE off Texas in July with the closure at 15 nautical miles (1986, 1987 and 1988) instead of the 200 nautical mile closure (1981-1985) (Table 13). An average catch of brown shrimp was predicted this season off Texas (Table 4a), but CPUE values will probably be very low, because of the increased fishing effort.

The average size of shrimp taken in the offshore waters of both Texas and Louisiana during the May-August 1988 period was larger than shrimp

taken during the same period in 1987, but similar to other years. In Texas during May and June 1987, the average size was 55 count and 66 count respectively, whereas in 1988, the average size was 50 count in May and 49 count in June. In July and August 1988 average sizes were 43 count and 37 count respectively, which was not much different from 1987.

Size of shrimp caught in Texas inshore waters were also much larger in 1988 when compared to 1987. During May 1988 average size was 120 count, whereas last year it was 130 count. June, July and August also had similar results with 103 count, 74 count and 62 count respectively in 1988, and 125 count, 94 count and 71 count respectively in 1987. Louisiana sizes were all similar to last year, with smaller sizes than Texas during May and July, but larger sized shrimp in June and August (Table 6). This is the second year in a row that Louisiana inshore fishermen have caught larger sized shrimp than Texas inshore fishermen.

BENEFITS OF CLOSURE

Impacts of the closure analyses this year showed no build up of biomass off Texas in 1987 or 1988 with the 15 nautical mile closure when compared to the build up experienced during the 200 nautical mile closure (Figs. 21 and 22). Thus, the potential increase in harvest of larger shrimp has been exchanged for access to offshore waters in May and June during the last three seasons (1986 was similar to 1987 and 1988 in this regards.

Last year an increase of around 0.82 million pounds would have resulted in the May-August 1987 period with a total closure of the EEZ off Texas. Projections for the May-April period showed an increase of around 2.18 million pounds with a total closure and there was no indication that there was going to be a winter fishery for brown shrimp (Nance, et al., 1988). All preliminary reports of catch data showed a significant reduction after the August 1987 period. Simulations run on the complete 1987 data set this year revealed that conclusions reached last year were quite accurate. Analysis this year indicated that if the 200 mile closure would have been in effect in the summer of 1987 that in the May-April period, 3.63 million pounds of small shrimp (>67 count) would be passed up with the closure, but

a gain of 1.15 million pounds of medium shrimp (31-67 count) and a gain of 2.54 million pounds of large shrimp (≤30 count) would have occurred because of a closure (Fig. 23).

For the 1988 biological year, results indicated that during the May-August period 1.56 million pounds of small shrimp (>67 count) would be passed up with the closure, 0.95 million pounds of medium shrimp (31-67 count) would be lost, and a gain of 0.68 million pounds of large shrimp (≤ 30 count) would be experienced with a total closure (Fig. 24). An overall decrease of 1.83 million pounds would be the predicted result in the May-August 1988 period with the total closure. Projections for the May-April period show a total increased of 0.30 million pounds with a 200 mile closure (Fig. 25). A loss of 1.56 million pounds of small shrimp (>67 count) would occur, along with a loss of medium shrimp (31-67 count) of around 0.72 million pounds. An increase of 2.57 million pounds in the large shrimp group (≤ 30 count) would offset this loss in smaller sized shrimp.

ADVERSE EFFECTS OF CLOSURE

All analyses show that effort has increased Gulf wide, with an overall decrease in CPUE. This change has occurred not because of the combined closure off Texas, but in response to the increase in vessels fishing the offshore waters. Thus, it seems that no adverse effects on CPUE or effort have occurred because of closure regulations.

Analysis of vessel mobility show that offshore vessels are starting to fish to a greater extent in home state waters each year. Percentage of catch from Louisiana waters by Texas vessels was lower this year than any year since 1985 (Fig. 27). Values in 1986 were higher than 1985 because of the higher catch rates off Louisiana compared to Texas. Many Texas vessels fished in Louisiana in 1986 to take advantage of this situation (Klima, et al., 1987). During 1987 and 1988 more and more vessels seem to be fishing in home state waters.

Shrimp catch in Texas waters from non-Texas vessels has decreased steady each year and this year was no exception (Nance, et al., 1988). The

very low level in June 1985 was because the entire EEZ was closed off Texas during this period. It appears as though the 15 nautical closure has decreased the take of shrimp from non-Texas vessels from waters off the state of Texas. This occurred even with the large influx of Florida vessels this year, because of the poor season experienced off their state this past winter and spring.

OTHER RELEVANT INFORMATION

Social Impacts

Responses of captains about the EEZ closure off Texas this year were very similar to responses received during the last two years. Greatest negative responses to a closure were again from captains in Louisiana and ports along the upper Texas coast (Fig. 30), while greatest positive responses were from captains in Florida, Alabama and ports along the lower coast of Texas (Fig. 29).

Farther indepth analysis again this year showed that the more freezer boats an area had, the greater the positive response to the closure and the more captains that selected a 200 mile closure over a 15 mile closure. Captains indicated that it was for better enforcement of the closure that the 200 nautical mile limit was selected.

Enforcement problems with the 15 mile closure seemed to be a problem only with lower Texas port vessel captains and Florida based vessel captains (Fig. 33). Most of these captains indicated that enforcement could be improved in one of three ways: 1) more agents, 2) 200 mile closure, or 3) stiffer punishment for violators.

15 Mile vs 200 Mile Closure

When 200 mile closure years (1981-1985) are compared with 15 mile closure years (1986-1988) some striking differences appear. The first difference is that much higher July CPUE's are experienced off Texas in 200 mile years (>1,000 pounds/day) than in 15 mile years (averaged 861 pounds/day) (Table 13). August CPUE values are comparable between the two closure types (excluding 1981) with an average around 685 pounds per day

for 200 mile closure years and 676 pounds per day for 15 mile closure periods.

Effort has increased tremendously the past two years. This however, has been a Gulf wide increase and has occurred along with an increase in the number of vessels fishing in the Gulf of Mexico. Thus, this is not an effect of a particular closure type.

Another difference between the two closure types is, as expected, the pounds of shrimp taken during the closed period (Fig. 35). About 20% of the shrimp landed during the closure period of the 15 mile closure years are small shrimp (>67 count). Figure 36 graphic depicts the catch of small shrimp during each of the eight closure years and periods. A dramatic increase in the landing of small shrimp has occurred during the past three seasons during the closure period. In each case between 50 and 70 percent of the catch is estimated to be inside the 15 mile closure line.

SUMMARY

The 1987 Fishery

Brown shrimp offshore production in statistical subareas 18-21 from May 1987 to April 1988 amounted to 27.8 million pounds. Over 12.5 million pounds were produced in July-August alone. Moderate catches and moderate levels of relative abundance occurred off the Texas coast in July and August. A peak in CPUE of almost 905 pounds/day occurred in July, but dropped to 653 pounds/day in August. Production of brown shrimp from September to December 1987 amounted to 8.6 million pounds with an average CPUE of around 417 pounds/day. This was an average catch value, but because of the high effort level, the CPUE value was one the lowest. In the January-April 1988 period, production amounted to only 1.7 million pounds with the CPUE falling to an average of approximately 211 pounds/day, but these values were about normal for the time period. Unlike the last two years, there really was no winter fishery off Texas this past season.

The offshore brown shrimp catch from statistical subareas 13-17 from May 1987 to April 1988 amounted to 27.3 million pounds. The 9.3 million pound brown shrimp catch in Louisiana offshore waters during the July-August 1987 period was lower than the 14.2 million pounds produced in Texas waters. In 1986 the catches from the two states were quite similar. This year catch ratios are back to average (Texas higher than Louisiana by a factor of about 1.5 to 2.0). The CPUE averaged 589 pounds/day. Effort was one of the greatest ever recorded for this time frame at 15,800 days. The September-December Louisiana offshore catch amounted to 5.1 million pounds, which was higher than all other closure years. During this time period the overall CPUE of 366 pounds/day was about the same as was occurring in Texas offshore waters. Effort off Louisiana was however the highest recorded since at least 1975. The catch in January-April 1988 amounted to 1.5 million pounds with an average CPUE of 228 pounds/day, which was also similar to Texas.

In comparing the catch, fishing effort and CPUE with their associated historical values, for Texas and Louisiana offshore waters from May 1987 to

April 1988, we found no significant differences in monthly catch off Texas, but significant difference in the monthly catch off Louisiana. Fishing effort was higher than the historical fishing effort off both Louisiana and Texas.

Recruitment to the Texas brown shrimp fishery in 1987 was slightly below average. Our predicted annual production of 25.7 million pounds from July 1987-June 1988 was close to the actual catch of 27.2 million pounds and was slightly above the average 26.9 million pounds for offshore production covering the past 28 years.

Recruitment to the Louisiana brown shrimp fishery in 1987, west of the Mississippi River, was slightly above average. Our predicted annual production of about 33 million pounds from the May 1987-April 1988 was below the actual catch of 40.00 million pounds. It was calculated this past year that the estimates of May catch that are used in our production model are usually about 10-15% below actual values. This adjustment in our model was made for 1988 predicted values.

A net gain of 0.06 million of shrimp would have occurred with a complete closure of the EEZ off Texas. This net gain was from a lost in small sizes (>67 count) of 3.63 million pounds, but a gain in medium (31-67 count) to large sizes ($\leq$30 count) of 1.15 and 2.54 million pounds, respectively.

The 1988 Fishery

Recruitment to areas 18-21 in 1988 appeared to be slightly below average. We estimated an annual yield of 25.9 million pounds for Texas offshore waters. The offshore catch in July-August 1987 from subareas 18-21 amounted to 12.5 million pounds or an estimated annual yield of 20.8 or 26.7 million pounds using historical percent of total caught during July-August.

Louisiana Department of Wildlife and Fisheries indicated that brown shrimp recruitment to Louisiana fisheries would be higher in 1988 than in most years. The NMFS forecasted an above average catch for Louisiana of up to 30.2 million pounds (average = 27.6 million pounds).

In 1988, the total Louisiana May-August catch was 28.9 million pounds compared to 22.1 million pounds in Texas. Catch levels in offshore waters were only slightly different between areas 13-17 and 18-21. This similarity in production set the tone for the summer offshore fishery.

Fishing effort was much greater off both Louisiana and Texas this year compared to most other years. This increase in effort with only average to slightly above average catch produced poorer than normal CPUE values in both areas.

The catch off Texas in July-August 1987 amounted to 12.5 million pounds. This represents an average catch for the area during this period. The average CPUE for this period was only 684 pounds/day. A rather low value when compared to other years.

The July-August catch off Louisiana amounted to 8.3 million pounds with an average CPUE of 538 pounds/day. In most closure years including 1987 and 1988, the CPUE off Texas has been at least 1.5-2.0 times greater than off Louisiana.

The average size of shrimp in July and August off Louisiana was 49 and 40 per pound, respectively, whereas off Texas the average count was 43 in July and 37 in August 1988.

Home port information indicated that during the June 1 though August 31 period Louisiana vessels predominantly landed in Louisiana and very few Texas vessels landed in Louisiana. Likewise, Texas vessels predominantly caught the majority of shrimp landed in Texas. Louisiana vessels rarely landed in Texas. Overall probably >90% of the offshore landings in Louisiana were caught by Louisiana vessels and between 80-90% of the Texas landings were caught by Texas vessels.

A net decrease of about 1.83 million pounds, would have resulted in the May-August 1988 period with a total closure of the EEZ. Projections for the May-April period, however, show an overall net increase of 0.30 million pounds.

Responses from interviewed vessel captains, about the EEZ closure, were similar to those received in 1986 and 1987. Greatest negative responses to a closure were again from captains in Louisiana and ports along the upper

Texas coast, while greatest positive responses were from captains in Florida, Alabama and ports along the lower coast of Texas.

Analysis of the EEZ closure each year has shown a positive benefit in pounds with or if a total closure out to 20 miles. Thus, the goals of the FMP were only partially achieved in 1988 with the 15 nautical mile closure. The closure did allow the capture of large shrimp in deeper waters, but problems were encountered in enforcement again this year. A lot of vessel captains complained about the poaching of small in the social survey conducted in 1987 and again in 1988. If the management plan is to be effective, compliance to the regulations must be observed by all involved.

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Table 1. Comparison of Texas closure dates.

Closure Year	Dates Closed	Length in Days
1981	May 22-July 15	55
1982	May 25-July 14	51
1983	May 27-July 15	50
1984	May 16-July 6	52
1985	May 20-July 8	50
1986	May 10-July 2	54
1987	June 1-July 15	45
1988	June 1-July 15	45

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ALL

Table 2. Copy of the social form used during the 1988 fishing season.

1988 OFFSHORE SOCIAL SURVEY
VESSEL CAPTAIN

BACKGROUND INFORMATION

Interview Date _____ Official Number _____

Vessel Home Port _____ Vessel Type ice or freezer

Vessel Length _____ Captain's Ethnic Group (Circle One) (White, Hispanic, Black, Asian, Am. Indian)

Number of years as a commercial shrimp fisherman _____

SURVEY INFORMATION

1. Should the Federal waters off Texas be closed? Yes or No
2. (If YES to # 1) What distance? _____
3. What needs to be done to improve the closure? _____

   _____

4. Was enforcement of the closure a problem this year? Yes or No
5. Has enforcement been a problem in other years? Yes or No
6. (If YES to # 4 or 5) What needs to be done to improve enforcement?

   _____

   _____

   _____

Table 3. Total offshore brown shrimp landings in millions of pounds, total fishing effort in 1000's of days and CPUE in lbs/day, for Louisiana statistical subareas 13-17, and Texas statistical subareas 18-21 for 1975-1988 (1980 not included).

	Jan.		Feb.		Mar.		Apr.	
Area	13-17	18-21	13-17	18-21	13-17	18-21	13-17	18-21
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
1985								
Catch	0.6	0.4	0.5	0.3	0.4	0.2	0.4	0.4
Effort	0.8	1.1	1.3	0.9	1.4	0.9	0.9	0.9
CPUE	734	357	405	326	298	267	519	464
1986								
Catch	1.4	0.9	1.0	1.0	0.8	0.6	0.4	0.8
Effort	2.9	1.6	2.1	2.5	1.5	1.9	0.9	2.2
CPUE	478	547	508	387	497	330	470	349
1987								
Catch	0.5	1.0	0.6	0.8	0.6	0.4	0.3	0.5
Effort	1.1	2.8	2.1	2.6	2.7	2.1	1.4	1.9
CPUE	459	347	308	304	239	199	189	248
1988								
Catch	0.5	0.5	0.5	0.6	0.2	0.3	0.3	0.4
Effort	1.5	1.8	2.1	2.5	1.3	1.5	1.5	2.3
CPUE	320	254	231	223	180	176	175	188

Table 3. cont. Total summary of total offshore brown shrimp landings in millions of pounds, total fishing effort in 1000's of days and average CPUE in lbs/day for Louisiana statistical subareas 13-17, and Texas statistical subareas 18-21 for 1975-1988 (1980 not included).

	May		June		July		Aug.	
Area	13-17	18-21	13-17	18-21	13-17	18-21	13-17	18-21
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
1985								
Catch	6.9	0.6	4.0	-	3.0	8.2	2.5	5.6
Effort	5.7	1.5	5.4	-	4.9	6.8	3.7	8.4
CPUE	1221	391	732	-	612	1223	682	672
1986								
Catch	7.8	1.0	5.4	2.3	6.3	5.7	3.3	5.0
Effort	8.0	2.6	7.9	3.7	7.5	6.3	4.3	6.2
CPUE	978	390	691	628	840	896	773	799
1987								
Catch	4.9	0.9	6.6	2.4	6.0	8.9	3.3	5.3
Effort	7.9	3.1	11.1	4.6	10.0	9.9	5.8	8.2
CPUE	618	300	595	519	595	905	577	653
1988								
Catch	2.2	1.1	4.4	1.6	4.2	7.5	4.2	5.0
Effort	8.6	3.4	10.2	3.7	7.5	9.6	8.0	8.7
CPUE	259	319	431	431	556	781	521	578

Table 3. Total offshore brown shrimp landings in millions of pounds, total fishing effort in 1000's of days and CPUE in lbs/day for Louisiana statistical subareas 13-17, and Texas statistical subareas 18-21 for 1975-1988 (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
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	430	310	439	962	526	452
1984								
Catch	1.3	0.9	7.1	0.8	6.6	15.3	2.7	5.2
Effort	3.4	3.9	9.8	2.4	11.2	18.6	4.7	14.2
CPUE	395	224	718	295	587	819	575	366
1985								
Catch	2.0	1.4	10.9	0.6	6.1	14.0	3.4	9.7
Effort	4.4	3.8	11.1	1.5	9.7	15.2	5.3	15.5
CPUE	459	353	982	389	625	918	642	626
1986								
Catch	3.6	3.3	13.2	3.3	9.6	10.7	4.8	10.5
Effort	7.5	8.4	15.9	6.3	11.8	12.5	8.0	16.8
CPUE	480	393	830	524	813	856	600	625
1987								
Catch	2.0	2.7	11.5	3.3	9.3	14.2	5.1	8.6
Effort	7.3	9.4	19.0	7.7	15.8	18.1	13.8	20.7
CPUE	274	287	605	429	589	789	366	417
1988								
Catch	1.5	1.7	6.6	2.7	8.3	12.5	-	-
Effort	6.3	8.1	18.8	7.1	15.4	18.2	-	-
CPUE	228	211	351	383	538	684	-	-

Table 4a. Galveston Bay Bait shrimp index values from 1960-1988 (average catch from 1960-1987 = 26.9 million pounds).

Year	Bait index	Predicted catch in millions of pounds	Actual catch in millions of pounds	Difference in millions of pounds
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
1966	-	-	31.5	-
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
1975	-	-	23.7	-
1976	34.1	23.8	25.7	+1.9
1977	58.1	30.5	34.4	+3.9
1978	40.5	25.5	27.7	+2.2
1979	-	-	16.5	-
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	18.2	+0.4
1984	31.2	22.9	24.1	+1.2
1985	44.9*	29.0	30.4	+1.4
1986	37.2	25.3	27.1	+1.8
1987	38.6	25.7	27.2	+1.5
1988	41.9	25.9	NA	NA

*Modified bait index model used.

Table 4b. Louisiana May catch index values from 1960-1988 (average catch from 1960-1987 = 27.6 million pounds).

Year	Catch index	Predicted catch millions of pounds	Actual catch millions of pounds	Difference
1960	2.16	--	15.99	--
1961	1.57	--	9.15	--
1962	2.54	--	7.26	--
1963	4.86	--	16.87	--
1964	1.97	--	9.59	--
1965	3.13	--	17.84	--
1966	2.56	--	19.07	--
1967	7.61	--	30.61	--
1968	4.76	--	25.42	--
1969	4.58	--	25.18	--
1970	5.23	--	28.09	--
1971	5.55	--	30.74	--
1972	5.87	--	32.45	--
1973	2.63	--	19.07	--
1974	3.98	--	20.74	--
1975	4.72	--	18.23	--
1976	8.90	--	37.53	--
1977	13.66	--	49.88	--
1978	9.57	--	45.88	--
1979	7.82	--	36.66	--
1980	4.36	--	23.71	--
1981	11.32	--	44.38	--
1982	9.89	--	33.12	--
1983	4.87	--	24.84	--
1984	6.96	--	33.36	--
1985	10.13	40.30	33.71	-6.59
1986	15.00	50.00	43.96	-6.04
1987	9.38	32.90	40.00	+7.10
1988	7.20*	30.20	NA	

*Modified index.

Table 5. Louisiana inshore brown shrimp catch 1988, in 1,000 pounds - Mississippi River to Texas. Does not include pieces.

Size Count	May	June	July	August	Total
<15	0.3	1.9	0.7	0.3	3.2
16-20	1.8	0.1	0.1	10.4	12.4
21-25	0.9	0.1	1.2	17.6	19.9
26-30	3.5	4.2	6.1	18.8	32.6
31-40	8.1	23.4	28.9	55.9	116.3
41-50	5.5	57.3	54.2	71.1	188.2
51-67	20.3	807.8	282.9	103.2	1,214.1
68-80	83.5	1,559.9	228.3	61.9	1,933.6
81-100	490.4	1,662.3	127.4	5.4	2,285.6
101-115	1,087.1	1,252.5	85.8	0.0	2,425.4
>116	3,983.5	1,572.3	98.0	0.2	5,654.0
Total	5,685.0	6,941.7	913.3	345.0	13,885.1

Table 6. Texas inshore brown shrimp catch 1988, in 1,000 pounds.

Size Count	May	June	July	August	Total
<15	0.0	0.0	0.2	0.0	0.2
16-20	0.6	0.7	5.5	0.2	7.1
21-25	0.7	0.3	1.4	2.6	5.0
26-30	0.9	0.9	8.4	11.0	21.1
31-40	8.1	40.1	56.8	71.5	176.5
41-50	13.1	101.7	150.7	172.3	436.8
51-67	43.2	141.9	248.2	87.0	520.3
68-80	130.8	434.3	250.9	91.3	907.3
81-100	260.1	576.0	148.9	64.7	1,049.1
101-115	594.9	556.4	60.8	18.8	1,230.8
116- >	1,306.8	1,070.2	112.1	23.3	2,512.9
Total	2,359.2	2,922.4	1,043.0	542.7	6,867.8

Table 7. Mean number of shrimp per pound from inshore waters in 1988.

State	May	June	July	August
LA	128	94	76	50
TX	120	103	74	62

Table 8. Mean number of shrimp per pound from offshore waters (1988).

State	May	June	July	August
LA	103	65	49	40
TX	50	49	43	37

Table 9. Numbers of shrimp caught in Texas and Louisiana from May-August 1988 (numbers in millions of shrimp).

State	May	June	July	August	Total
LA					
Inshore	727.4	655.5	969.7	17.2	1,469.8
Offshore	228.4	281.2	201.3	163.5	874.4
Total	955.8	936.7	271.0	180.7	2,344.2
TX					
Inshore	282.7	301.1	77.0	33.4	694.2
Offshore	53.7	77.8	320.7	183.0	635.2
Total	336.4	378.9	397.7	216.4	1,329.4

Table 10. May-August 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.

	Years								
Area	1988	1987	1986	1985	1984	1983	1982	1981	1980
Louisiana:									
Inshore	14.0	12.4	14.3	8.9	14.9	12.1	15.1	15.2	7.3
Offshore	14.9	20.8	22.8	16.9	13.6	8.8	13.7	23.1	11.7
Total	28.9	33.2	37.1	25.7	28.5	20.9	28.8	38.3	19.0
Texas:									
Inshore	6.9	7.6	5.1	5.4	7.1	5.9	4.1	4.2	4.5
Offshore	15.2	17.5	14.0	14.5	16.1	10.5	13.9	25.3	12.6
Total	22.1	25.1	19.1	19.9	23.5	16.4	18.0	29.5	17.1

Table 11. Percent of offshore Texas, Louisiana, Mississippi, Alabama and Florida landings caught off each state in 1988.

Percent of Texas Landings caught off each state offshore.

State Caught	June 1-30	July 1-31	August 1-31
TX	76.5	92.6	83.3
LA	23.2	7.3	16.7
MS	0.0	0.0	0.0
AL	0.0	0.0	0.0
FL	0.3	0.0	0.0
Thousand Pounds	2,993.6	7,944.7	5,772.2

Percent of Louisiana landings caught off each state offshore.

State Caught	June 1-30	July 1-31	August 1-31
TX	0.4	8.5	5.7
LA	99.5	91.5	94.3
MS	0.1	0.1	0.1
AL	0.1	0.0	0.0
FL	0.0	0.0	0.0
Thousand Pounds	3,625.5	4,019.0	6,055.3

Percent of Mississippi landings caught off each state offshore.

State Caught	June 1-30	July 1-31	August 1-31
TX	0.0	0.0	0.0
LA	81.8	6.8	36.8
MS	17.8	92.1	63.2
AL	0.3	1.1	0.0
FL	0.0	0.0	0.0
Thousand Pounds	1,099.1	194.5	475.5

Percent of Alabama landings caught off each state offshore.

State Caught	June 1-30	July 1-31	August 1-31
TX	0.0	11.4	12.5
LA	34.8	44.0	36.1
MS	54.3	43.0	51.0
AL	4.2	1.6	0.5
FL	6.6	0.0	0.0
Thousand Pounds	731.5	617.9	991.7

Table 11. continued.

Percent of Florida landings caught off each state offshore.

State Caught	June 1-30	July 1-31	August 1-31
TX	0.0	1.3	4.7
LA	1.0	2.6	0.0
MS	0.0	1.1	7.8
AL	2.1	0.0	2.5
FL	96.5	95.0	85.0
Thousand Pounds	894.5	436.8	450.6

Table 12. Percent and total pounds landed in millions of pounds (offshore only) by vessels and boats from Gulf States from June through August 1988.

Home Port	Area Landed	Area Fished	Pounds Landed	Total Landings in States	% of Total Pounds
			June 1-30		
LA	LA	LA	1.07	3.55	30.1
TX	LA	LA	0.24	3.55	6.8
Other*	LA	LA	0.03	3.55	0.9
Unknown**	LA	LA	2.19	3.55	61.7
LA	LA	TX	0.00	3.55	0.0
TX	LA	TX	0.00	3.55	0.0
Other	LA	TX	0.00	3.55	0.0
Unknown	LA	TX	0.01	3.55	0.4
LA	TX	LA	0.01	2.98	0.4
TX	TX	LA	0.61	2.98	20.4
Other	TX	LA	0.02	2.98	0.7
Unknown	TX	LA	0.05	2.98	1.7
LA	TX	TX	0.03	2.98	0.9
TX	TX	TX	2.05	2.98	68.7
Other	TX	TX	0.10	2.98	3.3
Unknown	TX	TX	0.11	2.98	3.6
			July 1-31		
LA	LA	LA	1.57	3.95	39.9
TX	LA	LA	0.17	3.95	4.3
Other	LA	LA	0.04	3.95	1.0
Unknown	LA	LA	1.83	3.95	46.3
LA	LA	TX	0.11	3.95	2.7
TX	LA	TX	0.03	3.95	0.7
Other	LA	TX	0.00	3.95	0.0
Unknown	LA	TX	0.21	3.95	5.3
LA	TX	LA	0.01	7.94	0.1
TX	TX	LA	0.49	7.94	6.2
Other	TX	LA	0.03	7.94	0.4
Unknown	TX	LA	0.05	7.94	006
LA	TX	TX	0.31	7.94	3.9
TX	TX	TX	5.70	7.94	71.8
Other	TX	TX	0.60	7.94	7.6
Unknown	TX	TX	0.74	7.94	9.4

Table 12. continued.

Home Port	Area Landed	Area Fished	Pounds Landed	Total Landings in States	% of Total Pounds
			August 1-31		
LA	LA	LA	2.07	6.05	34.3
TX	LA	LA	0.31	6.05	5.1
Other	LA	LA	0.07	6.05	1.1
Unknown	LA	LA	3.26	6.05	53.9
LA	LA	TX	0.18	6.05	2.9
TX	LA	TX	0.01	6.05	0.1
Other	LA	TX	0.02	6.05	0.4
Unknown	LA	TX	0.14	6.05	2.3
LA	TX	LA	0.02	5.77	0.4
TX	TX	LA	0.85	5.77	14.7
Other	TX	LA	0.05	5.77	0.8
Unknown	TX	LA	0.05	5.77	0.8
LA	TX	TX	0.08	5.77	1.4
TX	TX	TX	3.99	5.77	69.1
Other	TX	TX	0.43	5.77	7.5
Unknown	TX	TX	0.30	5.77	5.3

*Home port vessels from other states (i.e., Florida, Mississippi and Alabama).

**Unknown consolidated vessels and boats; mostly uninterviewed vessels and boats from the home port of the area fished.

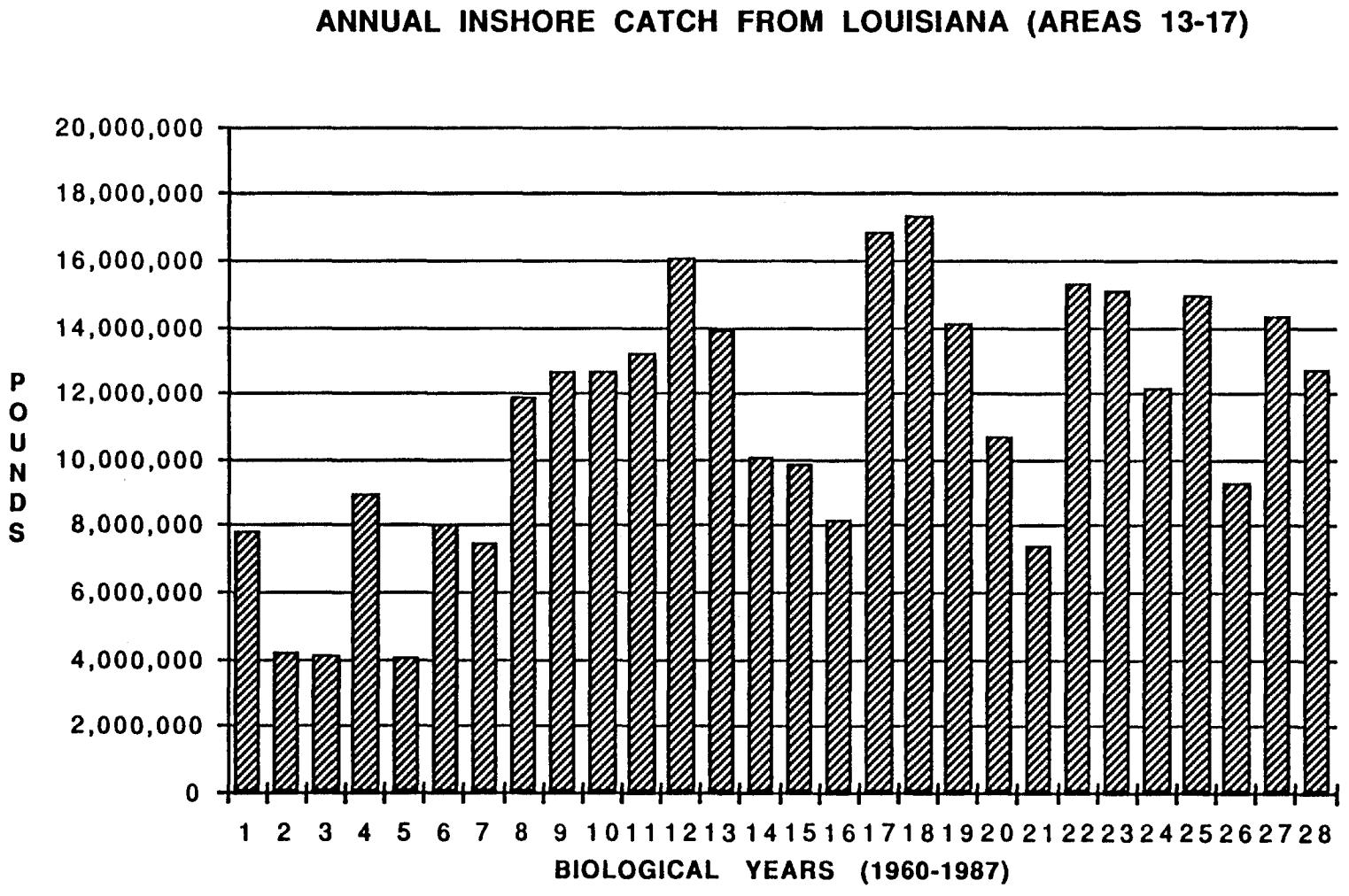
Table 13. Summary of fishing effort and CPUE for Louisiana (13-17) and Texas (18-21).

Fishing Effort (1000 Day)

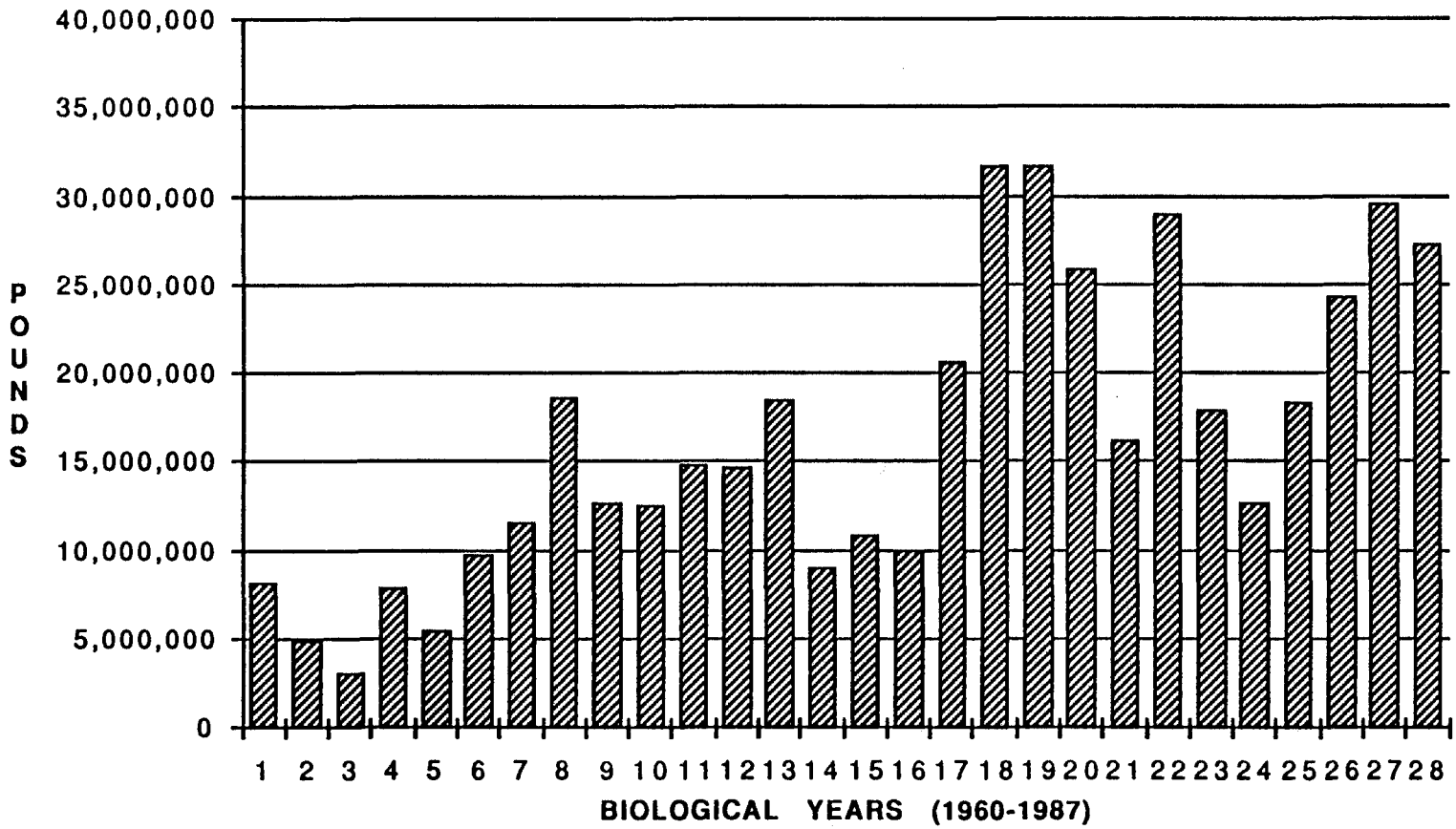
Year	Areas 13-17			Areas 18-21		
	May-June	July	August	May-June	July	August
1981	14.8	8.1	3.8	1.1	4.4	10.4
1982	14.2	6.4	3.4	2.6	5.2	10.2
1983	9.1	4.2	4.9	2.3	3.7	6.7
1984	9.8	6.4	4.7	2.4	8.2	9.0
1985	11.1	6.0	3.7	1.5	6.8	8.4
1986	15.9	7.5	4.3	6.3	6.3	6.2
1987	19.0	10.0	5.8	7.7	9.8	8.2
1988	18.8	7.5	8.0	7.1	9.6	8.7
Average (81-85)	11.8	6.2	4.1	2.0	5.7	8.9

CPUE (lbs/fishing day)

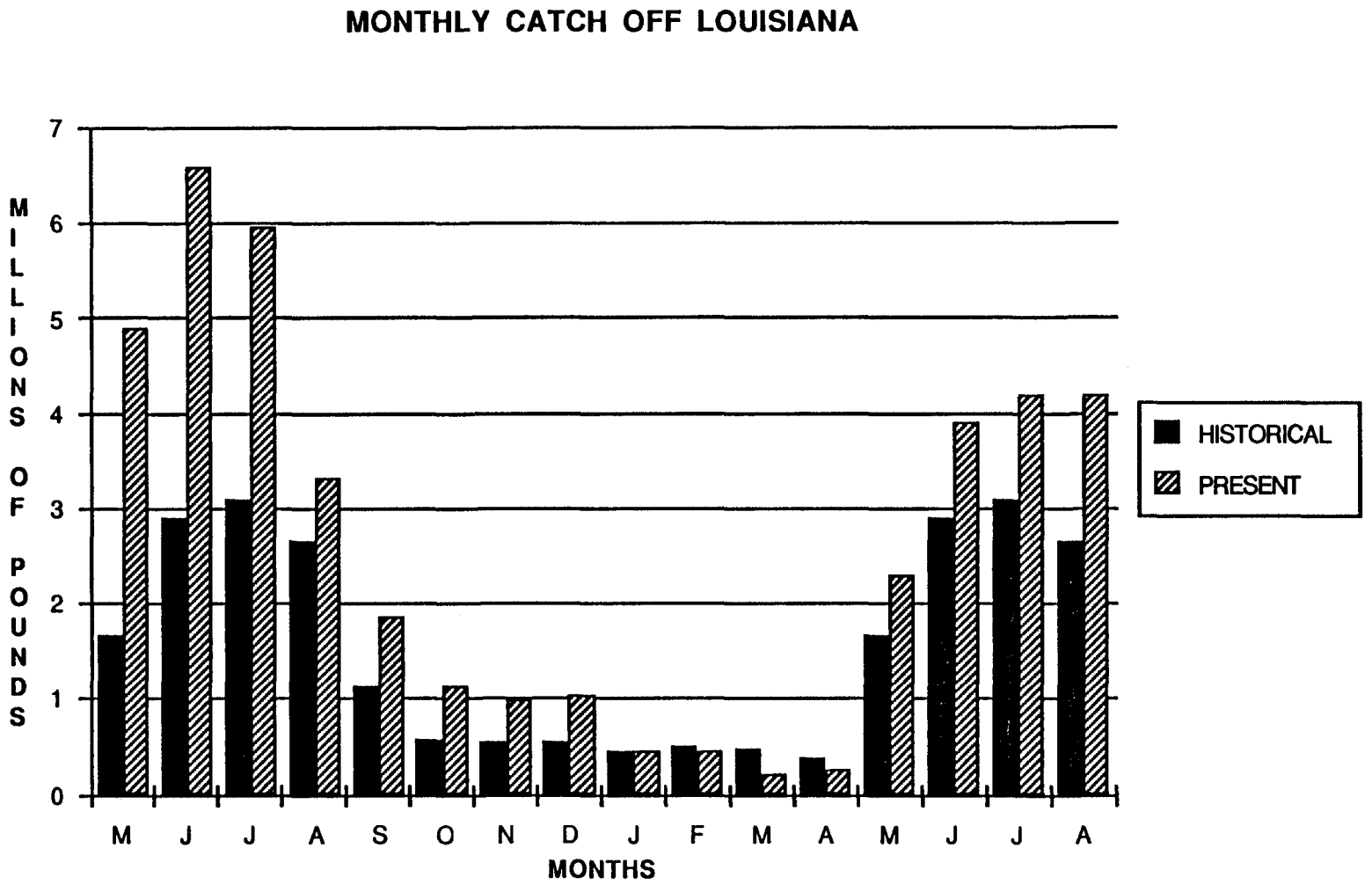
Year	Areas 13-17			Areas 18-21		
	May-June	July	August	May-June	July	August
1981	852	927	799	308	2,382	1,408
1982	607	525	522	295	1,279	629
1983	430	415	470	310	1,414	714
1984	718	598	573	295	1,074	723
1985	982	612	682	389	1,223	672
1986	830	840	773	524	896	799
1987	605	595	577	429	905	653
1988	351	556	521	538	781	578
Average (81-85)	718	615	609	319	1,474	829



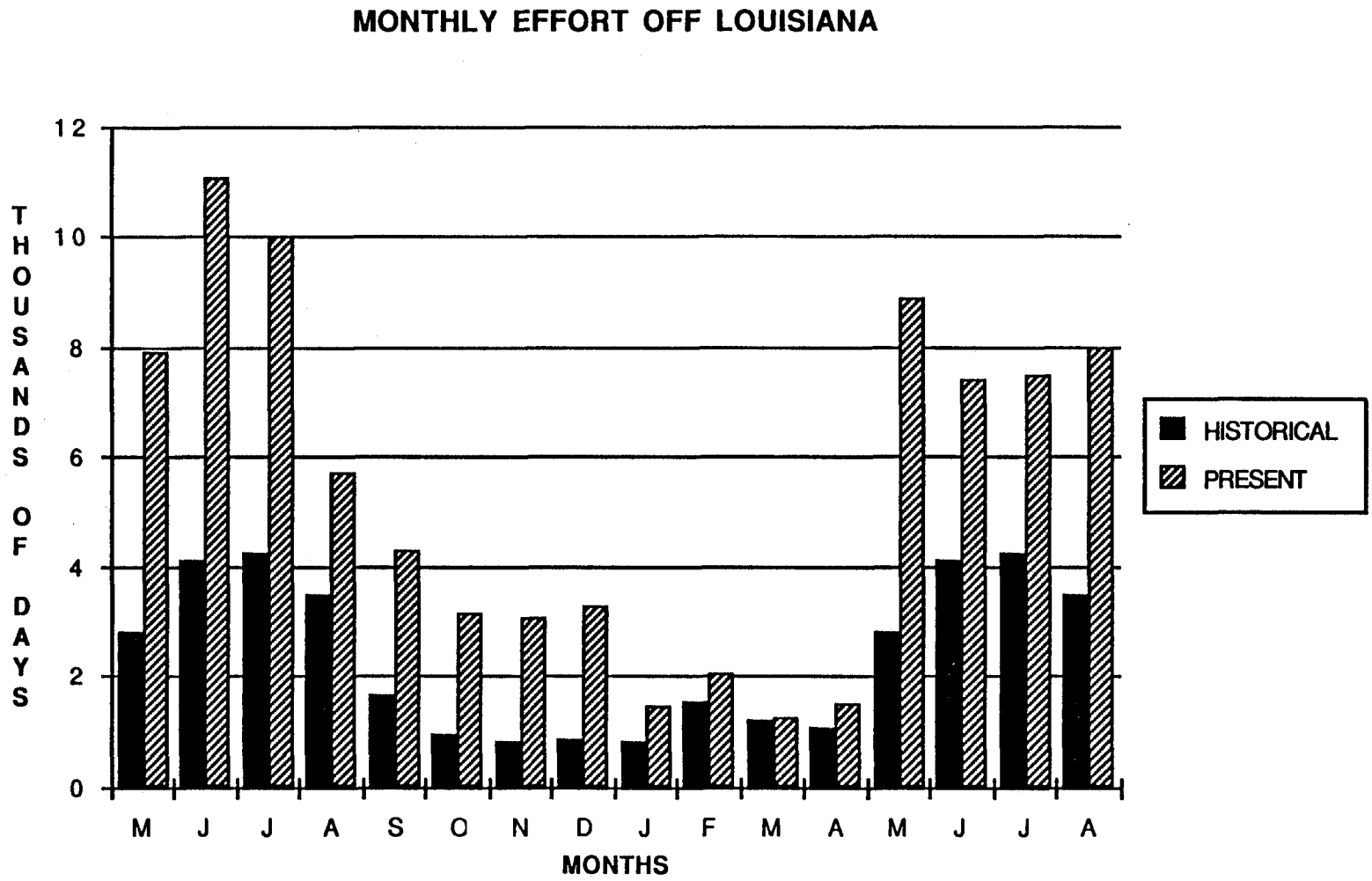
2. Annual inshore brown shrimp landings in Louisiana west of the Mississippi River.



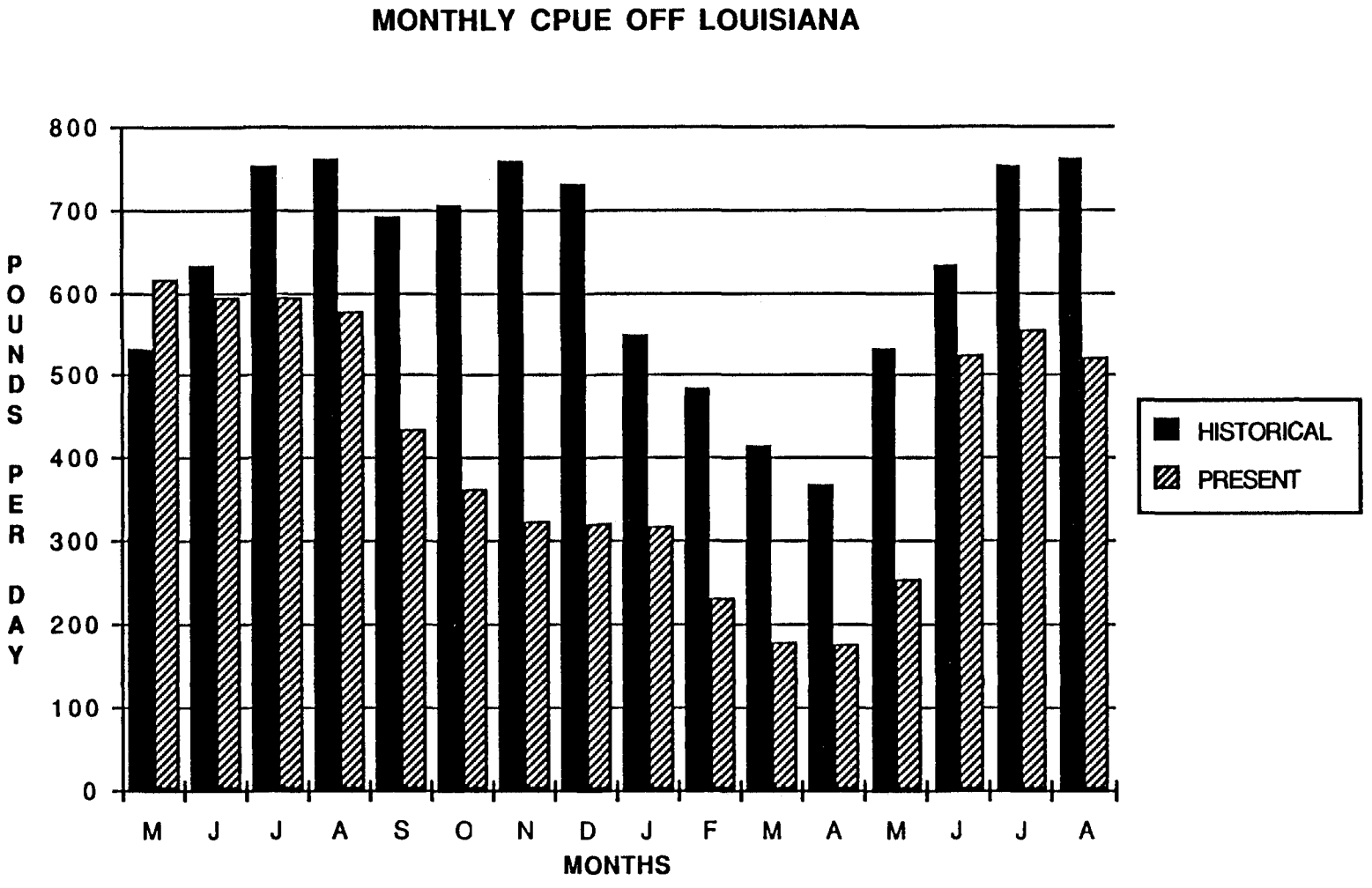
3. Annual offshore brown shrimp landings in Louisiana west of the Mississippi River.



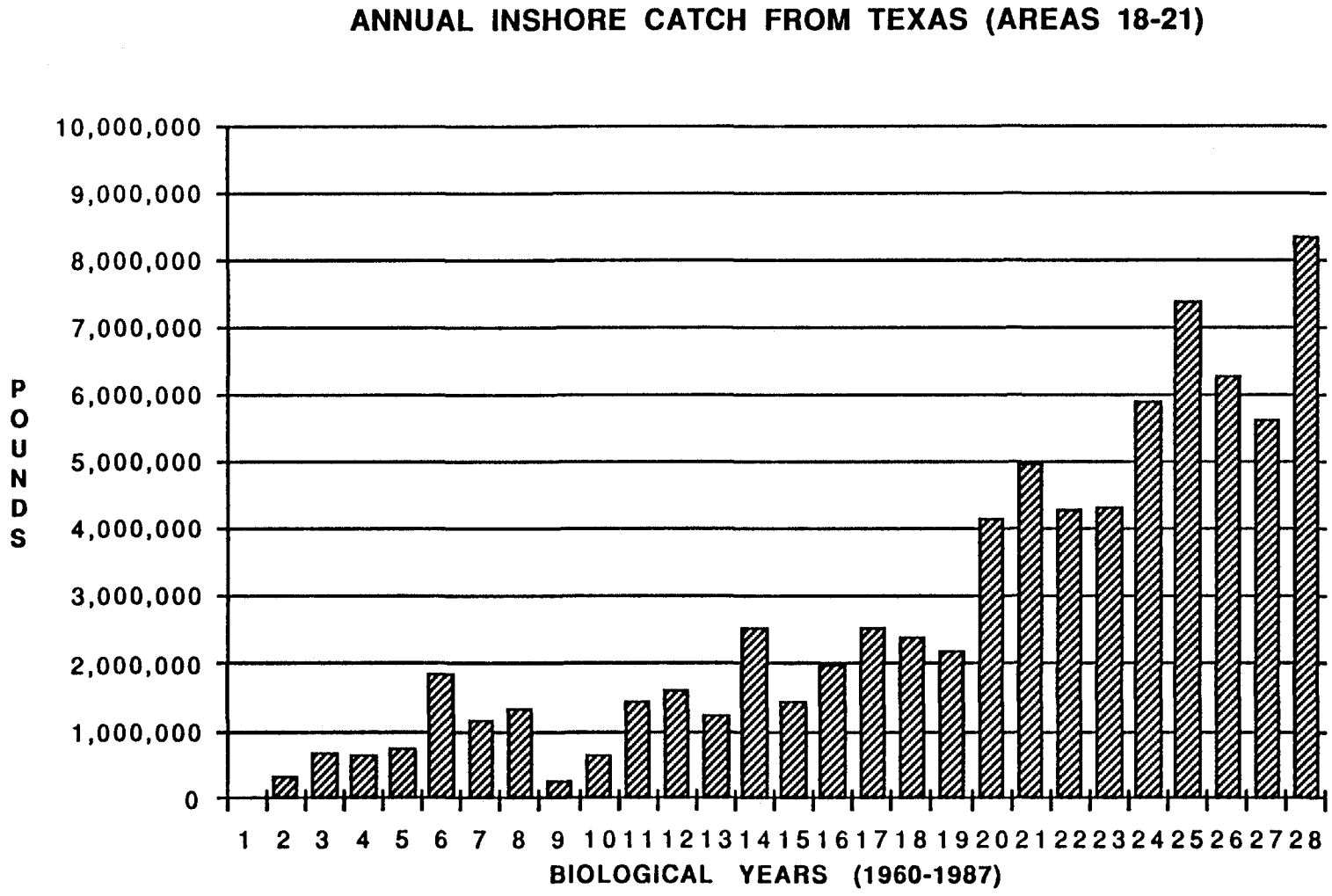
4. Average monthly historical catch compared to monthly catch values during biological year 1987 and the first four months of biological year 1988.



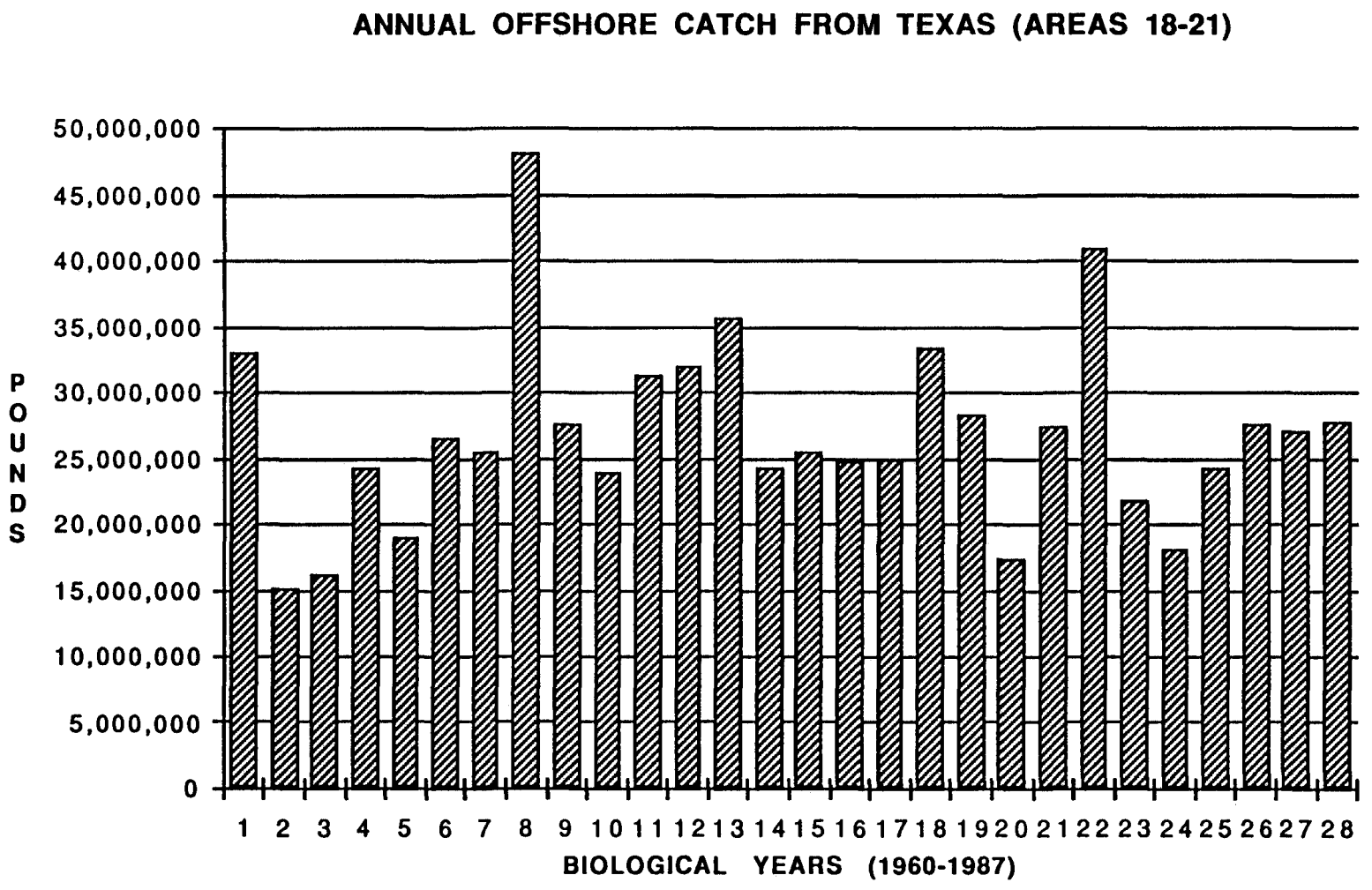
5. Average monthly historical effort compared to monthly effort values during biological year 1987 and the first four months of biological year 1988.



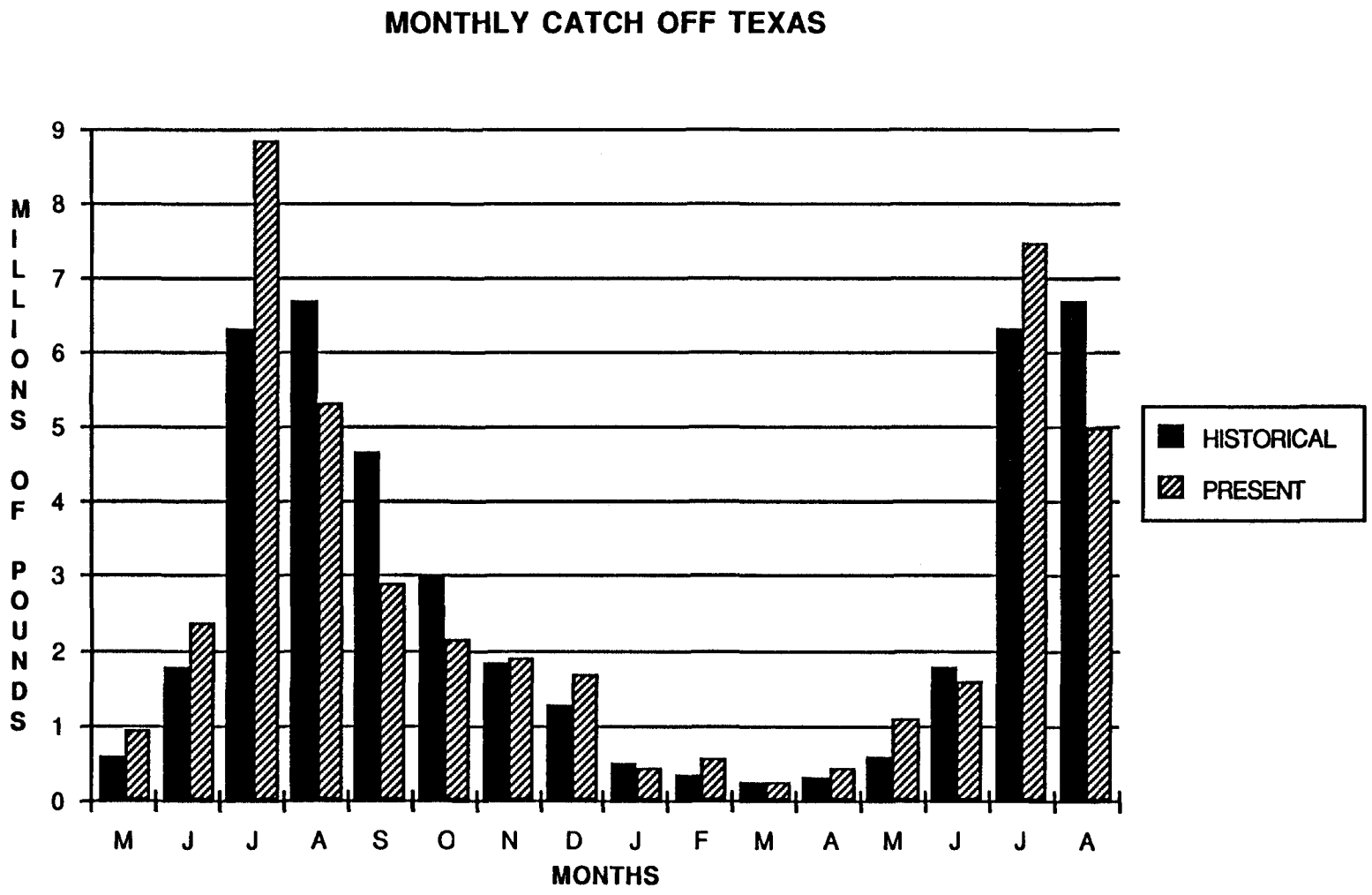
6. Average monthly historical CPUE compared to monthly CPUE values during biological year 1987 and the first four months of biological year 1988.



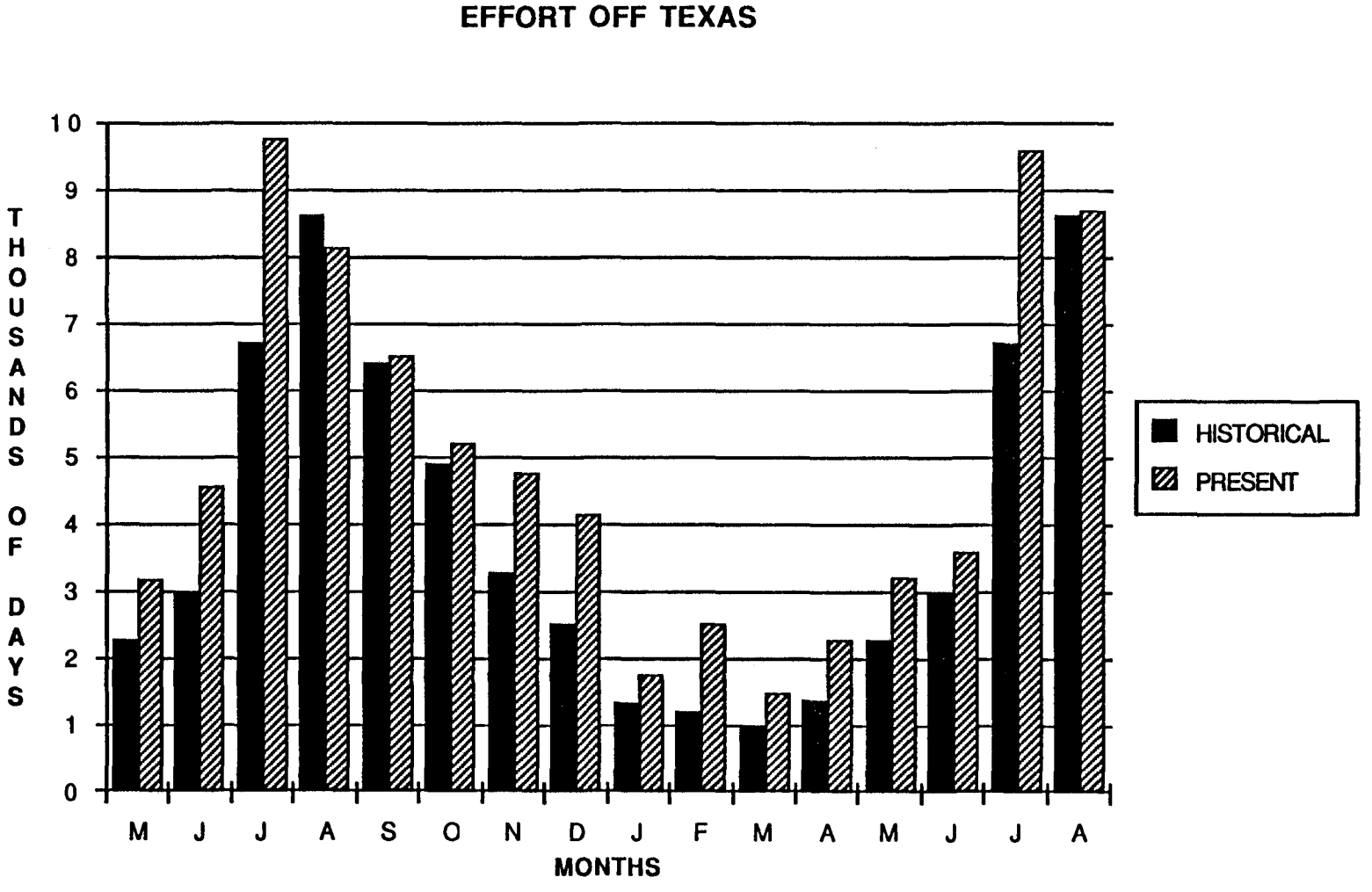
7. Annual inshore brown shrimp landings in Texas.



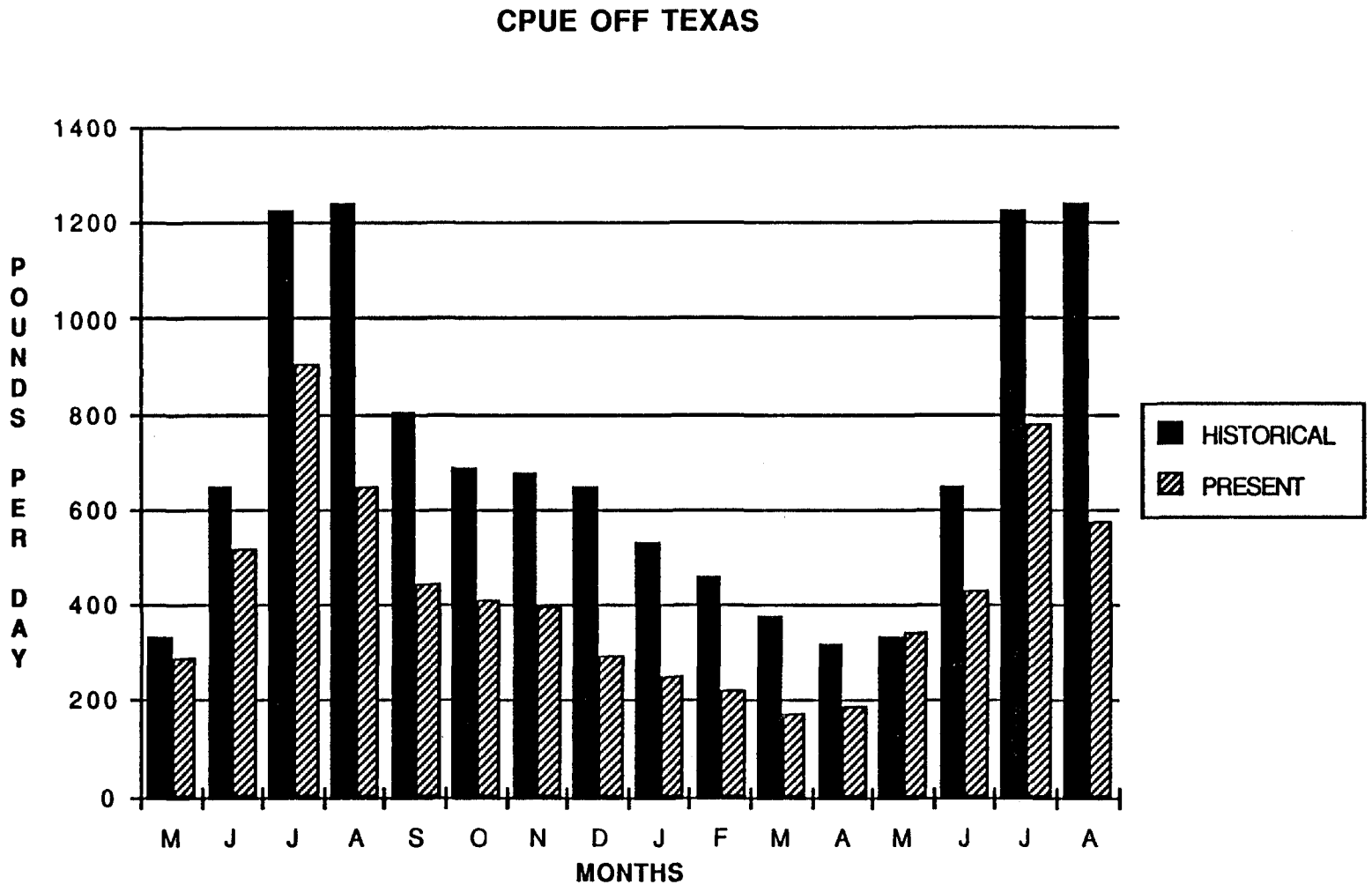
8. Annual offshore brown shrimp landings in Texas.



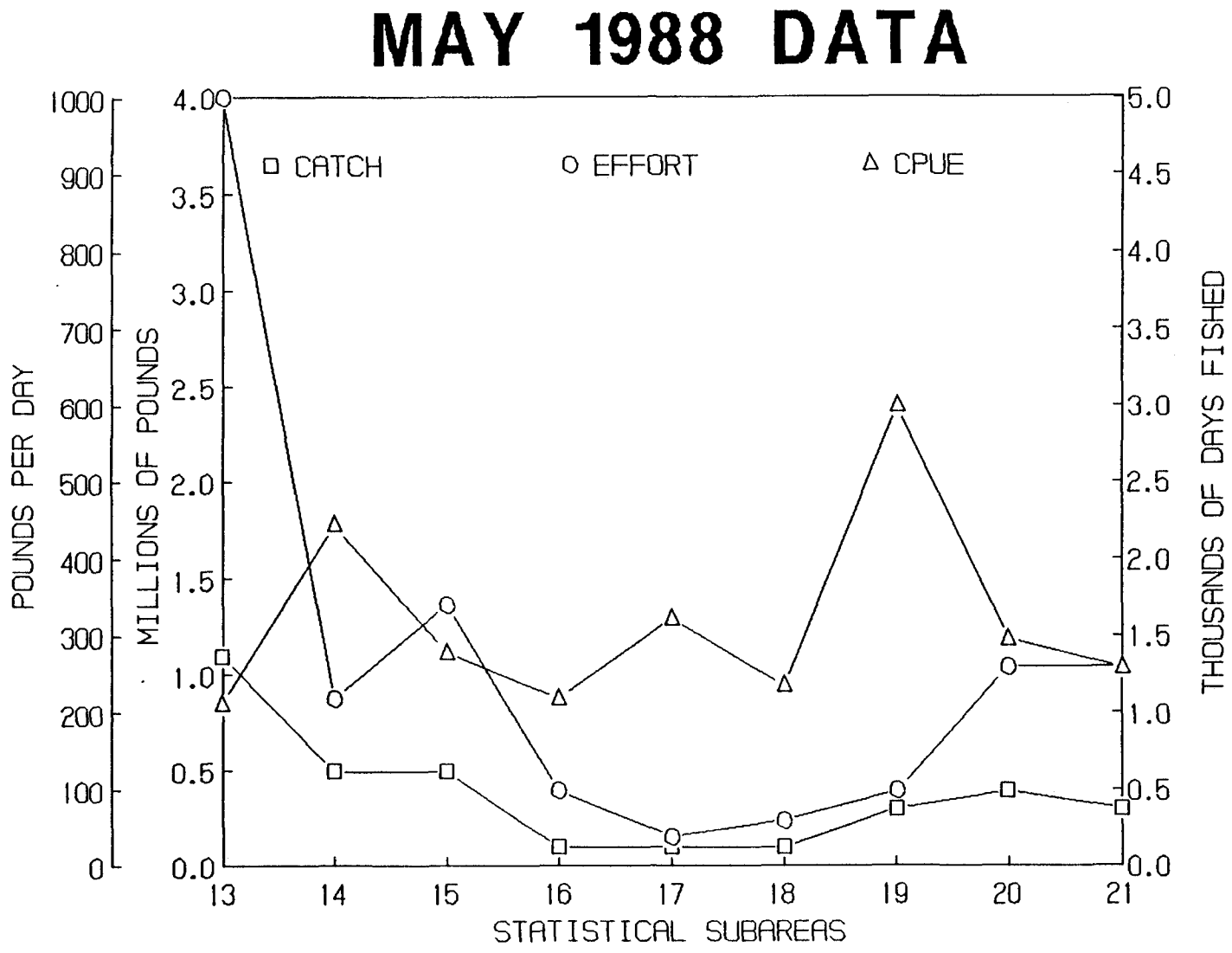
9. Average monthly historical catch compared to monthly catch values during biological year 1987 and the first four months of biological year 1988.



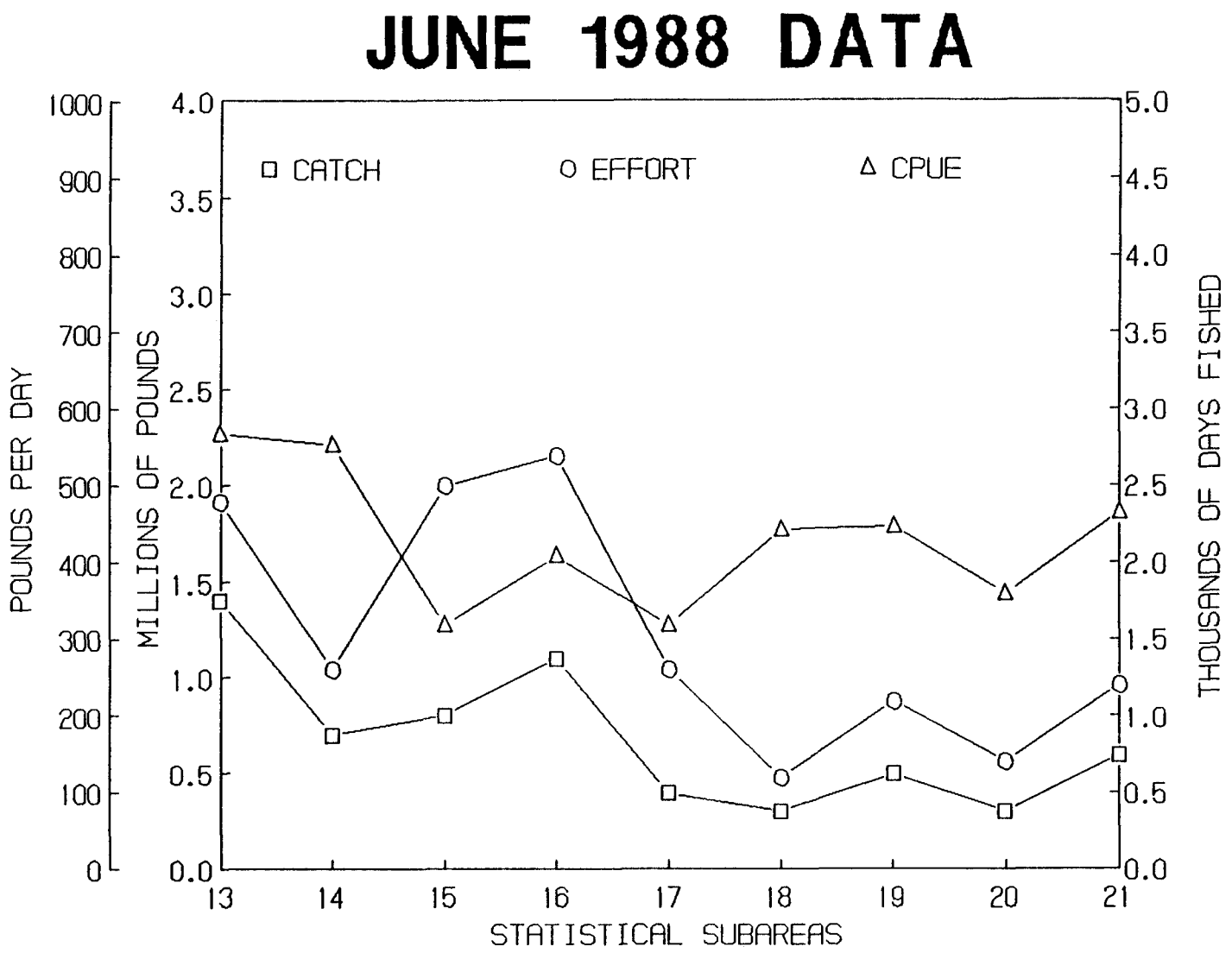
10. Average monthly historical effort compared to monthly effort values during biological year 1987 and the first four months of biological year 1988.



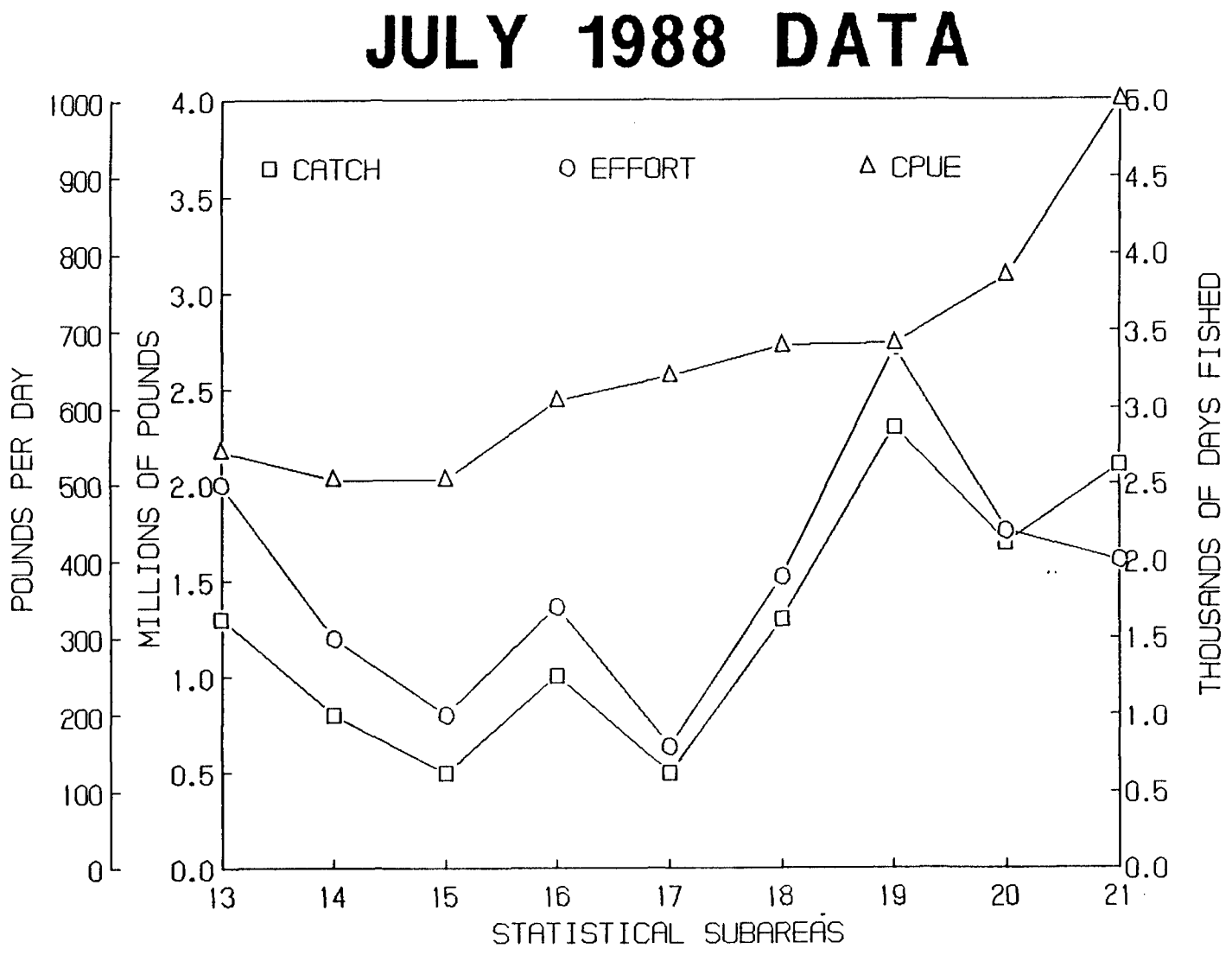
11. Average monthly historical CPUE compared to monthly CPUE values during biological year 1987 and the first four months of biological year 1988.



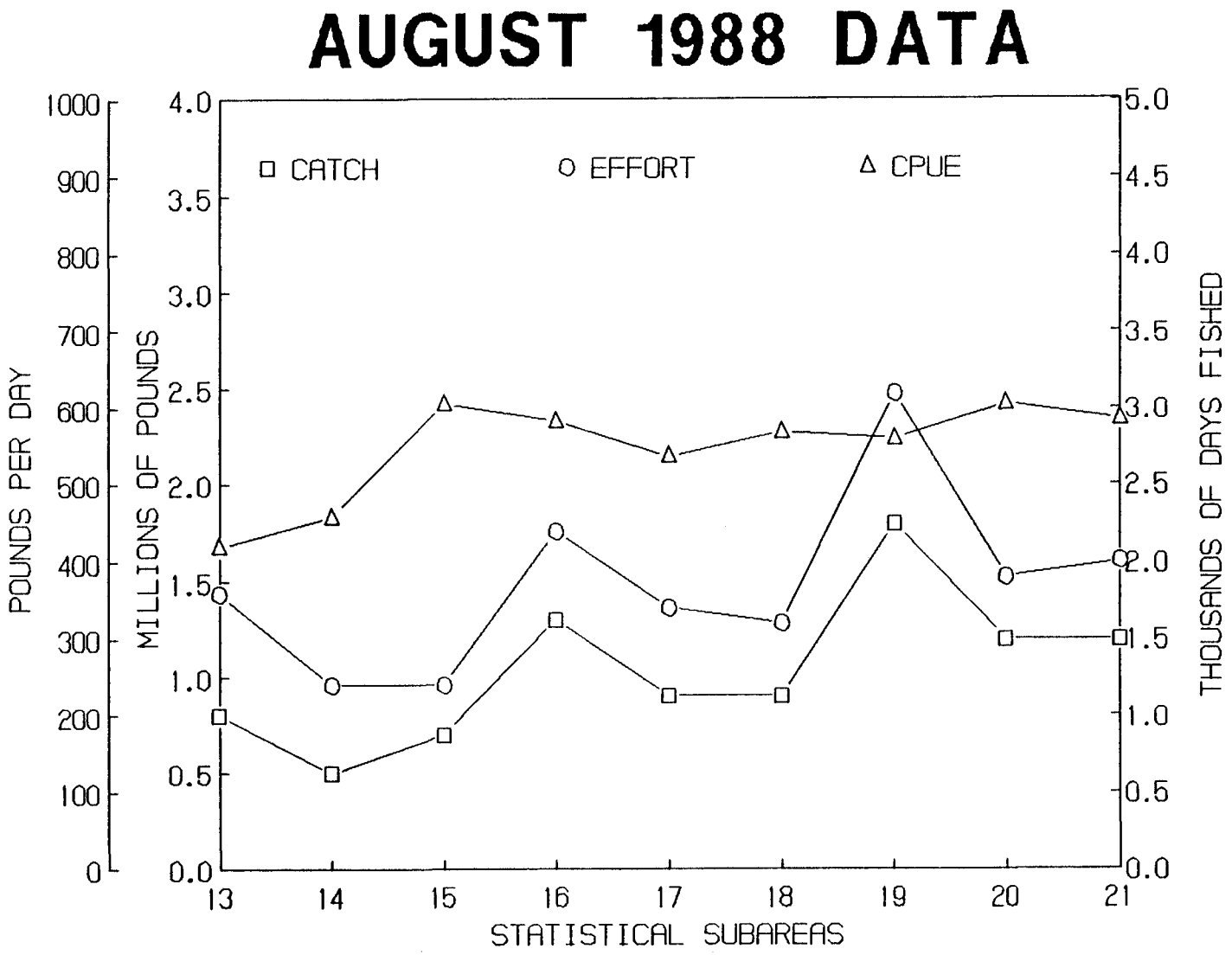
12. Offshore brown shrimp catch, fishing effort and CPUE from statistical subareas 13-21 in May 1988.



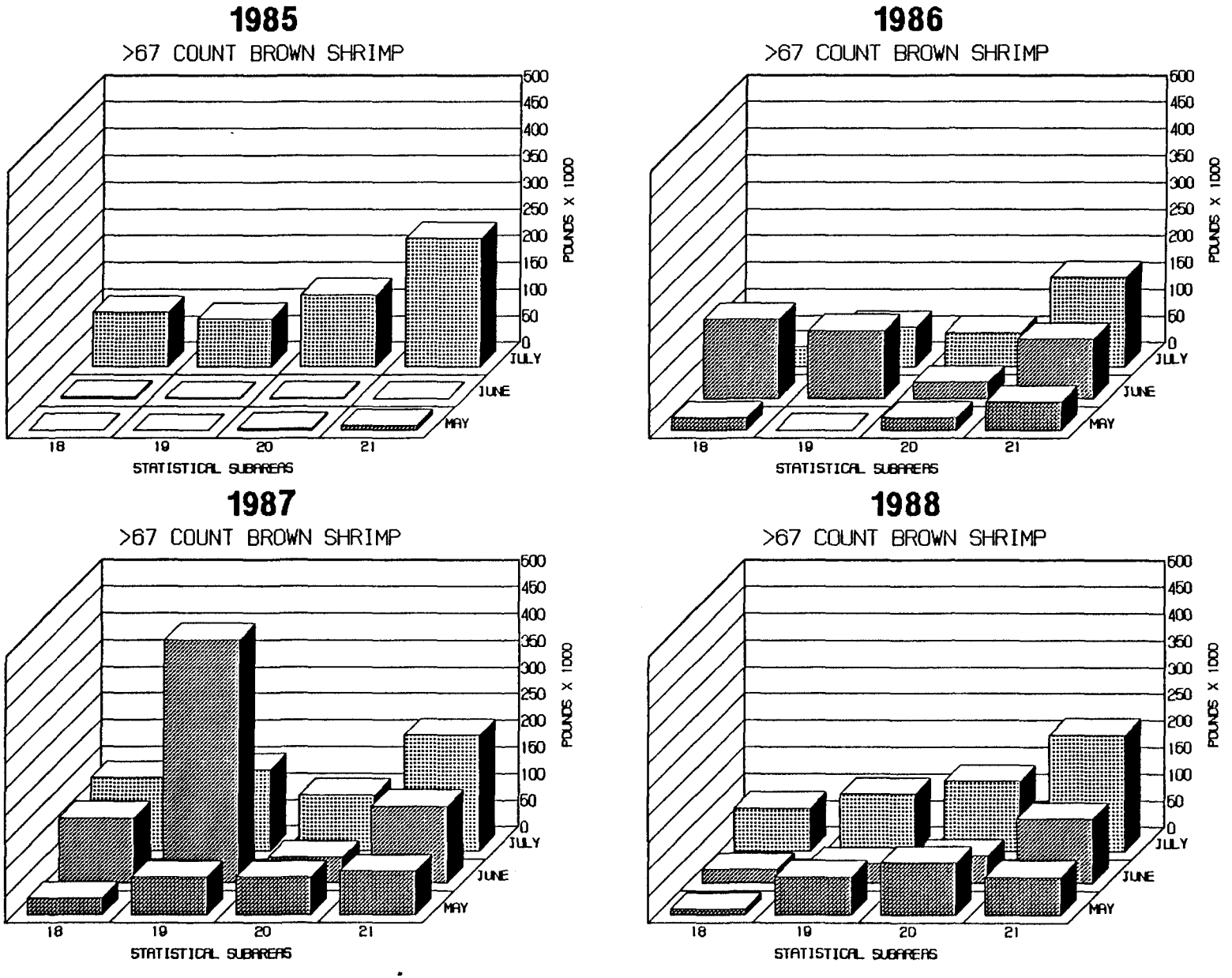
13. Offshore brown shrimp catch, fishing effort and CPUE from statistical subareas 13-21 in June 1988.



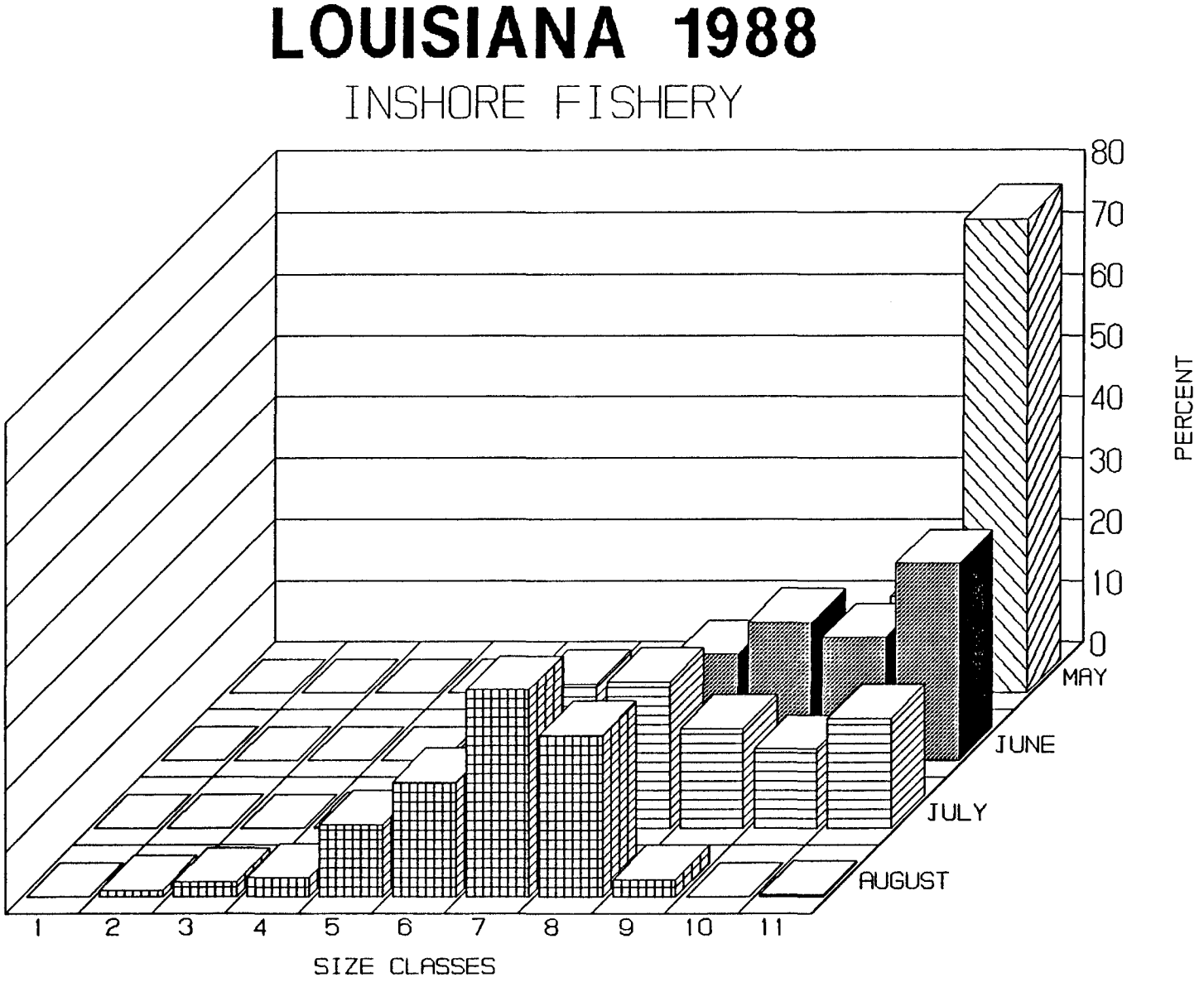
14. Offshore brown shrimp catch, fishing effort and CPUE from statistical subareas 13-21 in July 1988.



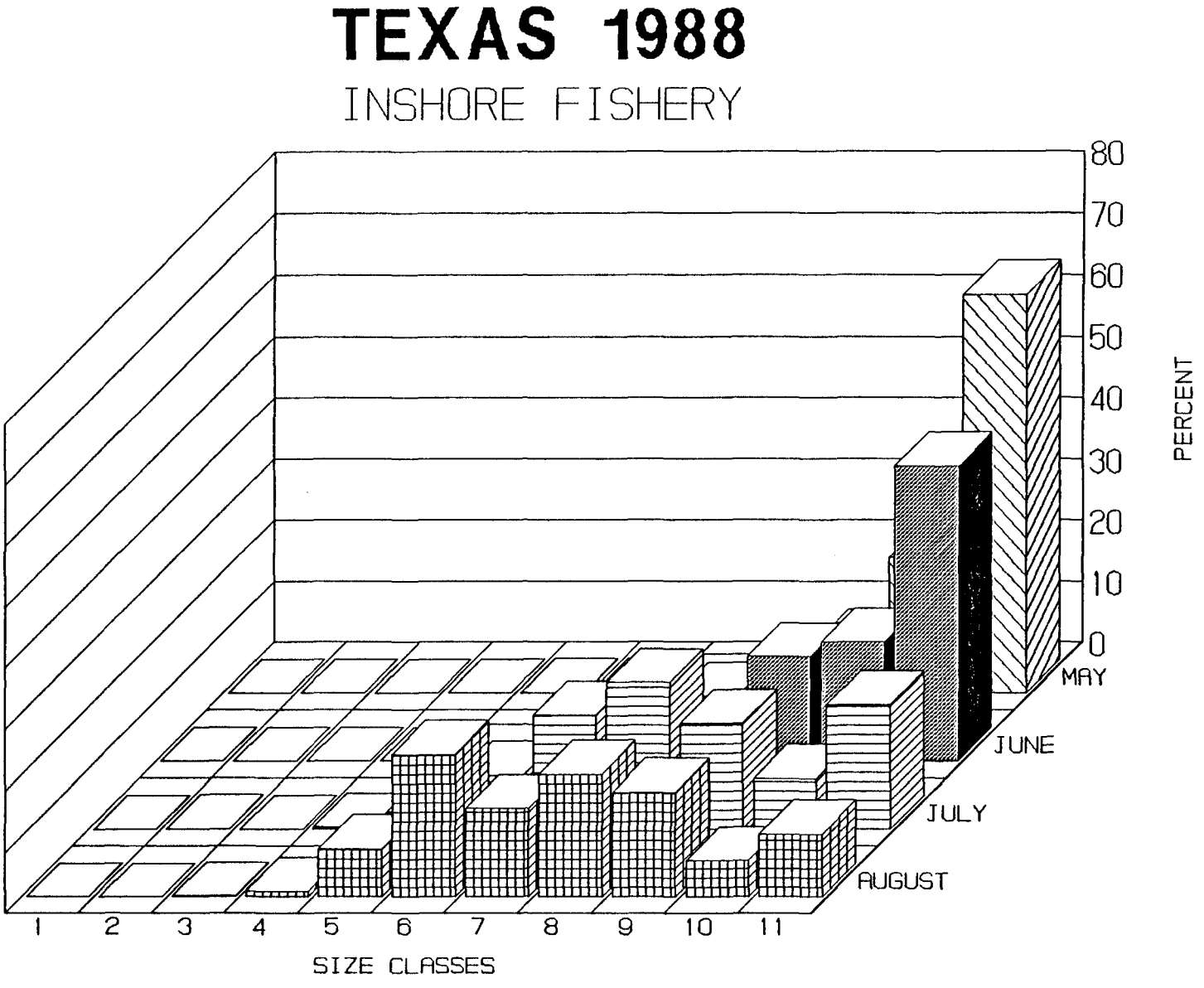
15. Offshore brown shrimp catch, fishing effort and CPUE from statistical subareas 13-21 in August 1988.



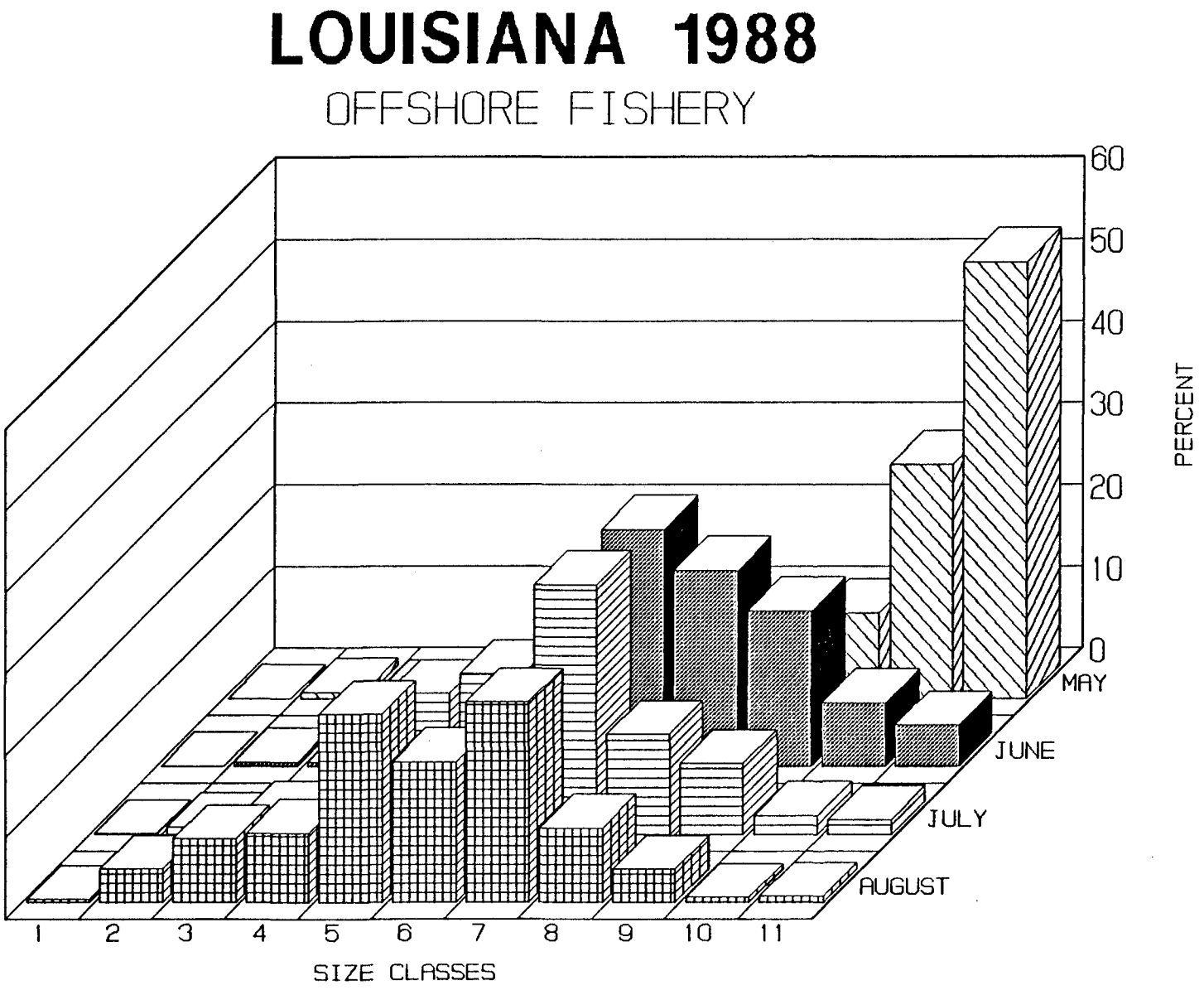
16. Catch of >67 count shrimp off the Texas coast.



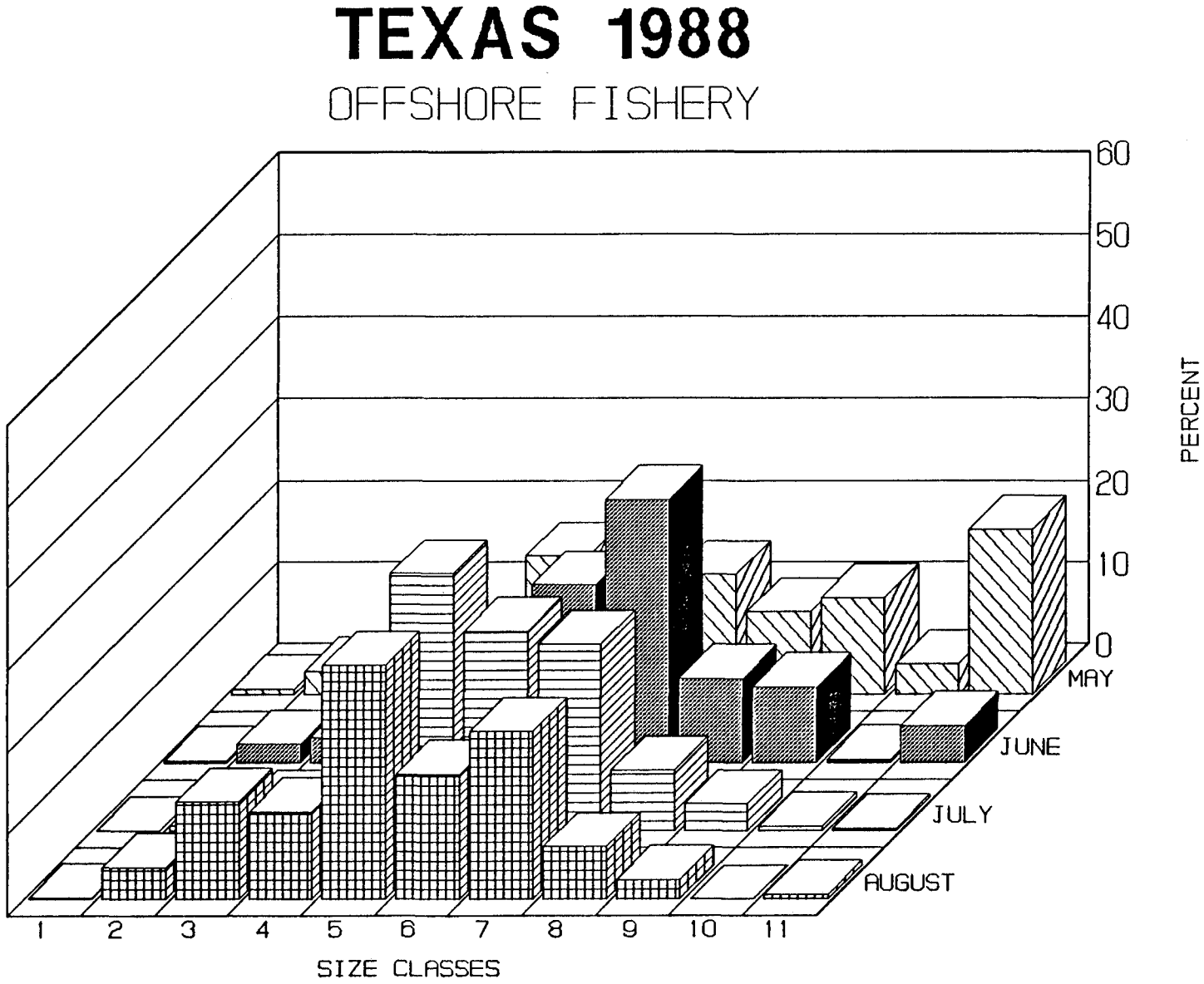
17. Size distribution of brown shrimp caught from inshore Louisiana during the May-August 1988 period.



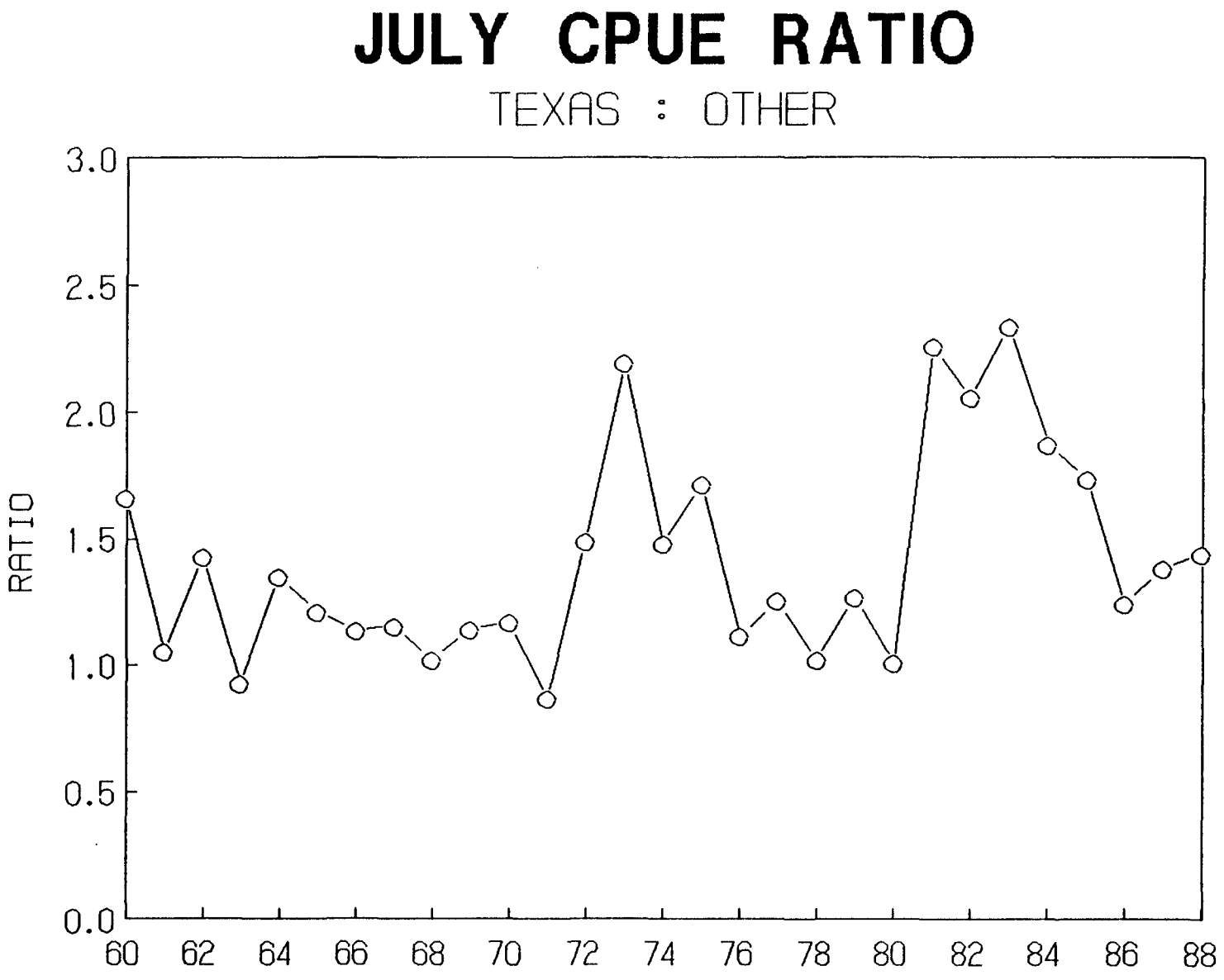
18. Size distribution of brown shrimp caught from inshore Texas during the May-August 1988 period.



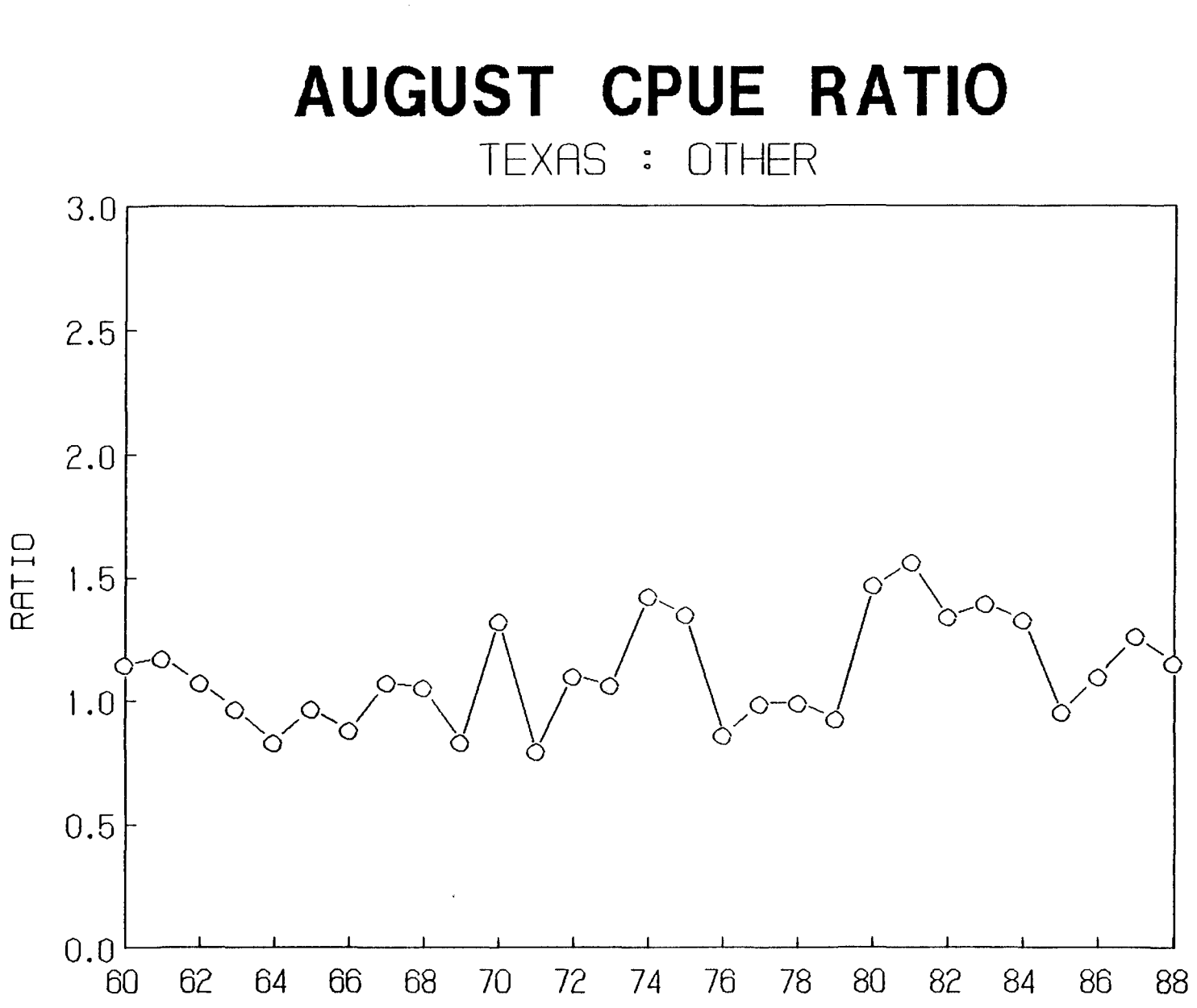
19. Size distribution of brown shrimp caught from offshore Louisiana during the May-August 1988 period.



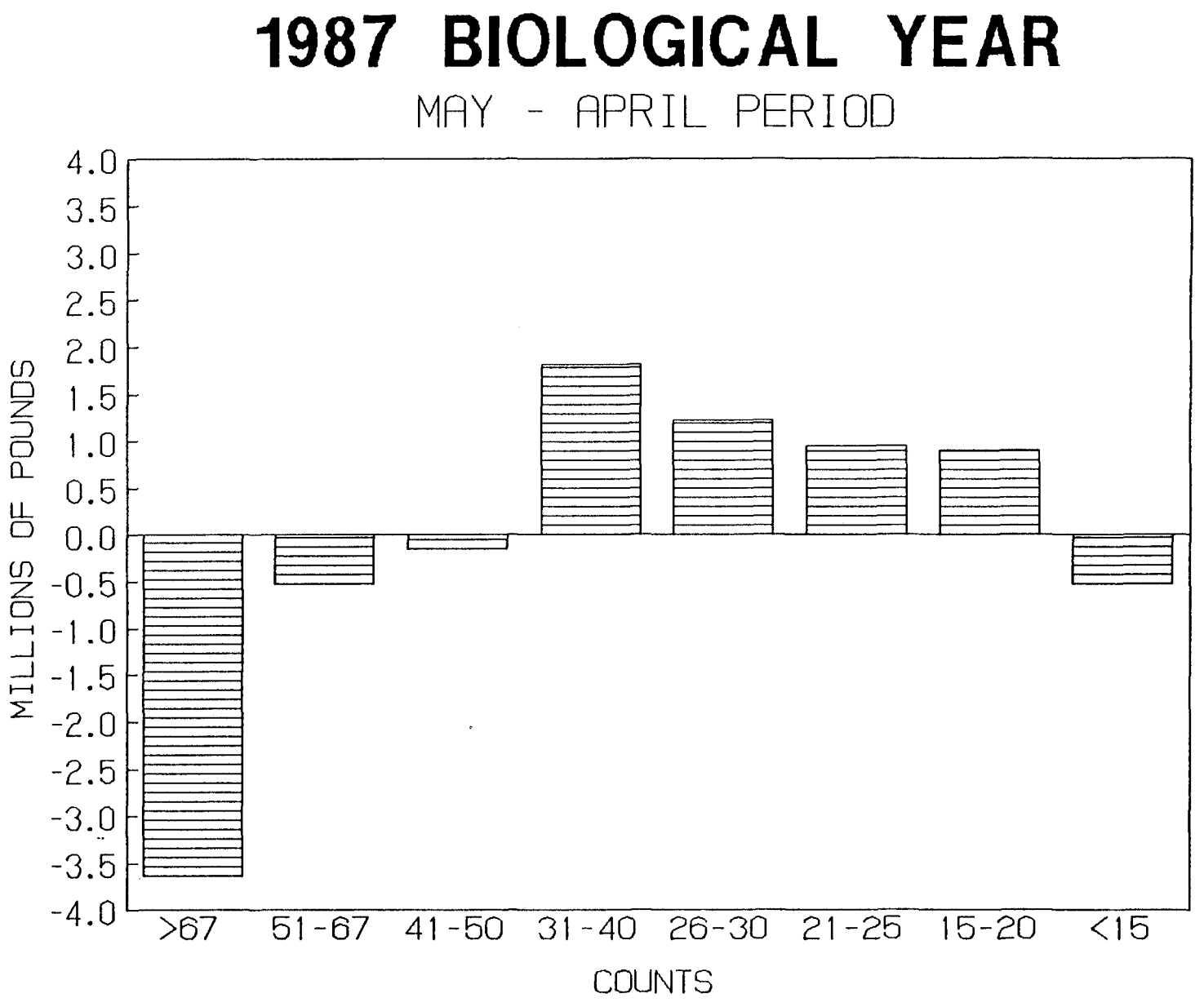
20. Size distribution of brown shrimp caught from offshore Texas during the May-August 1988 period.



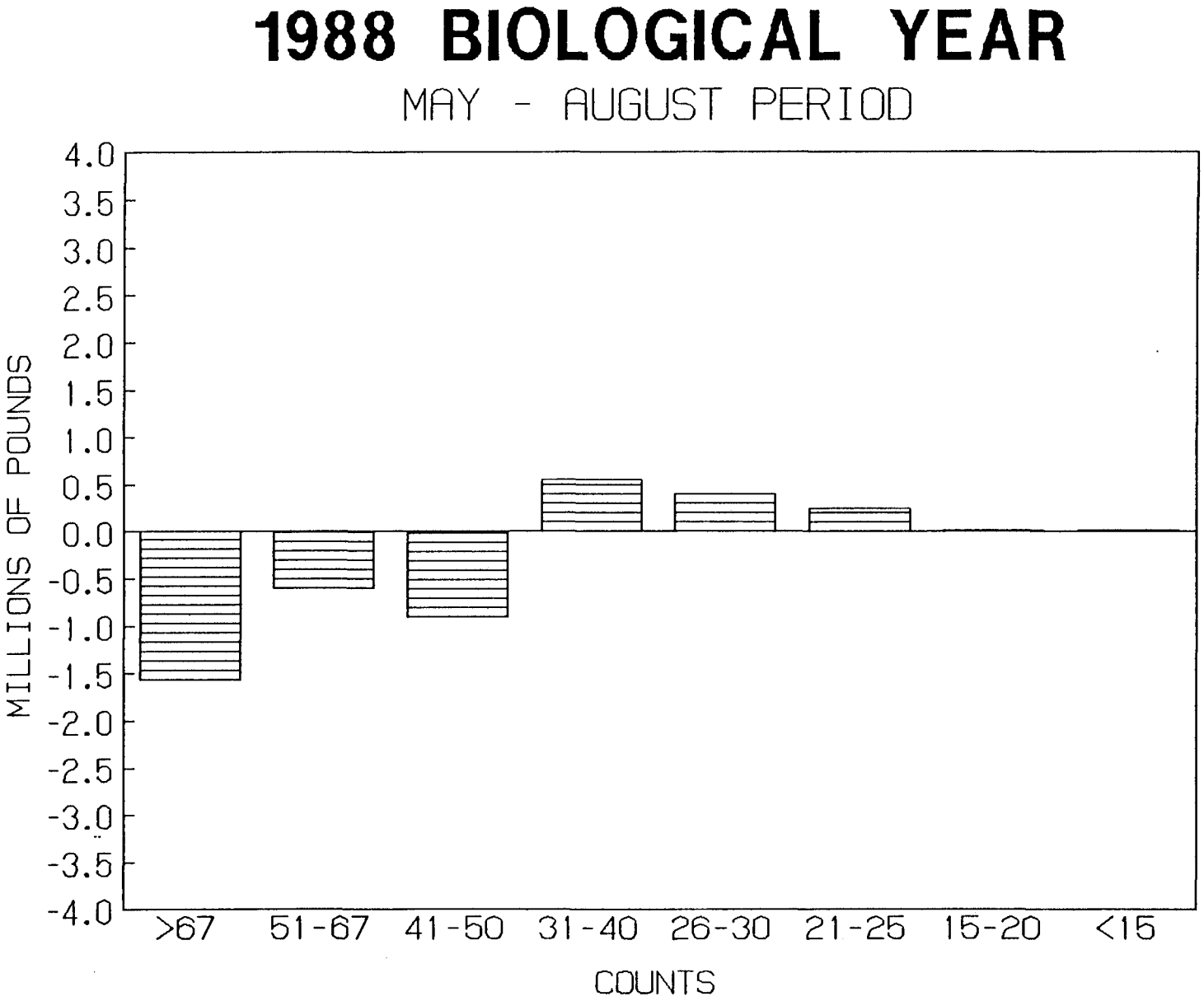
21. Analysis of July CPUE in the Gulf of Mexico. Ratio is Texas verses elsewhere in the Gulf.



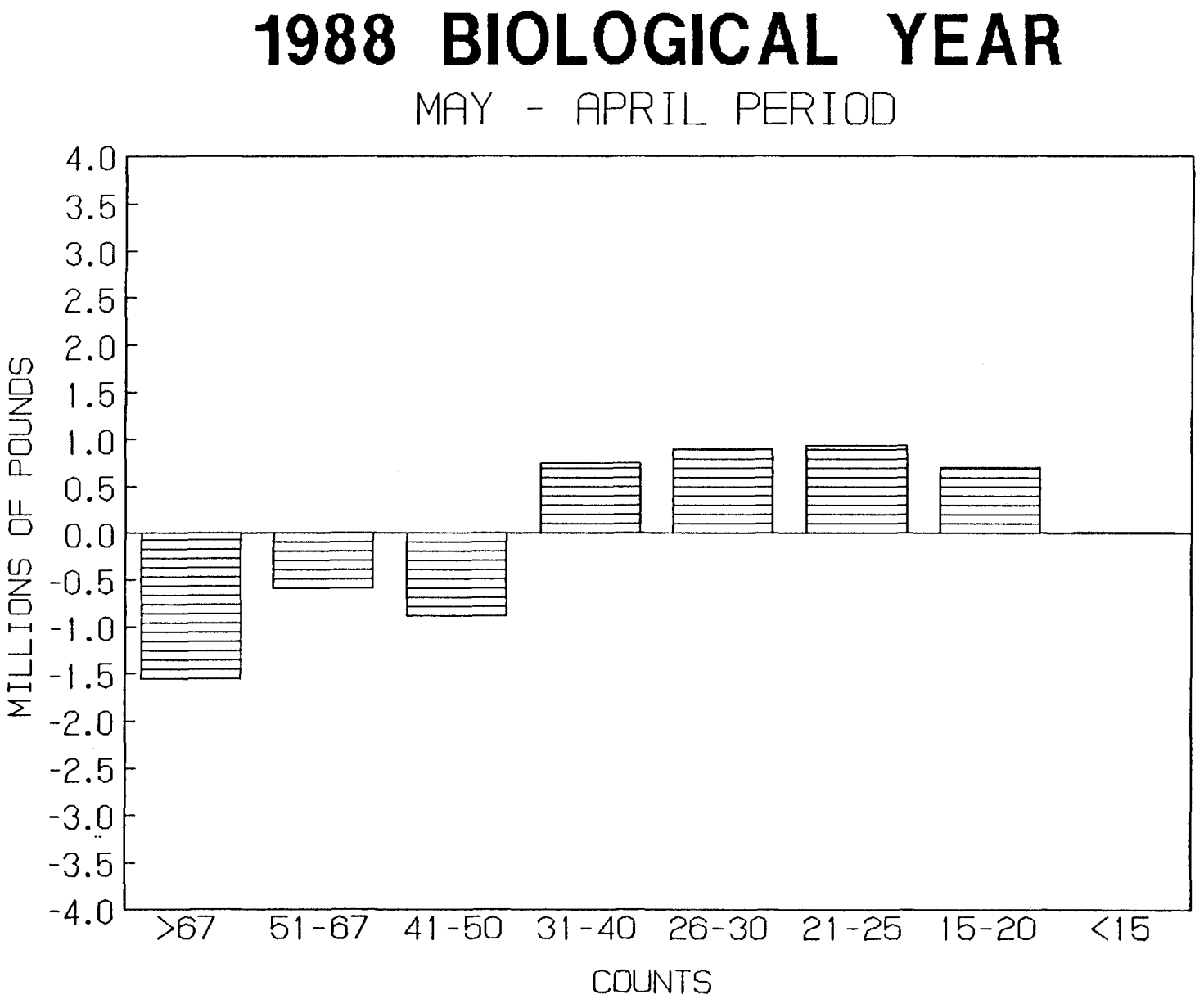
22. Analysis of August CPUE in the Gulf of Mexico. Ratio is Texas verses elsewhere in the Gulf.



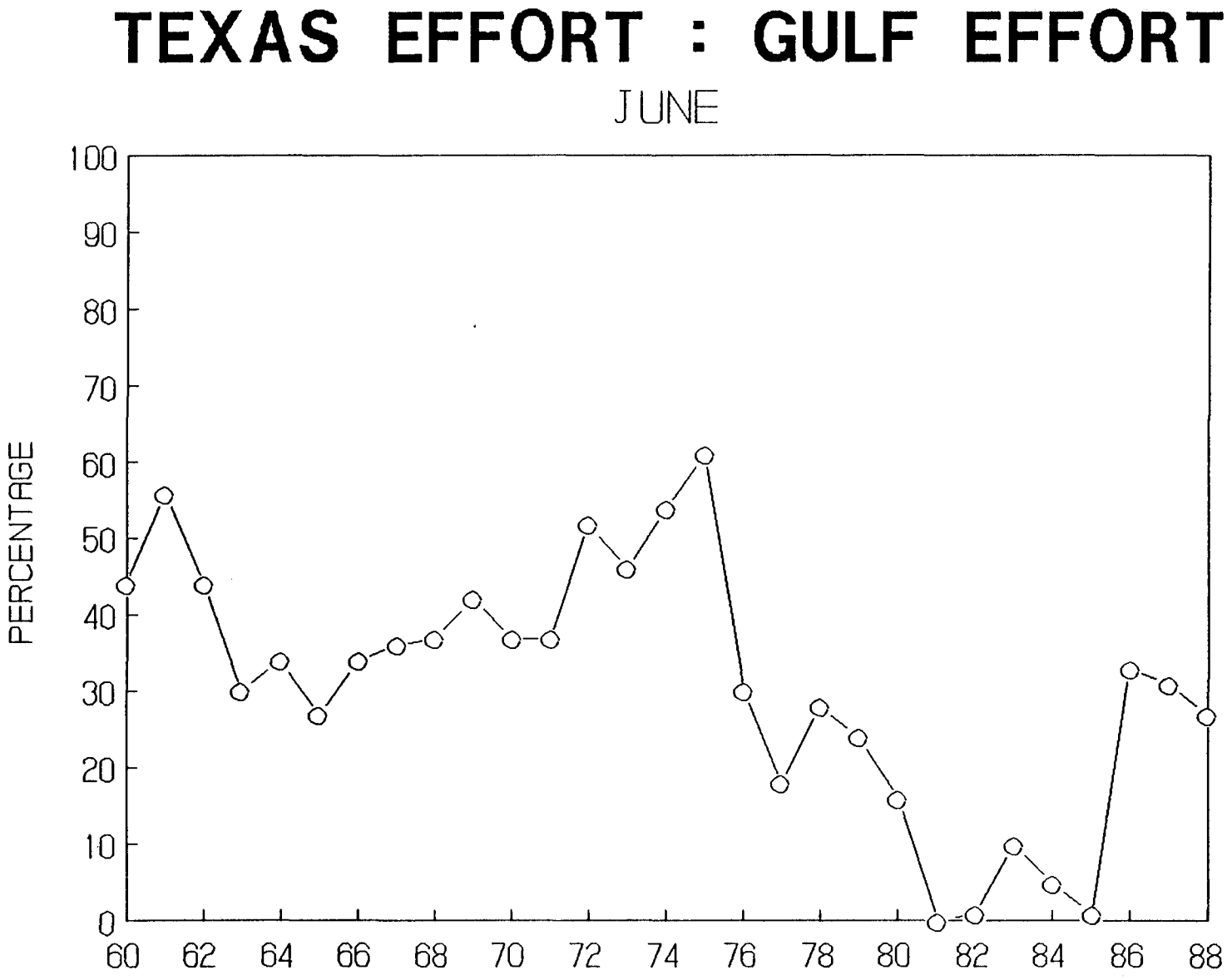
23. Estimated change in catch for various size groups with a 200 nautical mile closure during biological year 1987.



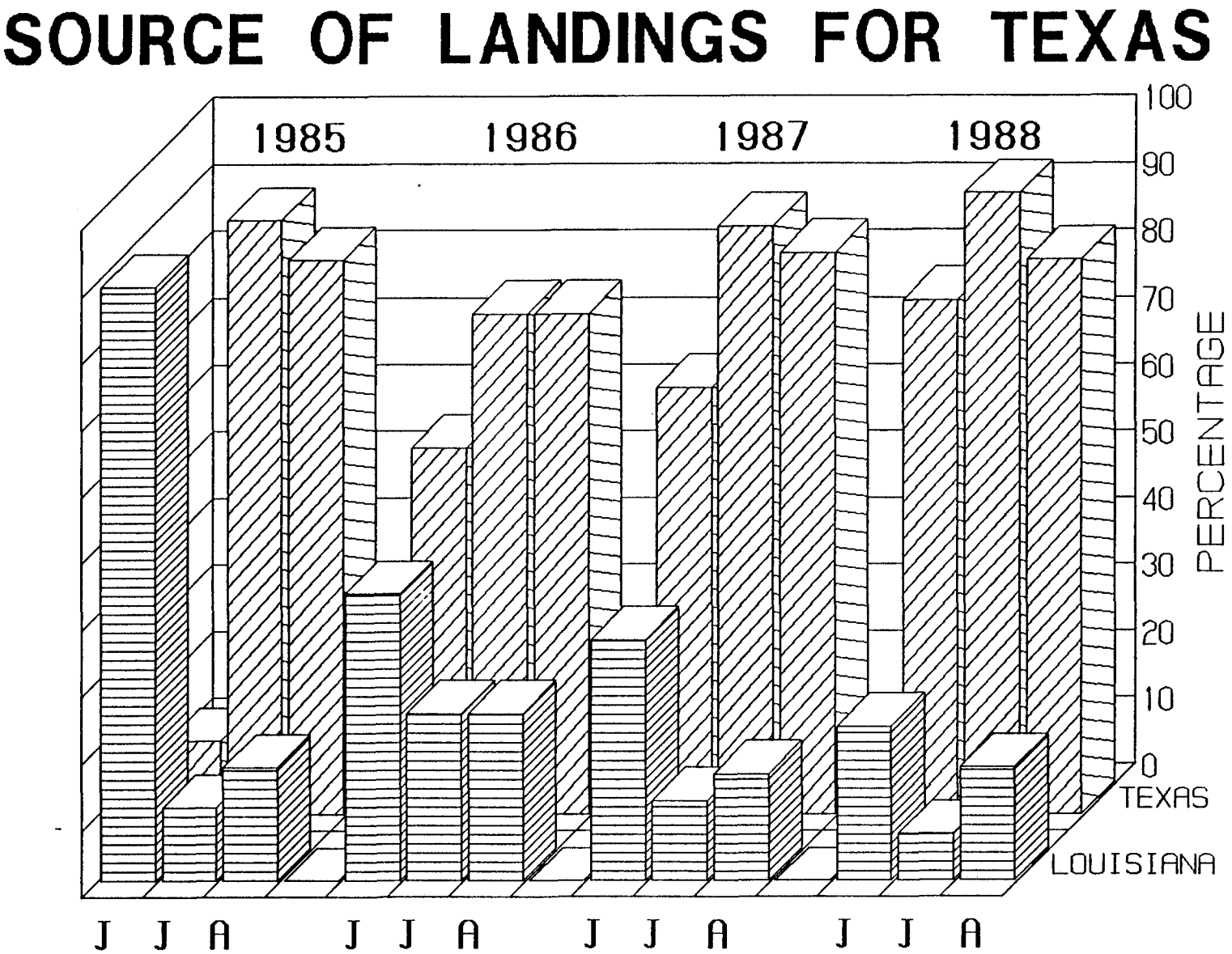
24. Estimated change in catch for various size groups during the first four months of biological year 1988, with a 200 mile closure.



25. Estimated change in catch for various size groups with a 200 nautical mile closure during biological year 1988.

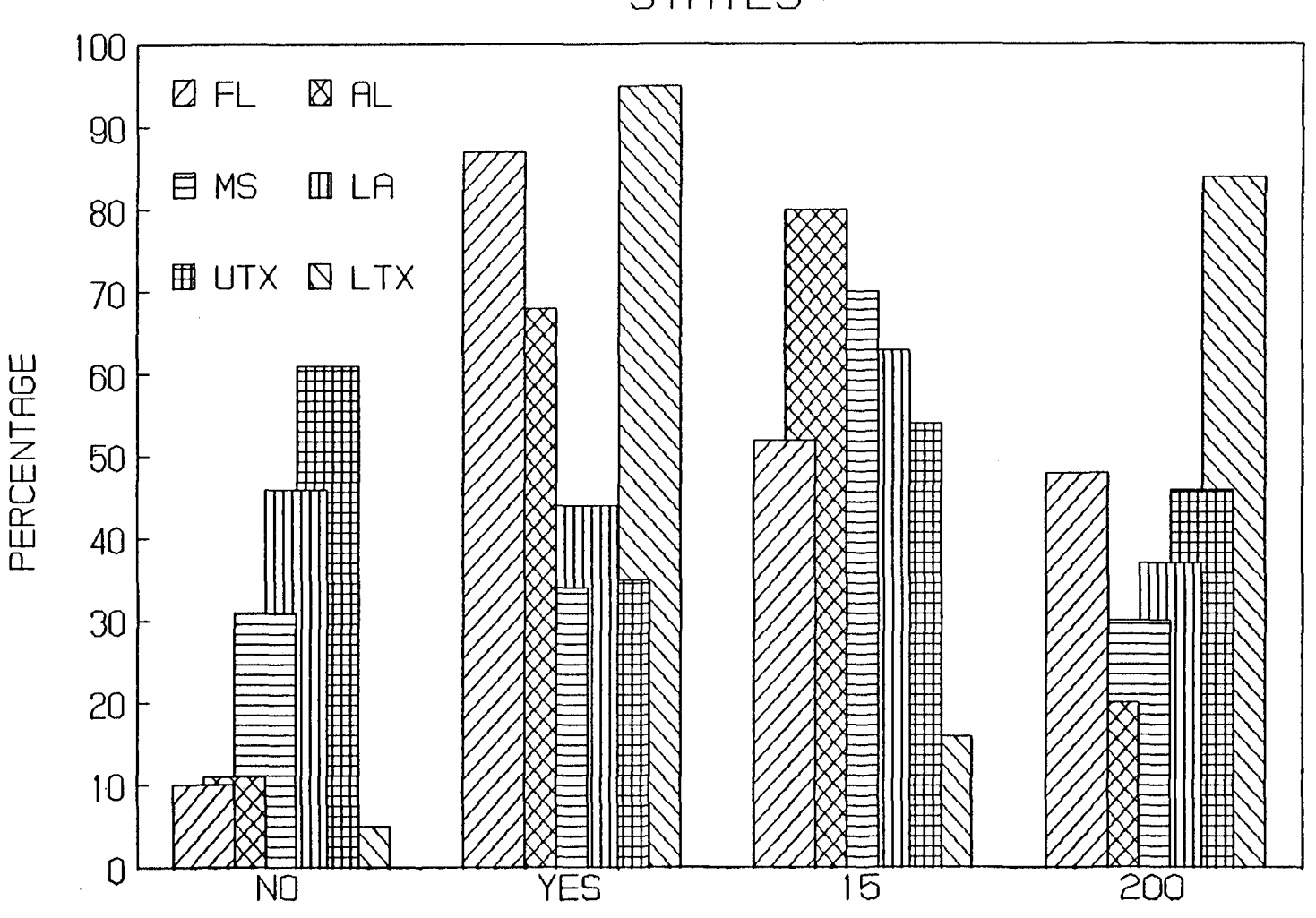


26. Analysis of June fishing effort. Ratio is Texas verses elsewhere in the Gulf of Mexico.

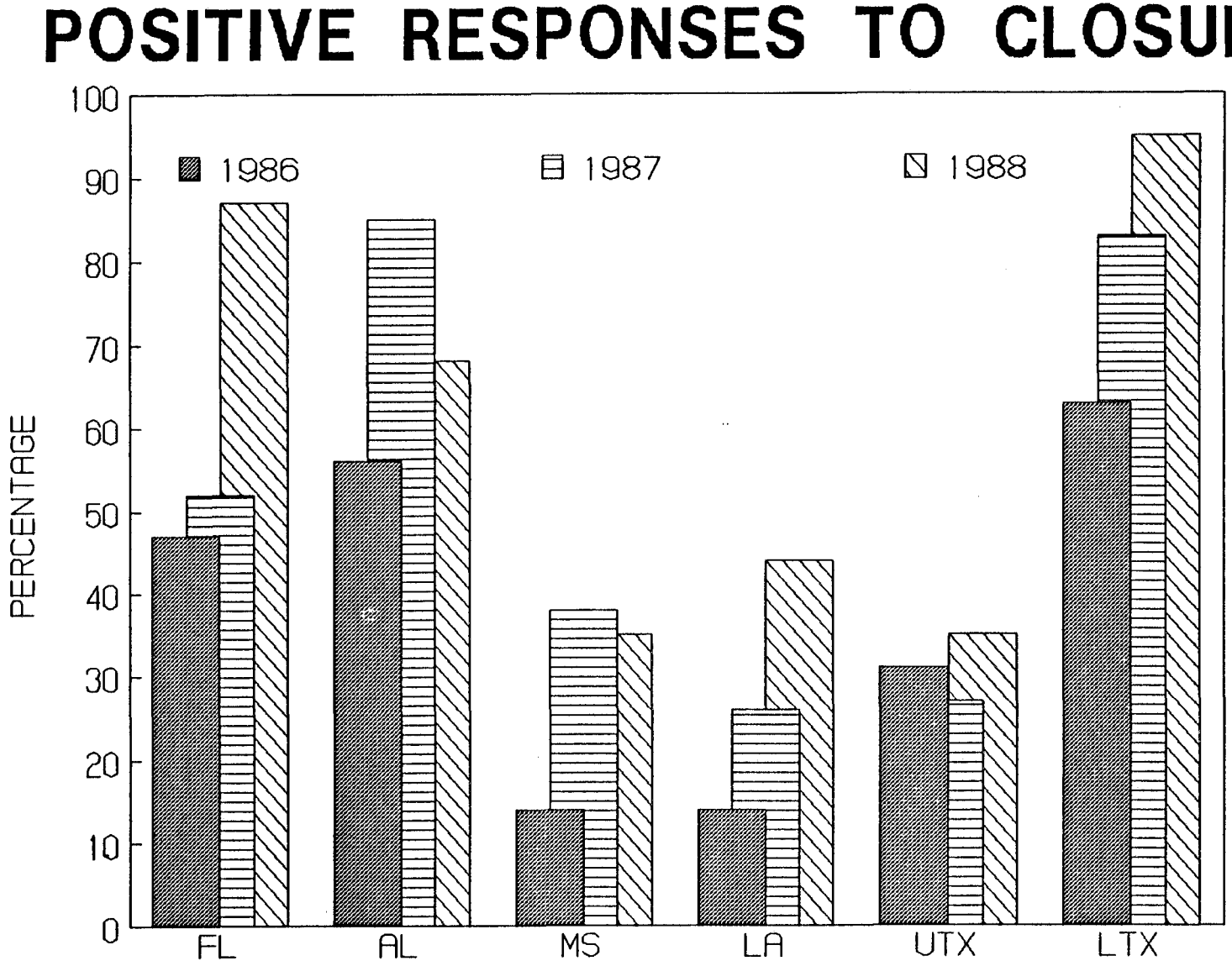


27. Percentage of landings in Texas taken from either Texas or Louisiana waters, during the June-August periods of 1985-1988.

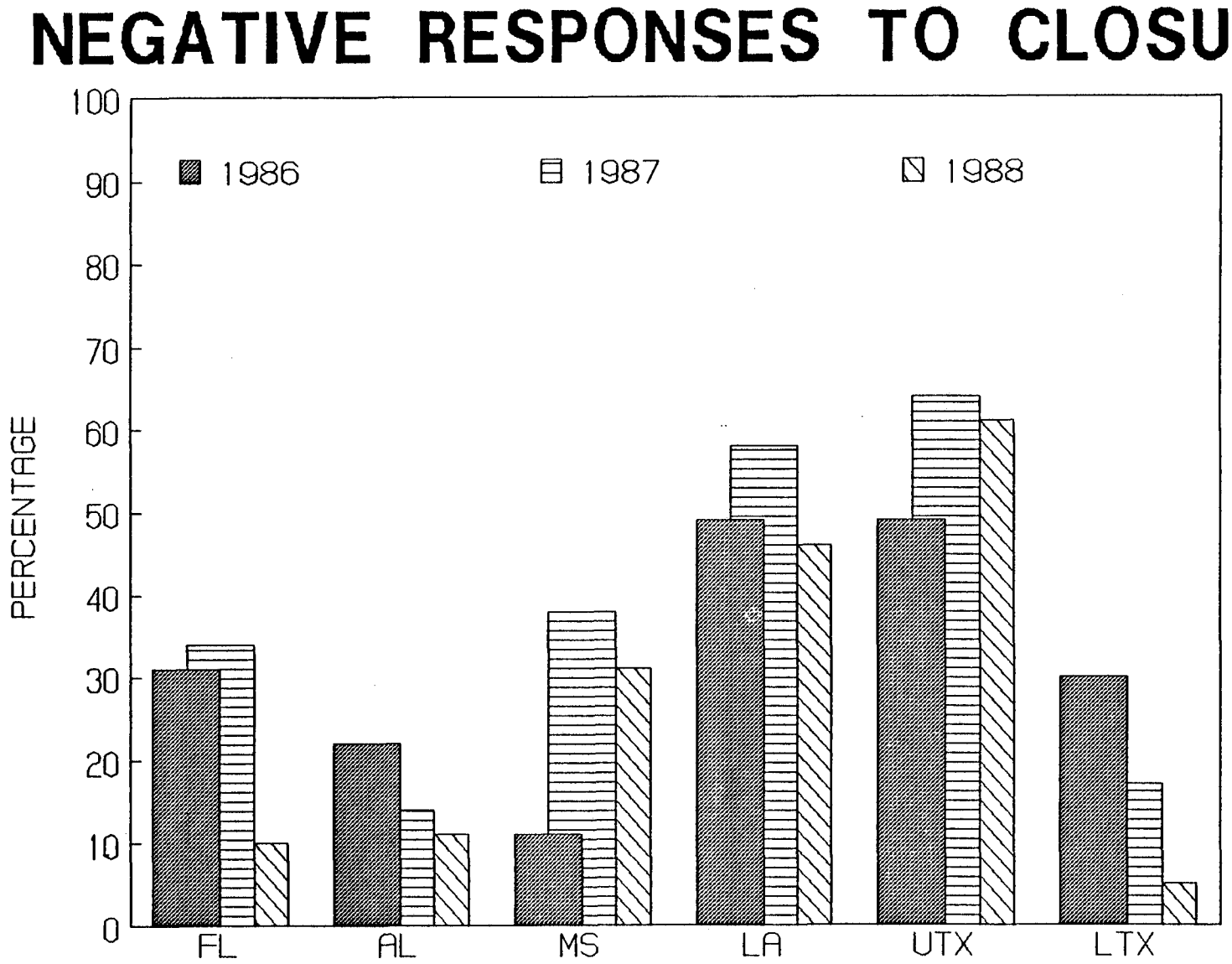
CLOSURE ANALYSIS



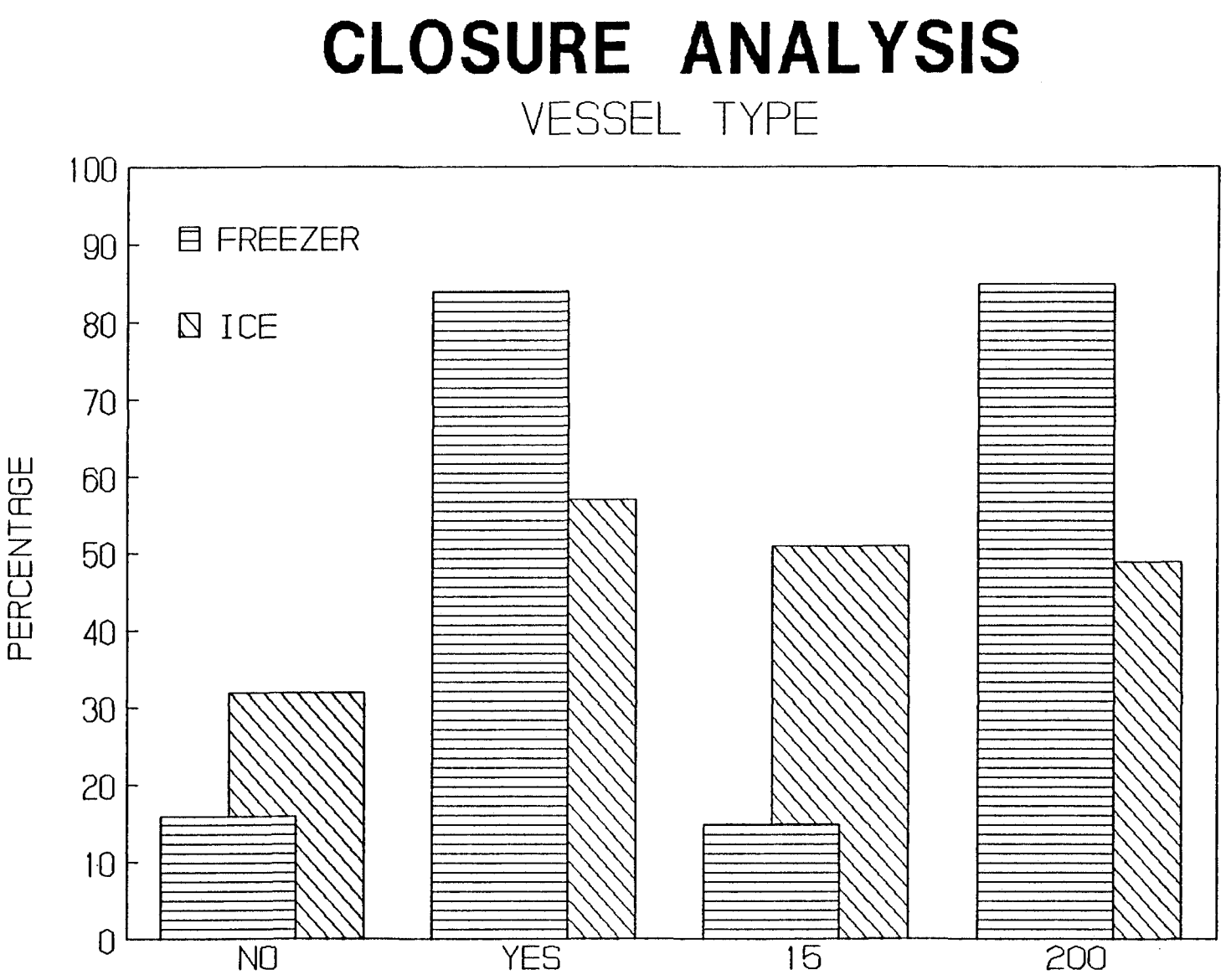
28. Percentage of interviewed captains from various states with expressed opinions about whether or not to have an EEZ closure off Texas, and if so, what distance.



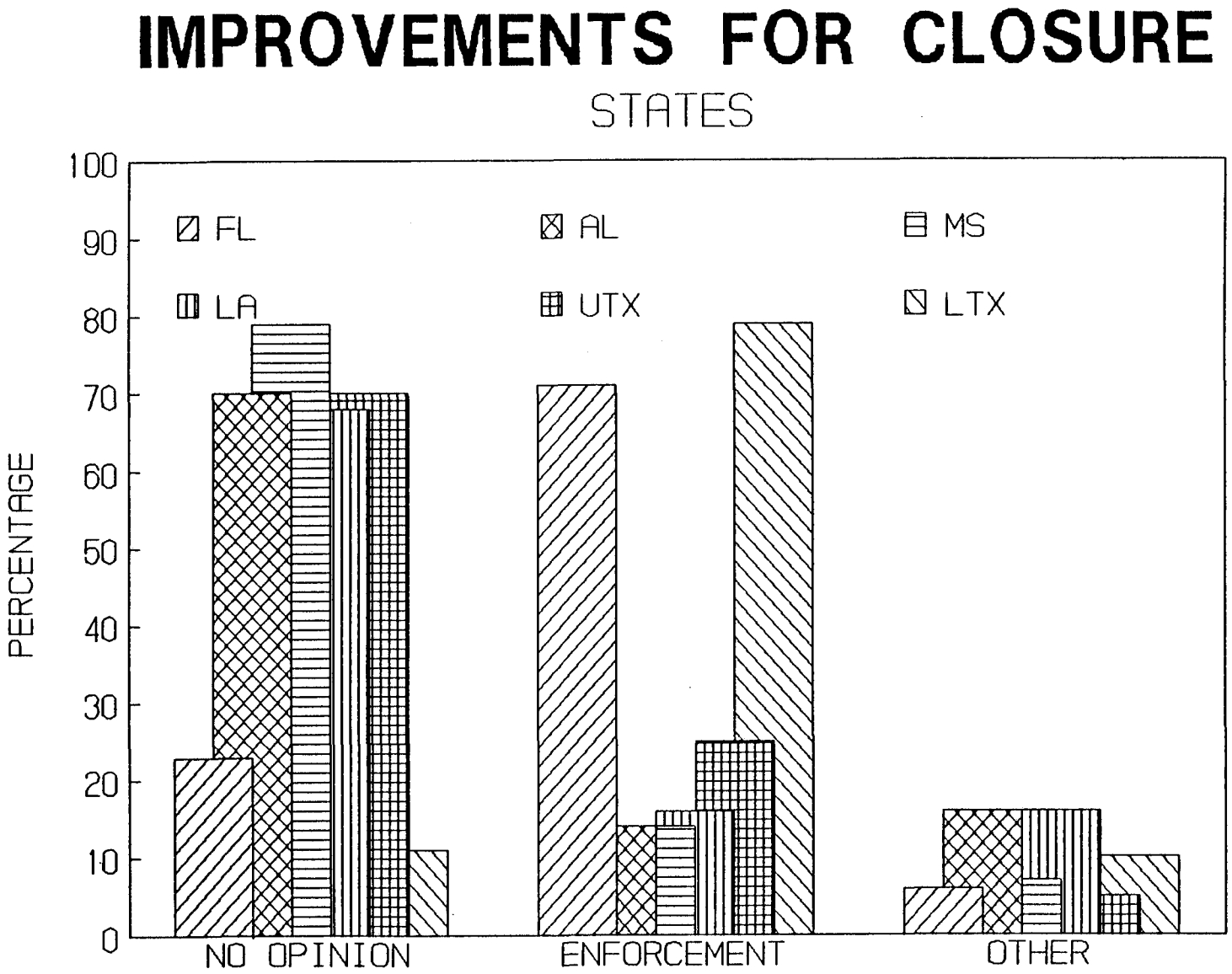
29. Comparisons of 1986-1988 social survey data with regards to percentage of captains from a certain area in favor of the EEZ closure off Texas.



30. Comparisons of 1986-1988 social survey data with regards to percentage of captains from a certain area against the EEZ closure off Texas.



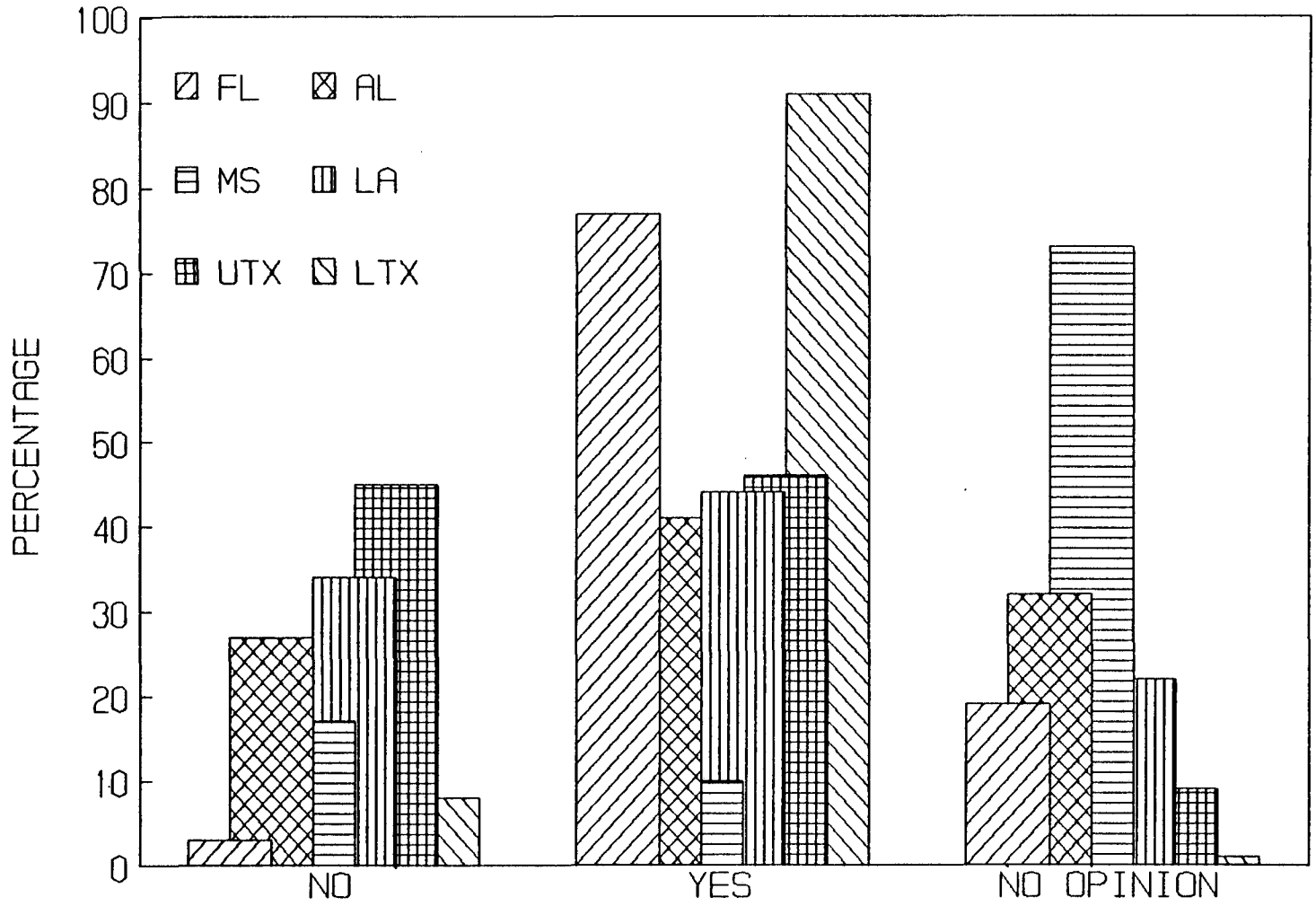
31. Percentage of interviewed captains from various vessel types with expressed opinions about whether or not to have an EEZ closure off Texas, and if so, what distance.



32. Percentage of interviewed captains from various areas with expressed opinions about improvements for the Texas closure.

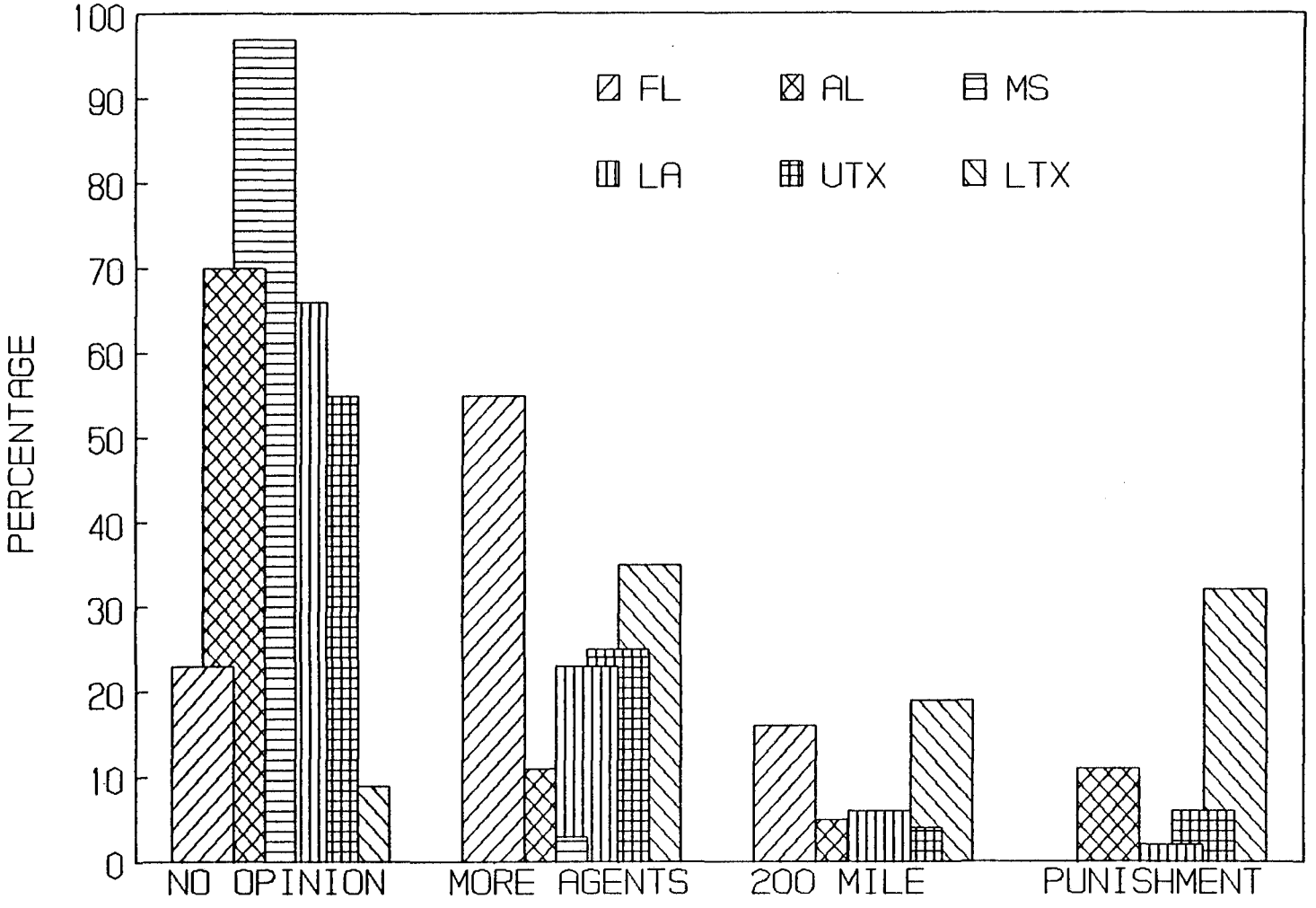
ENFORCEMENT PROBLEMS WITH CLOSURE

THIS YEAR (1988)

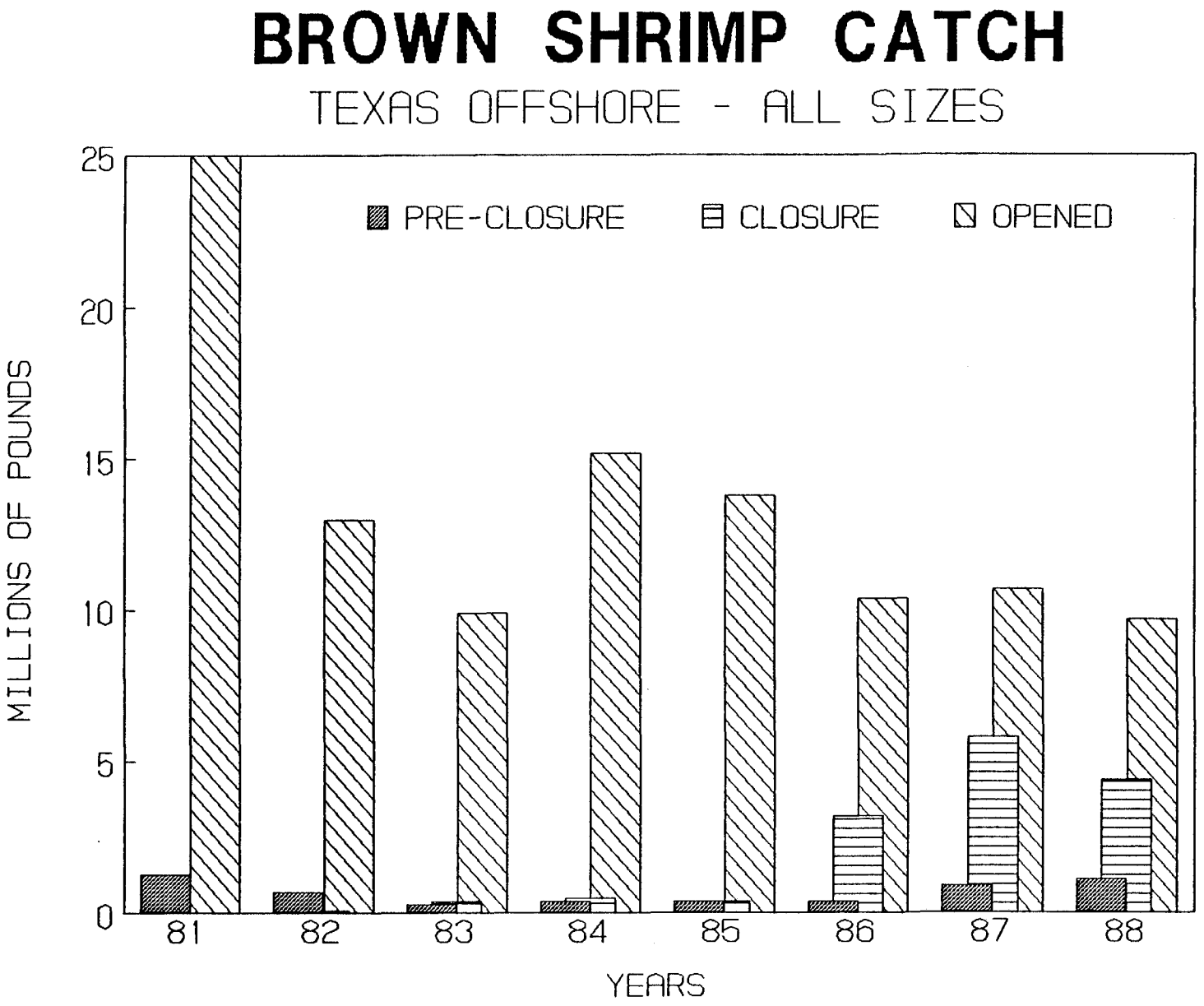


33. Percentage of interviewed captains from various areas who expressed concern about enforcement of the Texas closure in 1988.

IMPROVEMENTS OF CLOSURE ENFORCEMENT



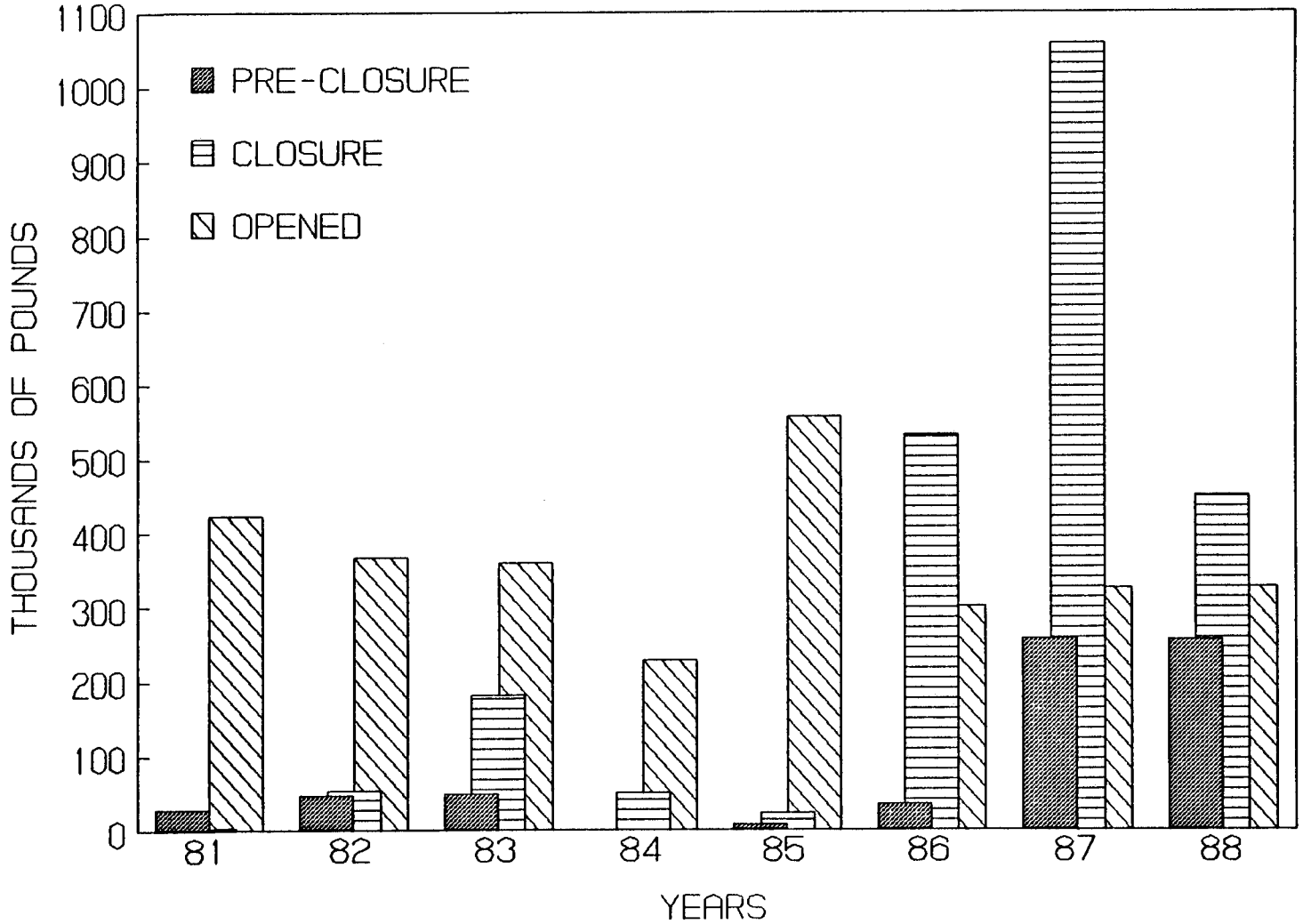
34. Percentage of interviewed captains from various areas with expressed opinions about improvements for enforcement of the Texas closure.



35. Total landings of brown shrimp from Texas waters from 1981-1988 during the following periods: 1) Pre-closure: May 1 through when offshore waters closed, 2) Closure: entire offshore closure period and 3) Opened: when offshore opened through August 31.

BROWN SHRIMP CATCH

TEXAS OFFSHORE - >67 COUNT



36. Total landings of >67 count brown shrimp from Texas waters from 1981-1988 during the following periods: 1) pre-closure: May 1 through when offshore waters closed, 2) Closure: entire offshore closure period and 3) Opened: when offshore opened through July 31.