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ANALYSIS ON TETRAPTURUS ALBIDUS POEY (1861), CAUGHT OFF SOUTH AND SOUTHEAST OF BRAZIL (1971-1984)

C. A. Arfelli, A. Ferreira de Amorim, J. C. Galhardo-Amado
Instituto de Pesca
C. P. 1070, 11100-Santos S.P., Brazil

SUMMARY

White marlin are caught all year round by Brazilian longliners which operate in the area 20°-33°S and 039°-050°W. Normally the yield and catch-per-unit-of-effort values are higher in the fourth quarter, while average weight is higher in the third quarter. The annual CPUE showed a slight decreasing trend. The eye-fork length/dressed weight relationship obtained was: $W_d = 7.97 \times 10^{-7} EFL^{3.47}$. The catch included individuals in the 85-90 cm and 200-205 cm classes; individuals in the 135-140 cm to 145-150 cm were the most frequent. Spawning of the species occurs from the middle of the fourth to the end of the first quarter, at least in the areas 25°55' - 26° 20'S and 045°10' - 045°50'W. The south and southeast of Brazil does not seem to be a growing area for young white marlin.

RESUME

Le makaire blanc est capturé tout au long de l'année par les palangriers brésiliens qui opèrent dans la zone 20-33° S et 039-050° W. En ligne générale les valeurs du rendement et de la prise par unité étaient plus élevées au cours du quatrième trimestre alors que le poids moyen l'était pour le troisième. La CPUE annuelle montre une tendance légèrement à la baisse. La relation longueur oeil-fourche/poids manipulé obtenue est la suivante: $W_d = 7.97 \times 10^{-7} EFL^{3.47}$. La prise comprend des spécimens de 85 à 90 cm et de 200 à 205 cm, ceux de 135-140 cm à 145-50 cm étant les plus fréquents. La ponte des espèces a lieu au milieu du quatrième trimestre jusqu'à la fin du premier trimestre, au moins dans la zone 25° 55' - 26° 20' S et 045° 10' - 045° 50'W. Le sud et le sud-est du Brésil ne semble pas être une zone de ponte pour les jeunes makaires blancs.

RESUMEN

La aguja blanca se captura a lo largo del año por los palangreros de Brasil, que operan en la zona 20° - 33°S y 39° - 050°W. Generalmente, los valores del rendimiento y captura por unidad de esfuerzo fueron más elevados en el cuarto trimestre, pero el peso medio más alto se produjo en el tercer trimestre. La CPUE anual mostró una tendencia ligeramente decreciente. Se obtuvo la siguiente relación longitud ojo-horquilla/peso manipulado: $W_d = 7.97 \times 10^{-7} EFL^{3.47}$. La captura incluía especímenes con tallas entre 85 - 90 cm. y 200 - 205 cm, siendo más frecuentes las comprendidas entre 135 - 140 cm. a 145 - 150 cm. El desove tiene lugar desde la mitad del cuarto trimestre hasta el final del primero, por lo menos en el área 25° 55' - 26° 20' S y 045° 10' - 045° 50' W. Las costas sur y sureste de Brasil no parecen ser una zona de crecimiento para los ejemplares jóvenes de aguja blanca.

1. INTRODUCTION

The catch of white marlin off the South and Southeast of Brazil is realized all year round by Brazilian and leased longliners.

The number of Brazilian longliners settled in Santos, São Paulo, ranged from 3 to 8 in the 1971-84 period and operated at 20º - 33º S and 039º - 050º W (ARFELLI and AMORIM,1985). In this period they had an annual catch around 23 t of white marlin, representing about 2% of the total catch of these tuna boats.

The sport fishing also catches white marlin, but in smaller quantity. According to PAIVA and PIRES JÚNIOR (1983), the sport fishing occurs pratically along the whole Brazilian coast: nevertheless the main area of fishing game is off Rio de Janeiro, from Cabo Frio to Ilha Grande (about 23º S). The annual average was 0.14 t for the 1969/1970 to 1980/1981 warm period (November to January).

The present paper contains results and analysis of eye-fork length/dressed weight relationship: season and area of spawing: sex ratio: size-frequency: yield: fishing effort: catch per unit of effort; and average weight of white marlin caught by the Brazilian longliners settled in Santos.

2. MATERIAL AND METHODS

Basically the methodology used in this paper follows the same presented in other papers: AMORIM; ARFELLI and GALHARDO-AMADO (1985) and ARFELLI and AMORIM (1981 and 1985).

In order to establish the eye-fork length/dressed weight relationship, data of 504 specimens were collected, from April 1974 to May 1981 period, at the Fishing Terminal of Santos. They were grouped in 1 cm classes (58 classes) in order to obtain an expression as follows:

$$W_d = a \cdot EFL^b$$

were W_d is the fish weight without gut, gill, bill and caudal fin.

The gonadal analysis based on OVCHINNIKOV (1971) was obtained from 52 female gonads, collected from January 1974 to December 1983. Some gonads were examined immediately after the catch on board of the longliners, and others, preserved on ice, were received for analysis in the laboratory.

The sex ratio was based on 53 specimens examined during seven research trips, from 1974 to 1977.

The individual dressed weight was obtained per trip from log commercial sheets of fisheries companies, settled in Santos. From 1971 to 1977 some companies united Tetrapturus albidus and Istiophorus platypterus. Thus far the proportions of each species in the period when I. platypterus occurs (October to March) was estimated based on data collected from 1971 to 1982 of companies that made distinction between the two species. After the estimation of weight the number of fish was obtained on the basis of the monthly average weight. So, the data of yield and catch per unit of effort represented the total catch of the longliners.

The size-frequency of 9,378 specimens only includes white marlin identified in the log commercial sheets. Through the eye-fork length/dressed weight relationship, presented in this paper, the weight was converted into length, gathered in 5 cm classes, expressing the monthly and yearly size-frequency for 1971-84. The graphics of monthly size-frequency was only made for number of fish higher than 11.

The number of fish and weight for the second quarter of 1975 only includes data of April and May.

The CPUE (number of fishes per 1,000 hooks), yield (number of fishes and dressed weight), fishing effort and average dressed weight are expressed by quarter and year, from 1971 to 1984.

The fishing effort (number of hooks) was obtained from DATA RECORD of ICCAT (Volumes 6, 8, 10, 12, 16, 18, 20, and 25). For the period from 1971-73 and 1983-84, was estimated on the basis of the effective fishing days to an average of 1,200 hooks per day.

3. RESULTS AND DISCUSSION

In the Brazilian longline fisheries, from 1971 to 1984, the catches of billfishes (white and blue marlins, sailfish and swordfish) constituted from 19 to 51%, by weight, of the total catches of tuna and alike species, with an average of 30%. In this period white marlin represented about 2% of the catch.

Morphological differences were observed in some specimens which presented pectoral and dorsal fins sharp, likely Tetrapturus audax, but the anus position similar to T. albidus. The existence of some morphological differences in white marlin (T. albidus) was also mentioned by Dr. Robins during the Workshop on Billfish (ICCAT, 1981). In spite of that UEYANAGI and WARES (1975) cited the presence of T. audax in the studied area, we did not find any specimen.

a. Eye-fork length/dressed weight relationship (Figure 1)

$W_d = 7.97 \times 10^{-7} EFL^{3.47}$

$r = 0.978$

$N = 504$

$n = 58$

The variation amplitudes of length and weight were 104 to 186 cm, and 7.2 to 62 kg, respectively.

By analysis of the length-weight relationship obtained, a close coefficient of correlation (r = 0.978) and linearity, with a little deviation, was verified upon application of the ln/ln transformation.

b. Gonadal analysis (Figure 2)

By the analysis the 52 females it is possible to observe that from April to August all gonads were in the early development stages (II and III): the running ripe gonads (stage V) were collect from December to March, two of them in the area 25º 55' - 26º 20' S and 045º 10' - 045º 50' W.

According to Ueyanagi et alii (1970) in MATHER; CLARK and MASON (1975) the only area in the South Atlantic with a concentration of maturing white marlin is the one between 20º S and 30º S and along 020º W. In the area 20º - 30º S and 040º - 050º W, the same as that studied by the present paper, these authors found that 77% of 51 fish were maturing in the fourth quarter and 89% of 94 fish were also maturing in the first quarter. The cited authors also found one larvae close to our studied area (around 22º S - 032º W).

In spite of the presence of running ripe females in this area, it was not found any juvenile white marlin in the stomach contents of the longliner caught species (billfish, tuna, and others) observed during our seven research trips and by ZAVALA-CAMIN (1982) from 1972 to 1980. It indicates that the fishing area of the Brazilian longliners is not a growing area for white marlin, what is reinforced by the absence of young (less than 95 cm) specimens in the catch of these boats and of the sport fishing boats.

c. Sex ratio (M:F)

The sex ratio of the 53 specimens was 1.2:1 .

Sex ratio of white marlin varies considerably with season, area and size (females reach larger sizes and are heavier than males of the same size); however males apper to be predominant in most areas (DE SYLVA and DAVIS, 1963; NAKAMURA and RIVAS, 1972; Hayasi et alii, 1970 and Ueyanagi et alii, 1970 in MATHER; CLARK and MASOS, 1975; HONMA and SUZUKI, 1977).

d. Size-frequency

The analysis of annual size-frequency (Figure 3) shows that the largest proportion of the caught specimens was concentrated from the 135 ⊣ 140 cm to 145 ⊣ 150 cm classes, in the 1972-83 period, but from 120 ⊣ 125 cm to 125 ⊣ 130 cm in 1971 and 1984. In the studied period, the caught specimens were distributed from 85 ⊣ 90 cm to 200 ⊣ 205 cm classes.

By the analysis of the monthly size-frequency of the period 1971-84 (Figures 3 to 17) it is possible to state that:

- the widest distribution (where the classes with smaller and larger exemplars appeared usually occurred from October to December (mainly in November);
- the shortest distribution usually occurred in March and June;
- The analysis of the length class with the highest frequency in

each month, shows that September presented an increase in the size of the fish caught in higher proportion.

Comparing the size-frequency from November to April of our period (1971-84) with the period 1956-66, showed by UEYANAGI et alii (1970) for the studied area, it is possible to state that:

- the largest proportions of specimens were concentrated from the classes of 130 ⊣ 135 cm and 135 ⊣ 140 cm for the two periods;
- the size-frequency for the period 1971-84 was wider than the period 1956-66 (85 ⊣ 90 cm to 200 ⊣ 205 cm and 111 - 120 cm to 191 -200 cm, respectively).

Considering that white marlin attains sexual maturity at around 130 cm - EFL (UEYANAGI et alii, 1970), only 11% of the caught fish by Brazilian longliners were in immature size.

e. Yield, fishing effort and catch per unit of effort (CPUE)

- Yield - in weight (Figure 18) and number of fish (Figures 19 and 20)

Analysing the annual catch of this species, there is a noticeable fluctuation with alternates of high and low catches, ranging from 14 to 27 t and 523 to 1,145 fishes until 1982: in the two last years the catches increased to 34 and 37 t - 1,362 and 1,762 fishes.

The quarterly catches were always higher in the fourth quarter, except in number of fish in 1981 (first quarter) and smaller in the third quarter with few exceptions.

- Fishing effort (Figures 19 and 20)

The annual fishing effort has shown an increasing trend in the analysed period, ranging from 432 thousand (1972) to 2,200 thousand hooks (1984).

The fishing effort was higher in the third and fourth quarter.

- CPUE (Figures 19 and 20)

The annual and monthly analysis of CPUE, from the period of 1971 to 1982, presented in AMORIM, ARFELLI and GALHARDO-AMADO (1985), shows a slight decreasing trend. After 1982, the CPUE shows an increasing trend: however, for the hole period, the slight decreasing trend is still verified.

The quarterly highest values of CPUE usually occured in the fourth quarter (mainly in November and December).

Considering the data in item "e", it was observed that the annual and quarterly fluctuations of yield (in weight and number of fish) followed the CPUE fluctuations (except 1978); however they did not follow the CPUE decreasing trend. Comparing the Figure 19, the fluctuations of yield and CPUE only follow the fishing effort fluctuations in the last two years. The increase of yield and CPUE verified in the period 1983-84, was probably due that some longliners directed some fishery to this species.

f. Average weight - dressed weight (Figure 21)

The highest values of average weight occurred in the third quarter (mainly in September), except in 1979 and 1984, when they occurred in the second quarter. The lowest values of average weight occurred in the first quarter, except in 1984 (fourth quarter). These facts is also showed through the size-frequency distributions.

The annual average weight fluctuated from 24.0 to 27.7 kg till 1983, decreasing to 21.1 kg in 1984. The small average weight in 1984 was due the catch of smaller fish, mainly in the fourth quarter, observed through the size-frequency.

4. CONCLUSIONS

White marlin is caught all year round, in the area 20º - 33º S and 039º - 050º W (South and Southeast of Brazil). Their yield, around 2% of total caught, is constituted of around 89% of fish that have already reached their first maturity. Their catches and CPUE were higher in the fourth quarter. In this quarter the size-frequency was wider, where the smaller and larger specimens appeared. The highest values of average dressed weight occurred in the third quarter, mainly in September. The annual CPUE showed a slight decreasing trend. The great increase in yield in the last year, was constituted mainly by smaller fish (average of 21.1 kg).

In the South and Southeast of Brazil spawning occurs from December to March, at least in the area 25º 55' to 26º 20' S and 045º 10' to 045º 50' W; nevertheless the studied area is not a growing area for young white marlin.

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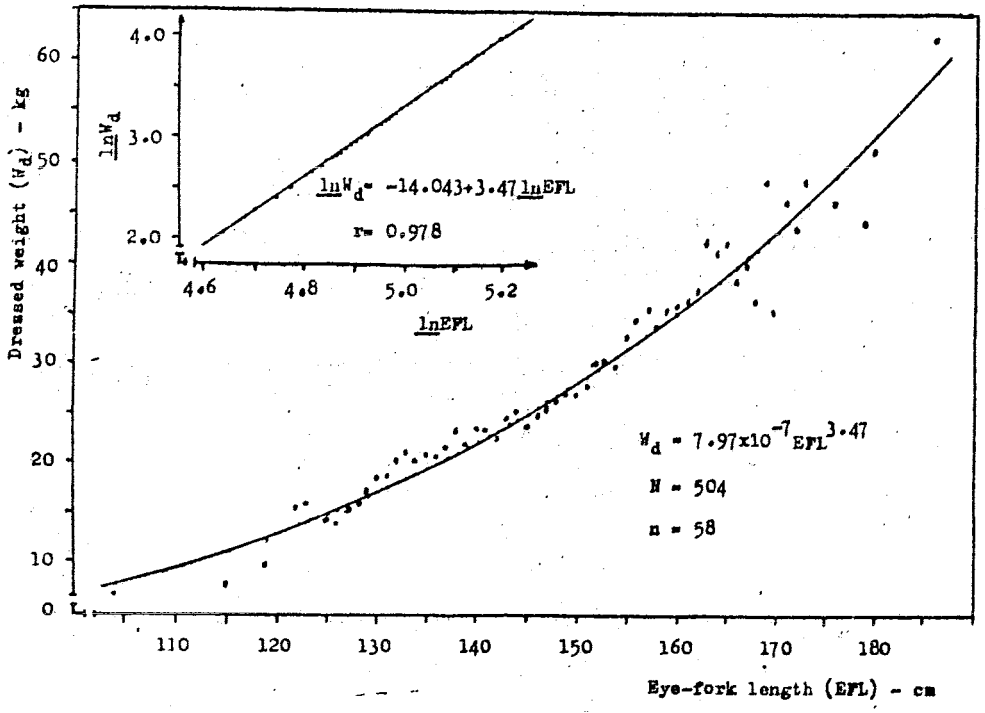

FIGURE 1 - Eye-fork length (EFL)/dressed weight relationship of Tetrapturus albidus, caught off the South and Southeast of Brasil in 1974-81.

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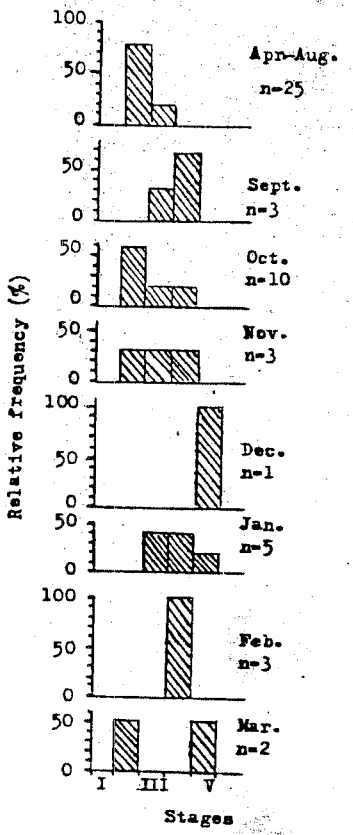

FIGURE 2 - Monthly gonadal frequency of female white marlin in the stages of maturity.

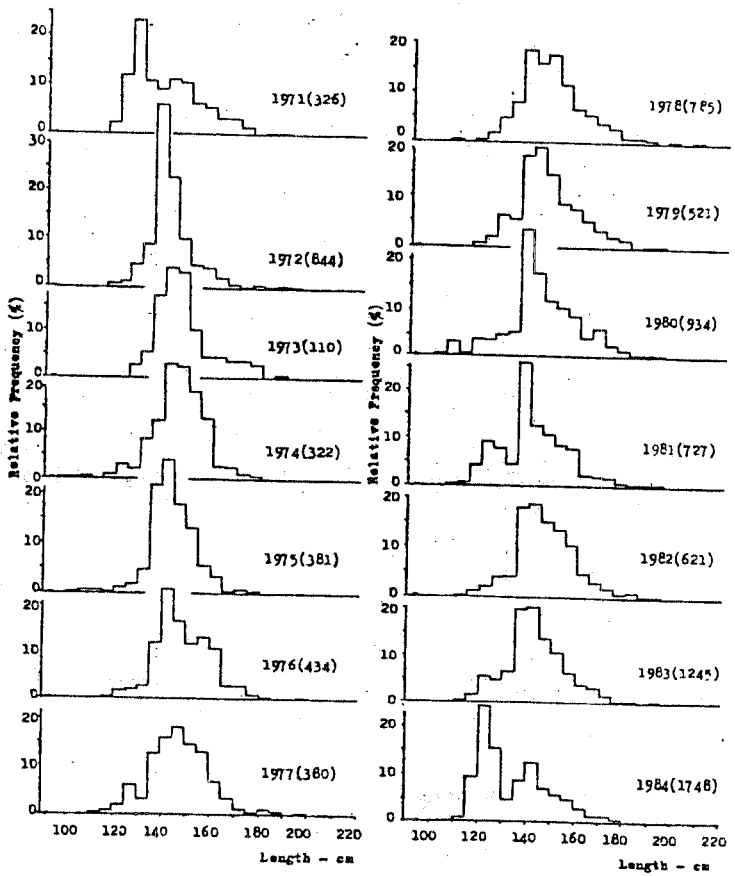

FIGURE 3 - Annual size-frequency for white marlin (1971-84).

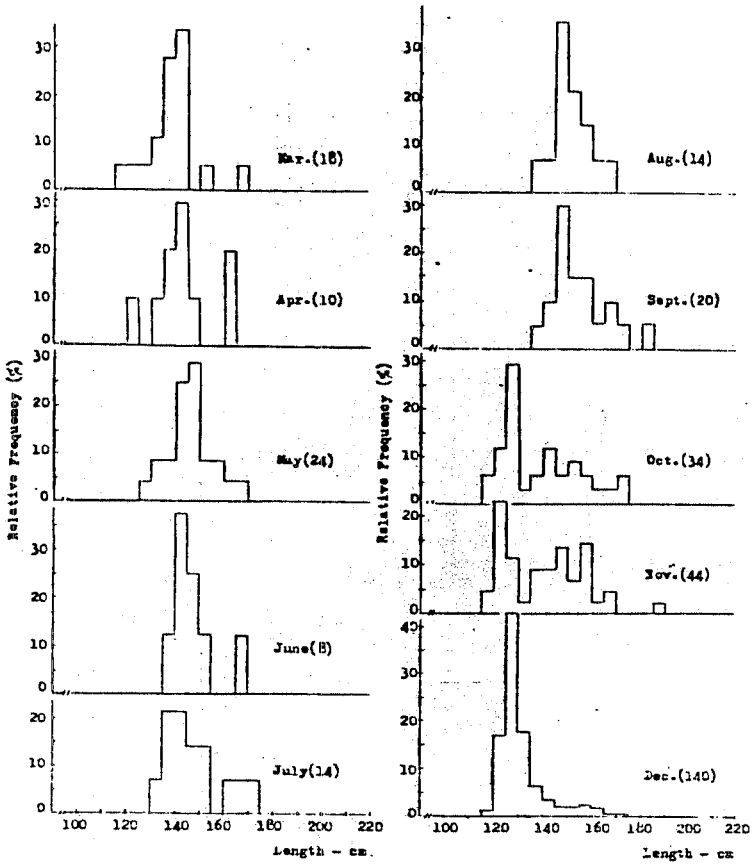

FIGURE 4 - Monthly size-frequency for white marlin (1971).

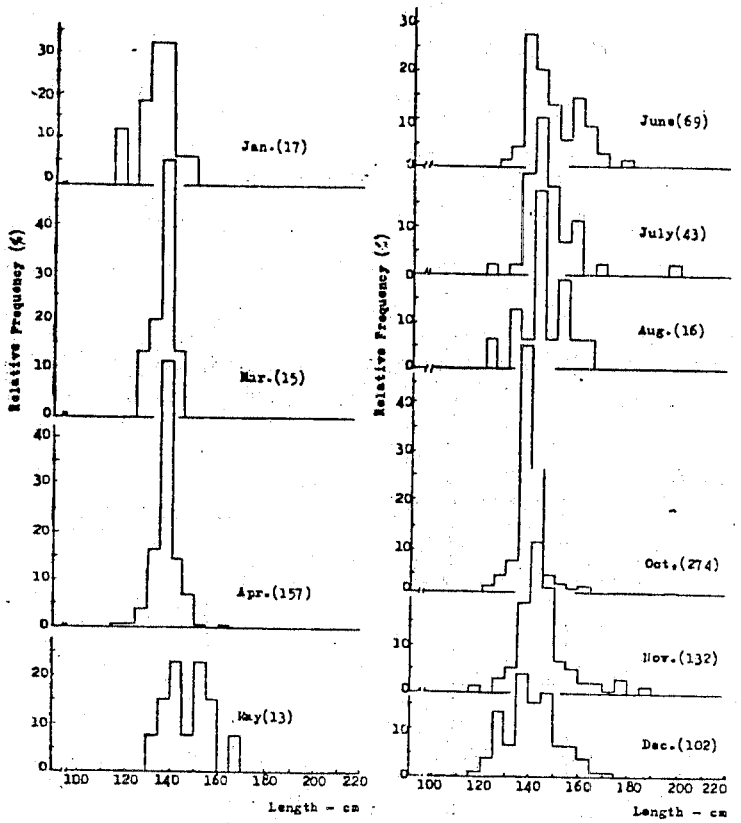

FIGURE 5 - Monthly size-frequency for white marlin (1972).

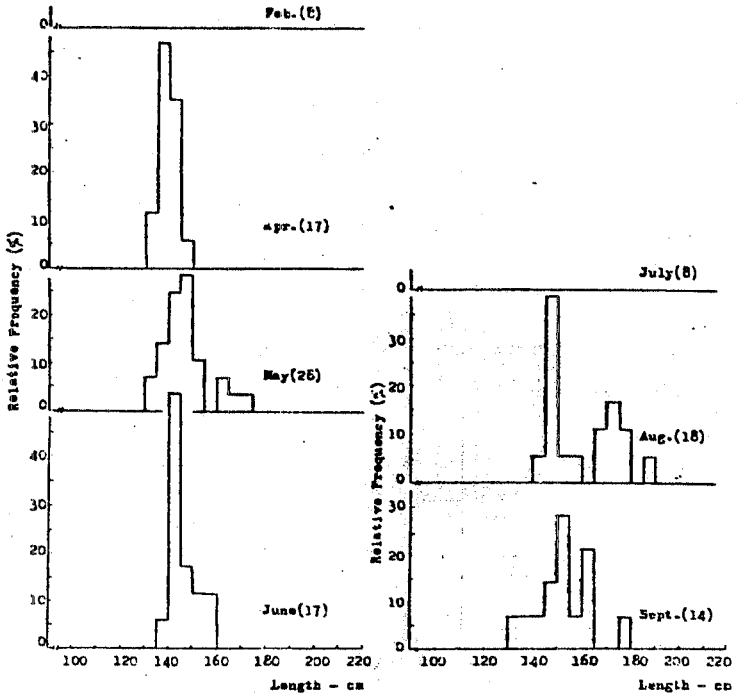

FIGURE 6 - Monthly size-frequency for white marlin (1973).

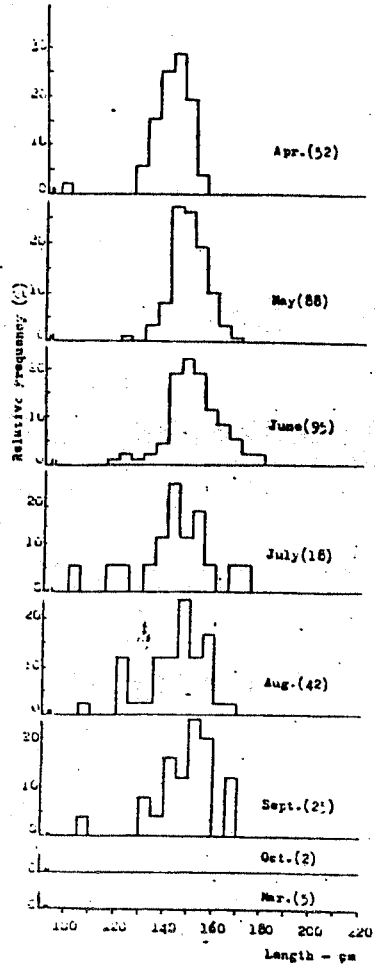

FIGURE 7 - Monthly size-frequency for white marlin (1974).

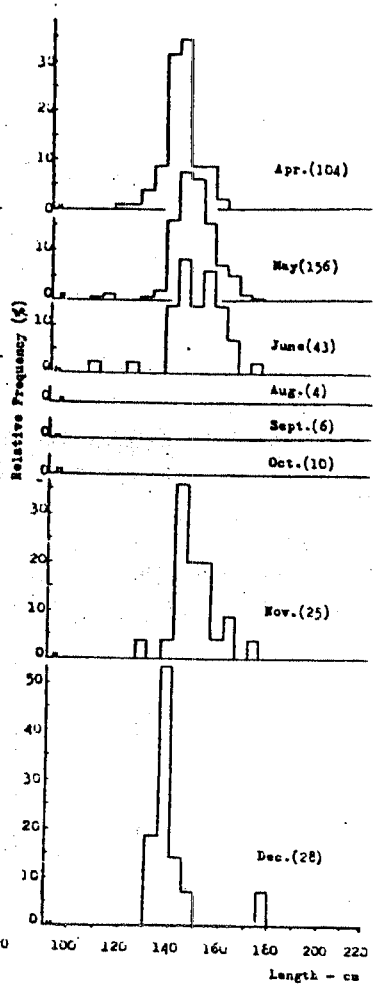

FIGURE 8 - Monthly size-frequency for white marlin (1975).

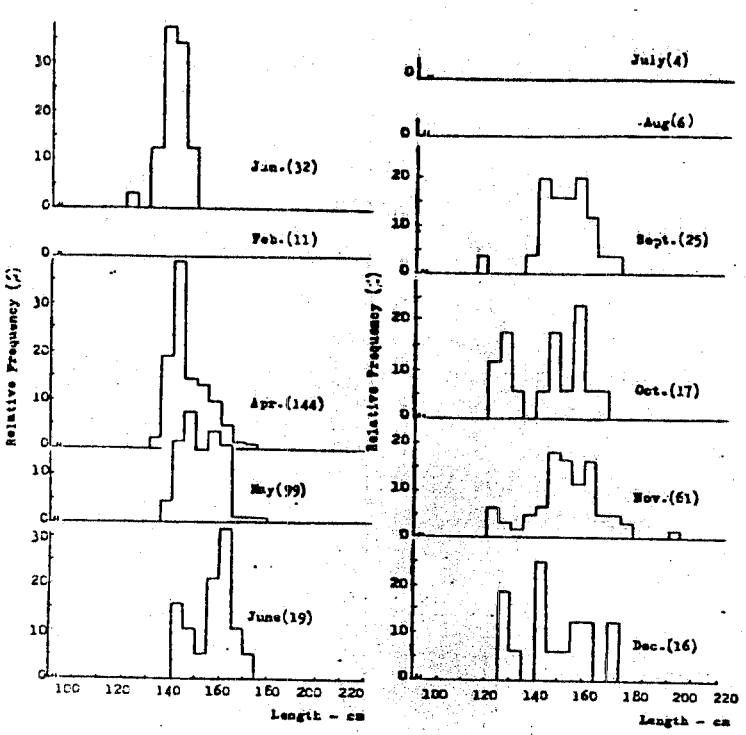

FIGURE 9 - Monthly size-frequency for white marlin (1976).

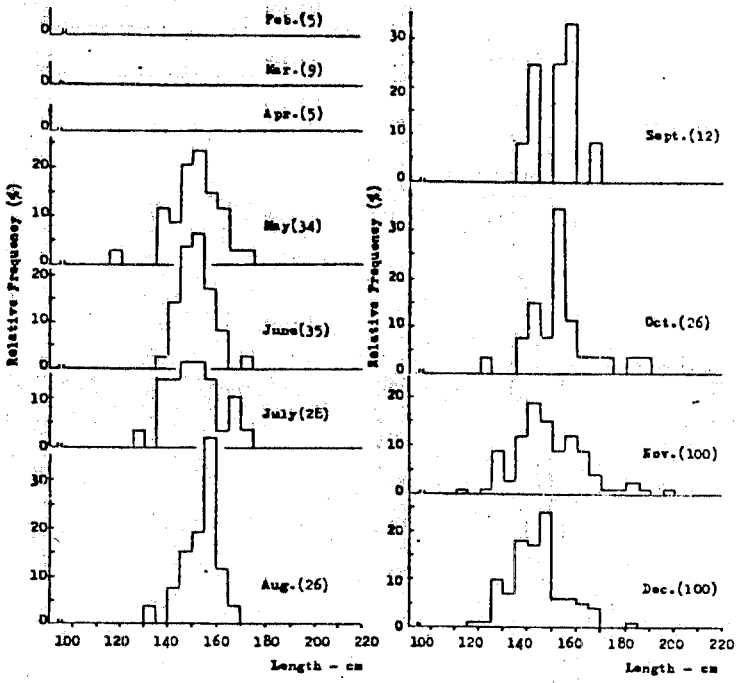

FIGURE 10 - Monthly size-frequency for white marlin (1977).

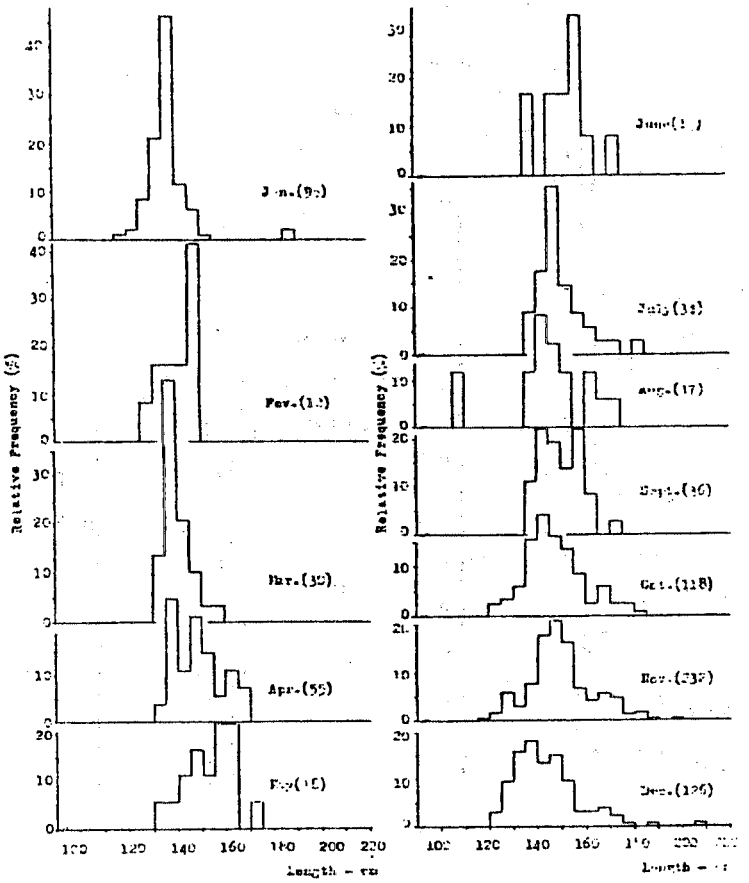

FIGURE 11 - Monthl size-frequency for white marlin (1978).

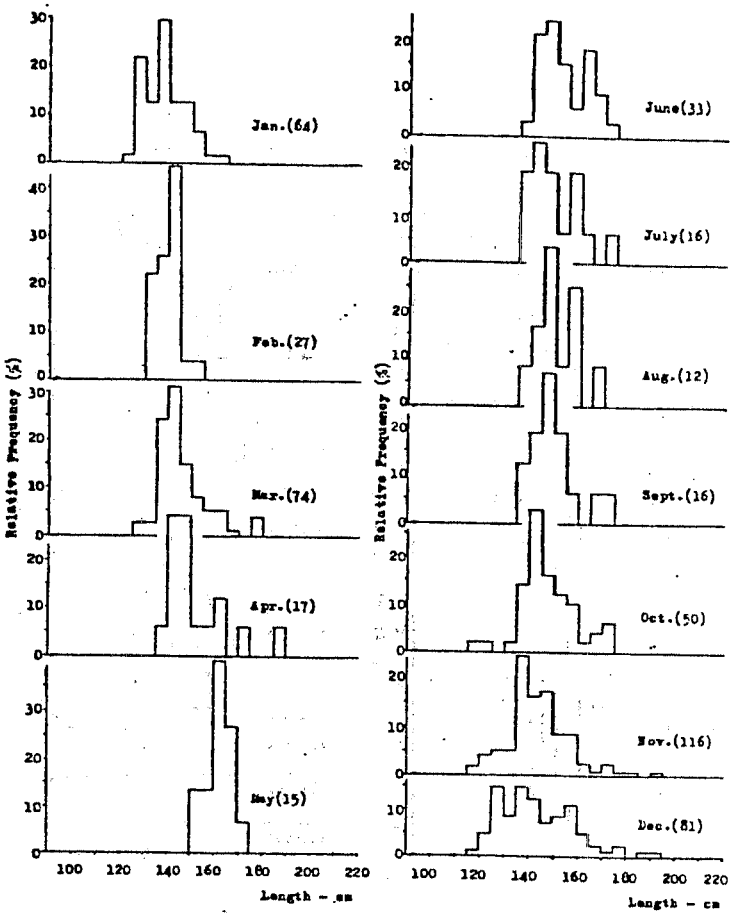

FIGURE 12 - Monthly size-frequency for white marlin (1979).

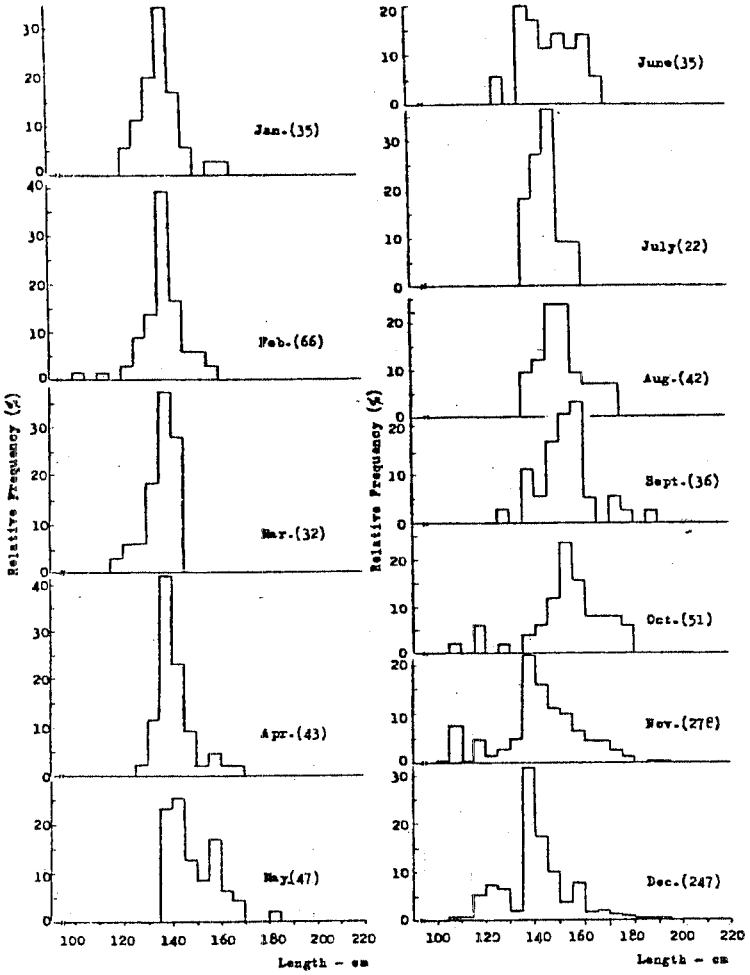

FIGURE 13 - Monthly size-frequency for white marlin (1980).

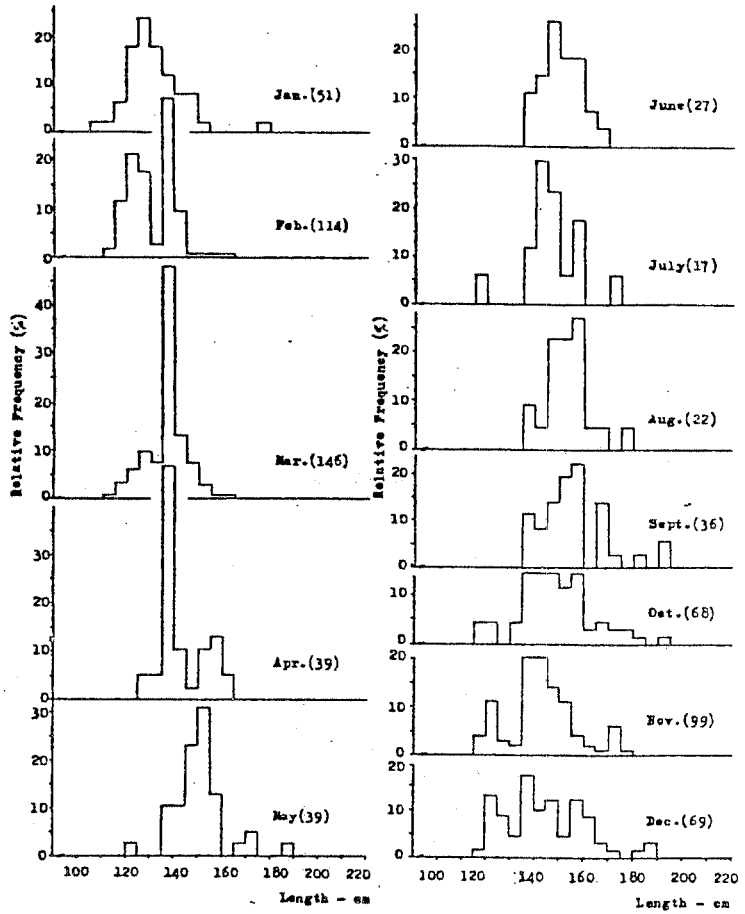

FIGURE 14 - Monthly size-frequency for white marlin (1981).

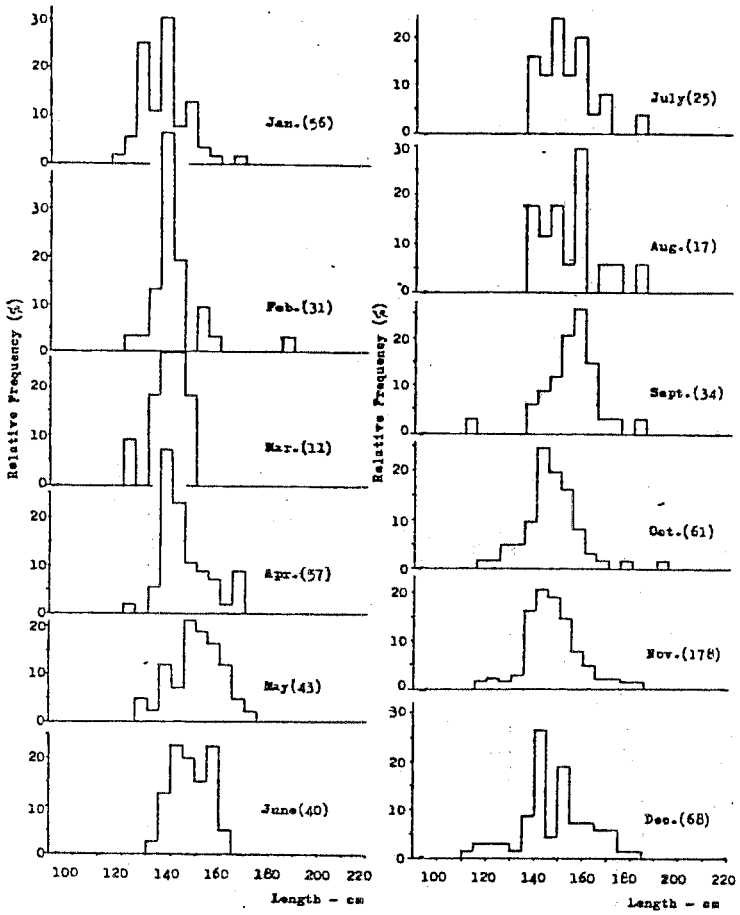

FIGURE 15 - Monthly size-frequency for white marlin (1982).

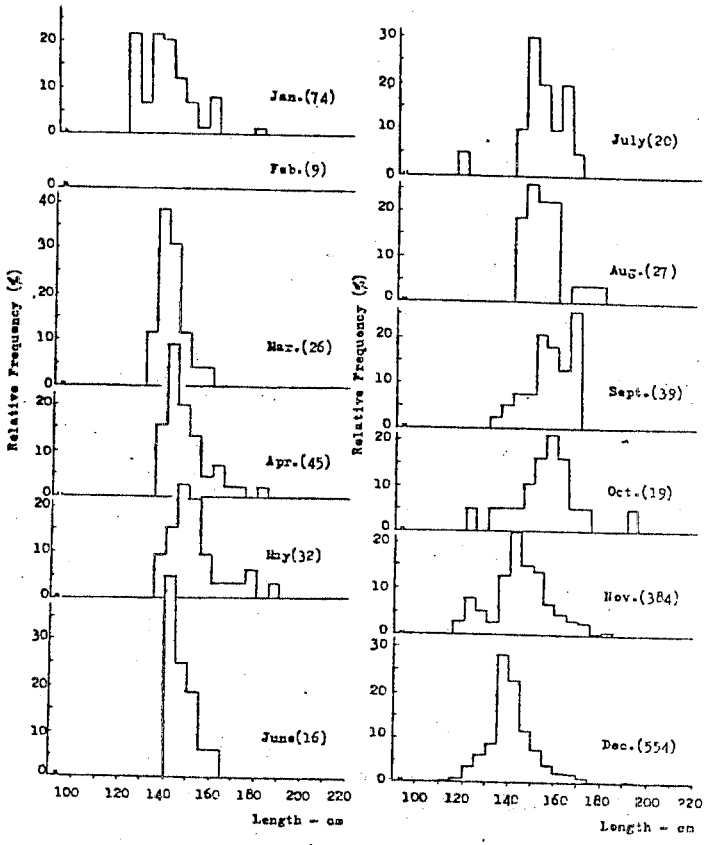

FIGURE 16 - Monthly size-frequency for white marlin (1983).

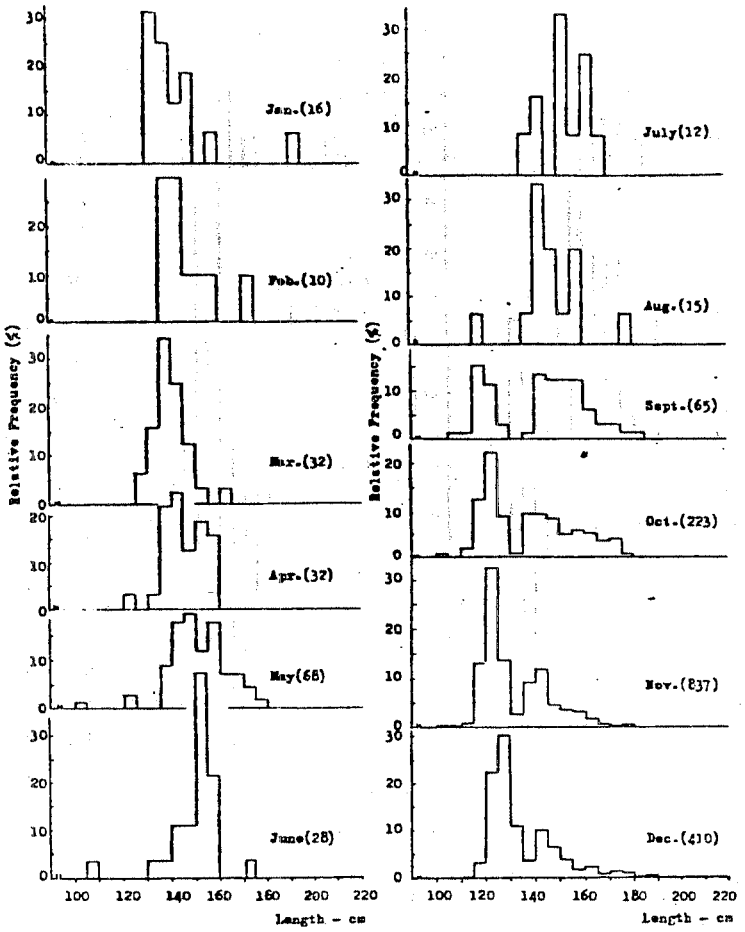

FIGURE 17 - Monthly size-frequency for white marlin (1984).

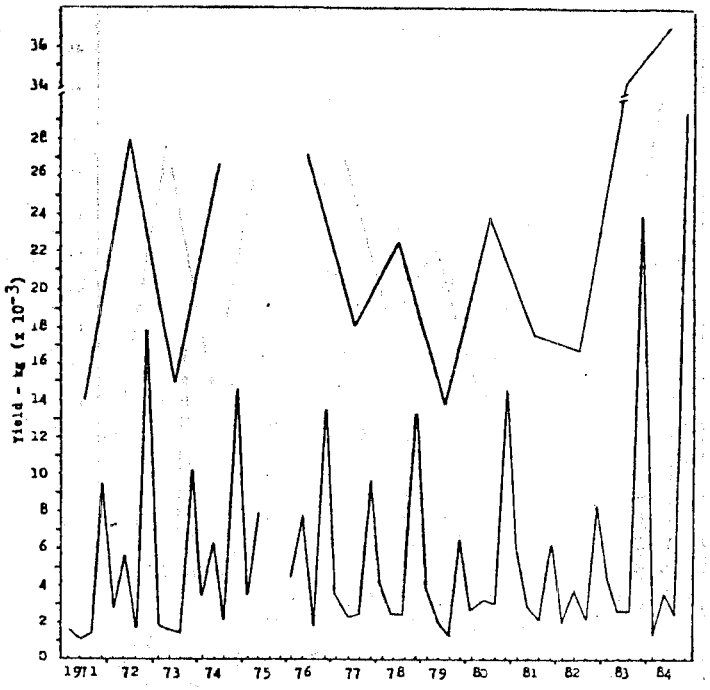

FIGURE 18 - Annual and quarterly yield (weight - kg) for white marlin caught off the South and Southeast of Brazil (1971-84).

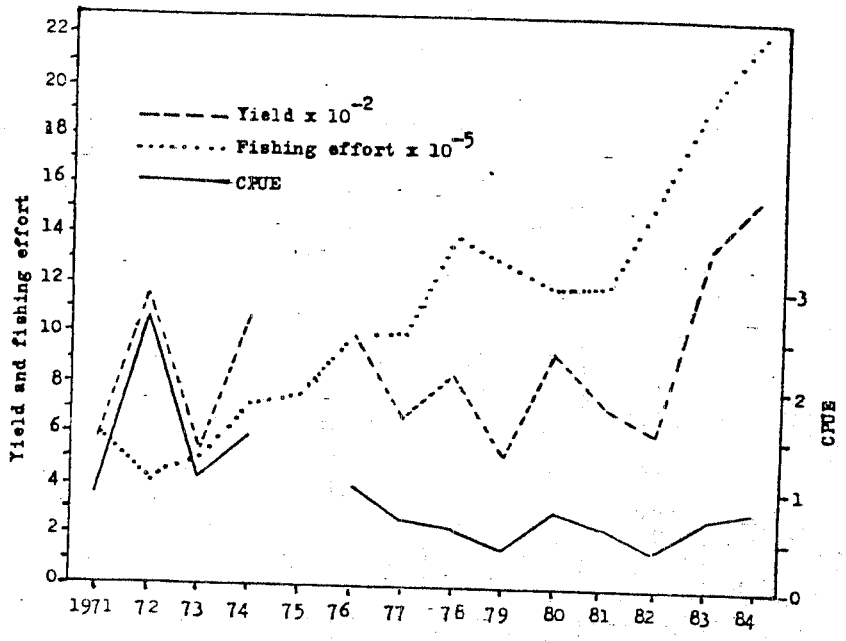

FIGURE 19 - Annual yield (number of fish), fishing effort (number of hooks) and catch per unit of effort - CPUE (number of fish/1,000 hooks) for white marlin caught off South and Southeast of Brazil (1971-84).

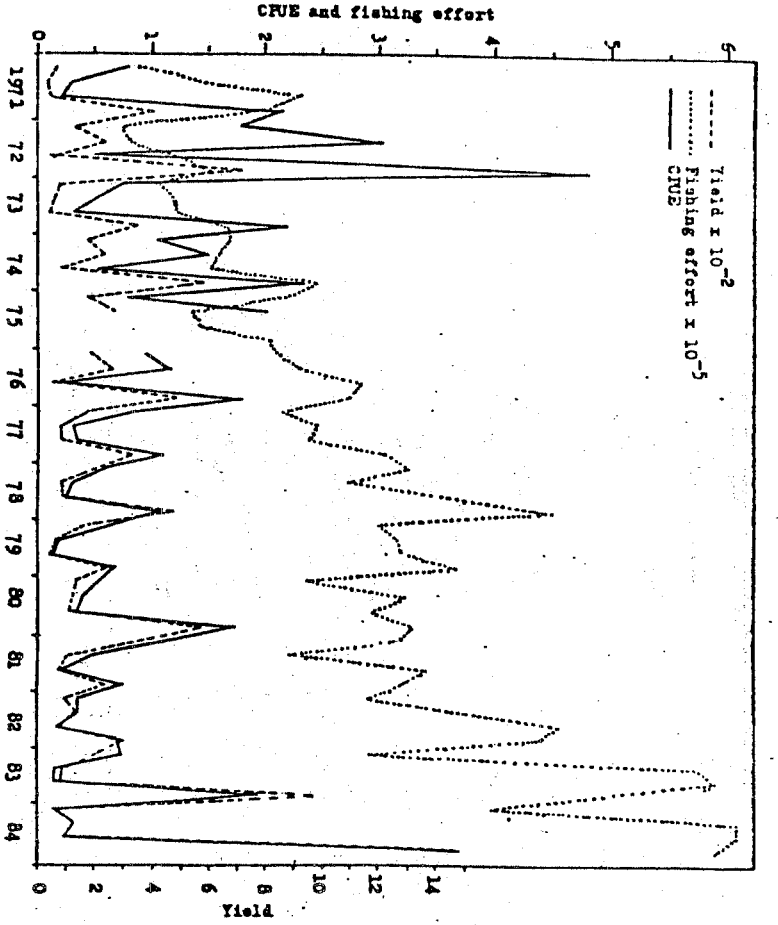

FIGURE 20 - Quarterly yield (number of fish), fishing effort (number of hooks) and catch per unit of effort - CPUE (number of fish/1,000 hooks) for white marlin caught off the South and Southeast of Brazil (1971 - 84).

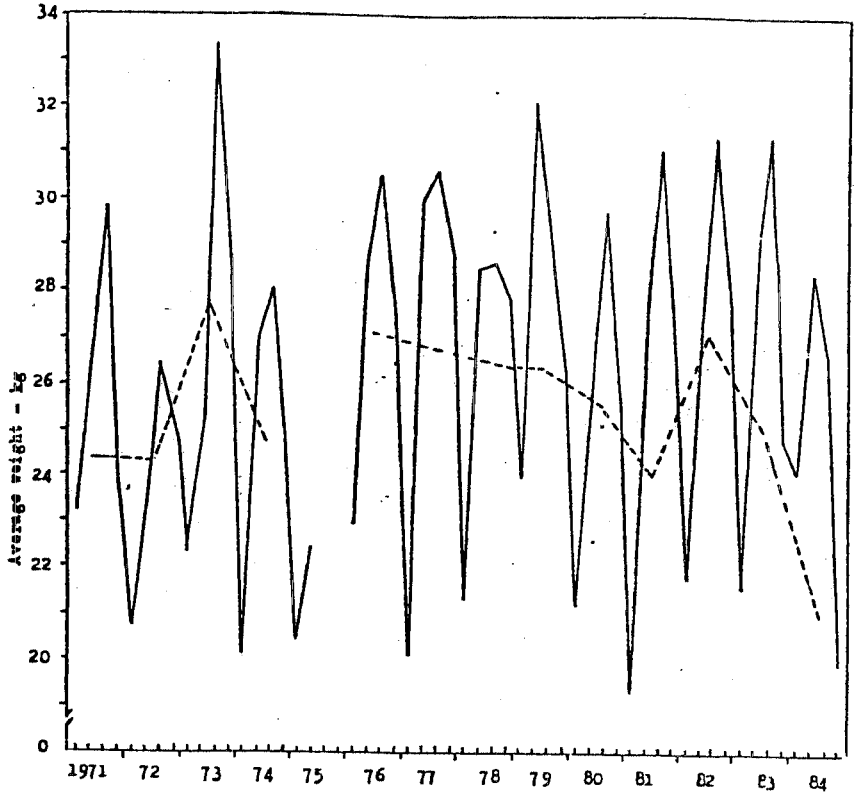

FIGURE 21 - Annual and quarterly average weight (dressed weight - kg) for white marlin caught off the South and Southeast of Brazil (1971-84).