# WHITE MARLIN (*Tetrapturus albidus*) FISHERIES OFF BRAZILIAN COAST FROM NATIONAL AND LEASED LONGLINERS FLEET

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## *SUMMARY*

*This paper analyses white marlin fisheries by longline fleet from Brazil. In Rio Grande city-RS a leased fleet operated from 1977 to 1991. In this period 23.9 million hooks were set, and the white marlin represented about 3% of the catches (in weight). Two tuna boats from a national fleet in Rio Grande also operated from 1982 to 1987. In this period they set about 1.2 million hooks, and the white marlin represented 0.4% of the catches (in weight). The national longline fleet form Santos has been in operation from 1965/66 through 1992. From 1971 to 1990, they set about 26.6 million hooks, and this species represented about 2.5% of the catches (in weight). A fleet of small longliners from Natal city RN, started operations in 1983. In the period 1983-91, they set about 2.3 million hooks, and white marlin represented about 4.2% of the catches (number of fish). The highest CPUE of white marlin in the Brazilian coast occurred around 20$^0$S, in the third quarter, (spring in this area). Nevertheless, in the fourth quarter in the area below 200S, the common values of yield and CPUE were higher, but the average weight was higher in the third. In this region white marlin spawned from the middle of the fourth to the middle of the first quarter.*

## *RESUME*

*Le présent document analyse les pêcheries de makaire blanc de la flottille palangrière basée au Brésil. Une flottille en location a pêché de 1977 à 1991 à partir de Rio Grande, Etat de Rio Grande do Sul. Pendant cette période, 23,9 millions d'hameçons ont été mouillés; le makaire blanc représentait environ 3 % des prises (en poids). Deux thoniers d'une flottille nationale ont pêche à partir de Rio Grande de 1982 à 1987. Pendant cette période, il ont mouillé environ 1,2 millions d'hameçons; le makaire blanc constituait 0,4 % des prises (en poids). La flottille palangrière nationale de Santos a été active de 1965-66 à l'heure actuelle. De 1971 à 1990 elle a mouillé environ 26,6 millions d'hameçons; cette espèce représentait environ 2,5 % des captures (en poids). Une flottille de petits palangriers basée à Natal, Etat de Rio Grande do Norte, a commencé à pêcher en 1983. Pendant la période 1983-91, elle a mouillé environ 2,3 millions d'hameçons; le makaire blanc constituait environ 4,2 % des prises (en nombre de poissons). La valeur la plus élevée de CPUE du makaire blanc sur les côtes brésiliennes s'est produite aux alentours de 20°S pendant le troisième trimestre (le printemps dans ce secteur). Néanmoins, pendant le quatrième trimestre, dans la zone en-dessous de 20°S, les valeurs communes de production et de CPUE étaient plus fortes, mais le poids moyen était plus élevé pendant le troisième trimestre. Dans cette région, le makaire blanc pond du milieu du quatrième trimestre jusqu'au milieu du premier trimestre.*

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*RESUMEN*

*Este documento analiza las pesquerías palangreras de aguja blanca establecidas en Brasil. Una flota, en sistema de "leasing" operó de 1977 a 1991 en la ciudad de Rio Grande (Estado de Rio Grande do Sul). En dicho período se calaron 23.9 millones de anzuelos y la aguja blanca representó un 3% de las capturas (en peso). En Rio Grande faenaron dos barcos atuneros pertenecientes a una flota nacional, de 1982 a 1987, período durante el cual calaron alrededor de 1,2 millones de anzuelos, representando la aguja blanca el 0.4% de las capturas (en peso). La flota palangrera nacional de Santos permaneció activa en 1965 y 1966. Desde 1971 hasta 1990 se calaron alrededor de 26.6 millones de anzuelos y esta especie constituyó aproximadamente 2.5% de las capturas (en peso). En 1983 inició sus operaciones una flota de pequeños palangreros, desde Natal (Estado de Rio Grande do Norte). Entre 1983 y 1991 calaron unos 2.3 millones de anzuelos, representando la aguja blanca un 4.2% de las capturas (en número de peces). La CPUE mas elevada sobre la aguja blanca, en la costa de Brasil se dio alrededor de los 20°S durante el tercer trimestre (temporada de primavera en dicha zona). No obstante, en el curso del cuarto trimestre, en la zona por debajo de 20°S, las cifras normales de rendimiento y CPUE fueron mas altas, pero el peso medio fue mas elevado en el tercer trimestre. En esta región, el desove de la aguja blanca tuvo lugar desde mediados del cuarto trimestre hasta mediados del primero.*

## 1. HISTORICAL DATA OF THE FISHERIES

The longline fishery in Brazil started when Japanese longliners settled in Recife city, Pernambuco State, in 1956. These longliners operated until 1971 (PAIVA, 1975). In the South and Southeast, a Brazilian company based in Santos city, Sao Paulo State, operated with 3 boats from 1958 to 1961, and in 1965/66 another company started to operate again with 2 boats (ARFELLI & AMORIM, 1988). Based in Rio Grande city, Rio Grande do Sul State, the tuna longline fishery started in 1977 with the leasing of 3 Japanese boats, and in 1982 national boats also began fishing. In Natal city, Rio Grande do Norte State, the fishery with small longliners started in 1983 and continues through 1992.

The leased Japanese fleet settled in Rio Grande, operated from September 1977 to October 1991. It comprised 19 large boats and 2 small ones, whose characteristics were described by Silva (1992). The number of boats ranged from a minimum of 2, in 1991, to a maximum of 6 in 1982 and 1986.

The national fleet in Rio grande operated with 1 tuna boat in 1982 and 2 from 1983 to 1987. The 2 small boats (28 and 31m) were built of naval steel. The smaller had a freezer and the other used broken ice for storage of fish.

The fleet in Santos increased to 3 longliners in 1971 and to 8 in 1984, decreasing to 6 in 1985 and then kept the same number through 1987. These boats ranged form 100 to 200 MT and used ice to preserve the fish (ARFELLI & AMORIM, 1988). In 1990 and 1991, this fleet was comprised of 11 and 13 boats respectively. In 1992, this number increased to 17 longliners, 5 of wood and 12 of steel (AMORIM & ARFELLI SCRS/92/31), ranging from 100 to 360 MT. The fishing trips usually take about 20 days.

The longline fishery from Natal started in 1983, with a small boat 16m long. In 1985, 3 tuna boats were in operation, reaching a maximum of 10 boats in 1990, and then declined to 3 in 1991. Most of them were made of steel, with a length ranging from 16 to 26m, and fish storage using ice. The duration of the cruises ranged from 10 to 15 days.

## 2. METHODOLOGY

In this paper, we evaluated white marlin distribution by dividing the Brazilian coast into 3 areas (Figure 1), in order to compare the fisheries from different fleets: the fishing fleet in area A (Northeast of Brazil) was composed of only the leased Japanese and the national fleet from Natal; only the leased fleet operated in area B (Northeast and Southeast of Brazil); the leased Japanese fleet and the national

boats from Santos and Rio grande operated in area C (Southeast and South of Brazil). The CPUE was given in numbers of fish per 1,000 hooks. The quarterly CPUE was shown from 1982 to 1991.

## 3. RESULTS

### 3.1. Fishing Areas-Fishing Effort

The leased Japanese tuna boats operated in almost all the South Atlantic, from international waters off Argentina, around $42^0$55'S, to $10^0$29'N (ANTERO-SILVA, 1992). This fleet fished in the coldest months off Rio Grande do Sul and Santa Catarina States, South of Brazil (MORA et **al.**, 1991), 73% of fishing effort occurred at $30^0$ to $35^0$S. In the hottest months (spring and summer), the fleet directed the activities to the equatorial region, fishing in the Northeast of Brazil near the Ascencao Islands (Figure 2).

During the whole period (1977-91), the Japanese fleet set about 23,876,158 hooks, distributed as follows: 19,399,944 hooks (81.25%) set in the South of Brazil (area C) ; 158,690 hooks (0. 66%) in area B; and 644,815 hooks (2.7%) in area A. Figure 2 shows the quarterly distribution of the effort in the South Atlantic.

The fishing activities of the national fleet from Rio Grande were restricted to South of $28^0$S to the boarder of Uruguayan waters. All fishing activities occurred west of $45^0$W. This fleet set 1,220,110 hooks in the whole period. The distribution of the hooks in blocks or sub-areas of 50 square, by quarter is in Figure 3.

The Brazilian longliners that settled in Santos operated at $20^0$-$33^0$S and $39^0$-$50^0$W. In order to increase their productivity, these longliners directed their fisheries to specific areas, according to the season of the year. From the beginning of May to the middle of October they fished to the South of Parallel $27^0$S (ARFELLI & AMORIM, 1981). However, the fishing areas have changed somewhat according to the season and since 1979, the longliners basically followed the above mentioned scheme, but sometimes fished in areas not normally fished for the season of year (ARFELLI & AMORIM, 1985). The data from 1989 and 1990 is preliminary.

The fleet from Santos operated only in area C. The annual fishing effort has shown an increasing trend in the 1971-85 period, ranging from 432,000 (1972) to 2,200,000 hooks (1984), according to AMORIM & ARFELLI (1987). For the whole period they set 26,639,567 hooks. Figure 4 shows distribution of effort from longliners.

The fishing area of the fleet from Natal was $7^0$N - $17^0$S latitude and $24^0$ - $24^0$W longitude (HAZIN et. al., 1992). The fleet from Natal set about 2,314,984 hooks in the whole period. The distribution of fishing effort per area is shown in Figure 4.

The annual distribution of effort per area for Santos and Rio Grande fleets are shown in Figure 5. An increasing effort of the fleet from Santos was observed in area C, with a maximum of 2,800,000 hooks in 1990. the maximum effort of the Japanese fleet in this area occurred in 1982, with 2,187,266 hooks, and the national fleet form Rio Grande had a maximum effort in 1983.

In area A, the fleet form Natal had a maximum effort in 1986 and 1987 with 500,988 and 505,615 hooks, respectively. The Japanese fleet in this area had a maximum effort in 1978 with 314,540 hooks.

In area B, just the Japanese fleet fished, resulting in a reduced effort. The highest effort occurred in 1977, with 55,850 hooks.

### 3.2. White Marlin Catch

White marlin are caught all year round by the mentioned fleets in the three areas. The highest catches of white marlin occurred in the South and Southeast of Brazil, due to the high fishing effort employed by the national fleet from Santos and the leased Japanese boats. The highest catch in area C

was in 1989 by the fleet from Santos, with 5,940 fish. The highest catch for the leased boats was in 1986 with 1,429 fish (Figure 6).

In area A, the highest catch was in 1977 by the leased fleet with 743 fish. For the fleet from Natal, it occurred in 1986 with 727 fish (Figure 6).

For area B the leased Japanese fleet had the highest catch in 1981 with 261 fish (Figure 6).

### 3.3. Catch Per Unit of Effort

In area A, the highest CPUE (6.3 fish per 1000 hooks) was obtained by the Japanese fleet in 1982 (Figure 7). The highest CPUE of the national fleet from Rio Grande in the area C, was 4.1 fish per 1000 hooks in 1984 (Figure 8). In the area C the national fleet from Santos presented the highest CPUE in 1986, with 2.9 fish per 1000 hooks. Figure 10 shows the comparison of CPUE in the 3 studies areas. The highest CPUE for white marlin was obtained in 1981, in area B, with 41.6 fish per 1000 hooks. In the same area in 1979, the CPUE was 32.3 (Figure 10).

The highest CPUE (· 20 per 1000 hooks) occurred at $15^0$-$25^0$S, in the fourth quarter, from the Japanese fleet. Figure 11 shows the quarterly CPUE obtained in the past 10 years, in areas A, B and C. In area A the CPUE was almost always higher in the third quarter. In area B, there were few data and they were concentrated in the first and fourth quarters, indicating very high CPUE values. For area C, the fleet from Santos always had the highest CPUE in the fourth quarter, and the leased fleet in the first quarter.

Comparing the quarterly CPUE for the three areas, it was observed that in the third quarter, white marlin were concentrated in area A (therefore there is a lack of information from area B) and in the fourth and first quarters in areas B and C. In the second quarter, low values of CPUE were normally found in all areas. The quarterly distribution of CPUEs had almost the same pattern that has found for white marlin in the period 1956-68 reported by UEYANAGI et. al., (1970) and Wise and Davis (1973).

The CPUE values presented by MATHER et. al. (1972, Fig. 6 caption) and by Wise and Davis (1973, Fig. 9 caption) were also higher when compared with the ones presented in this paper. The only exception was for area B, when the leased Japanese fleet CPUE in (Fig. 7) 1978 and 1980 were greater than those reported by MATHER et. al. (1972) and Wise and Davis (1973).

Areas A, in the Brazilian Northeast coast, shows a substantial decline in the white marlin catches from 1984 to 1991, obtained by the fleet from Natal. Apparently, in area C the trend of CPUE is not declining.

### 3.4. Spawning

In the South and Southeast of Brazil white marlin usually spawn from December to March, at least in the area $25^0$55' to $26^0$20'S and $45^0$10' to $45^0$50'W; nevertheless the area studied is not known for concentrations of juvenile white marlin (ARFELLI; AMORIM; GALHARDOAMADO, 1986).

The peak spawning season for white marlin in the South Atlantic Ocean was in early summer in the area $20^0$ to $30^0$S and $20^0$ to $50^0$W. Some white marlin larvae have been found at $24^0$ to $26^0$C thermocline from $15^0$ to $20^0$S -$10^0$ to $25^0$W, and also $30^0$S - $20^0$ to $25^0$W region (UEYANAGI et. al., 1970).

## 4. CONCLUSIONS

White marlin are considered secondary to tuna and swordfish in the longline fisheries. The results show that the fleet from Santos had the highest white marlin CPUE in the fourth quarter, (considered spring in the southern hemisphere), and the Japanese fleet in the first quarter (considered summer) . These data suggest a white marlin migration from North to South, which is supported by highest CPUEs of the leased fleet in the first quarter.

The catches of the leased Japanese fleet in areas A and B, in the second quarter, occurred mainly in April, i.e., in the beginning of autumn. This is part of the end of the cruises in the east and northeast region. The CPUE obtained in these areas were influenced by the end of summer in the region.

The fishing effort of Japanese fleet in the same regions in the third quarter occurred in the end of the period, i.e., beginning of spring, at the same time that the fishing cruises started in the Brazilian Northeast and East regions.

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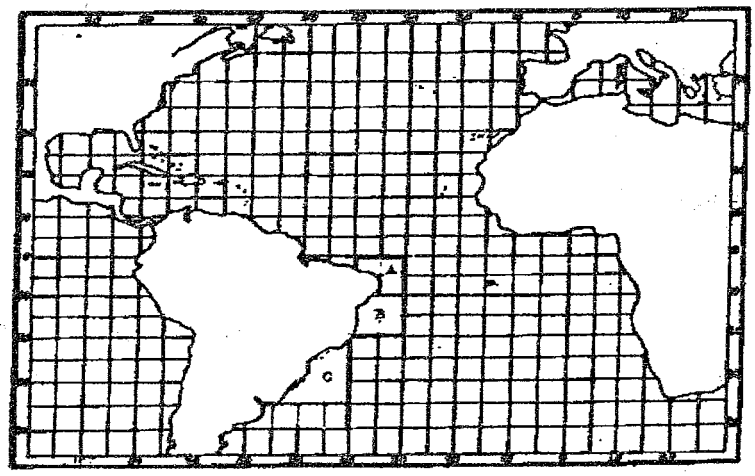


Fig. 1. Division of the Brazilian coast: Area A-fishing ground of leased Japanese and national longliners from Natal; Area B-fishing ground of leased Japanese longliners; Area C-fishing ground of leased Japanese,. and national longliners from Santos and Rio Grande.

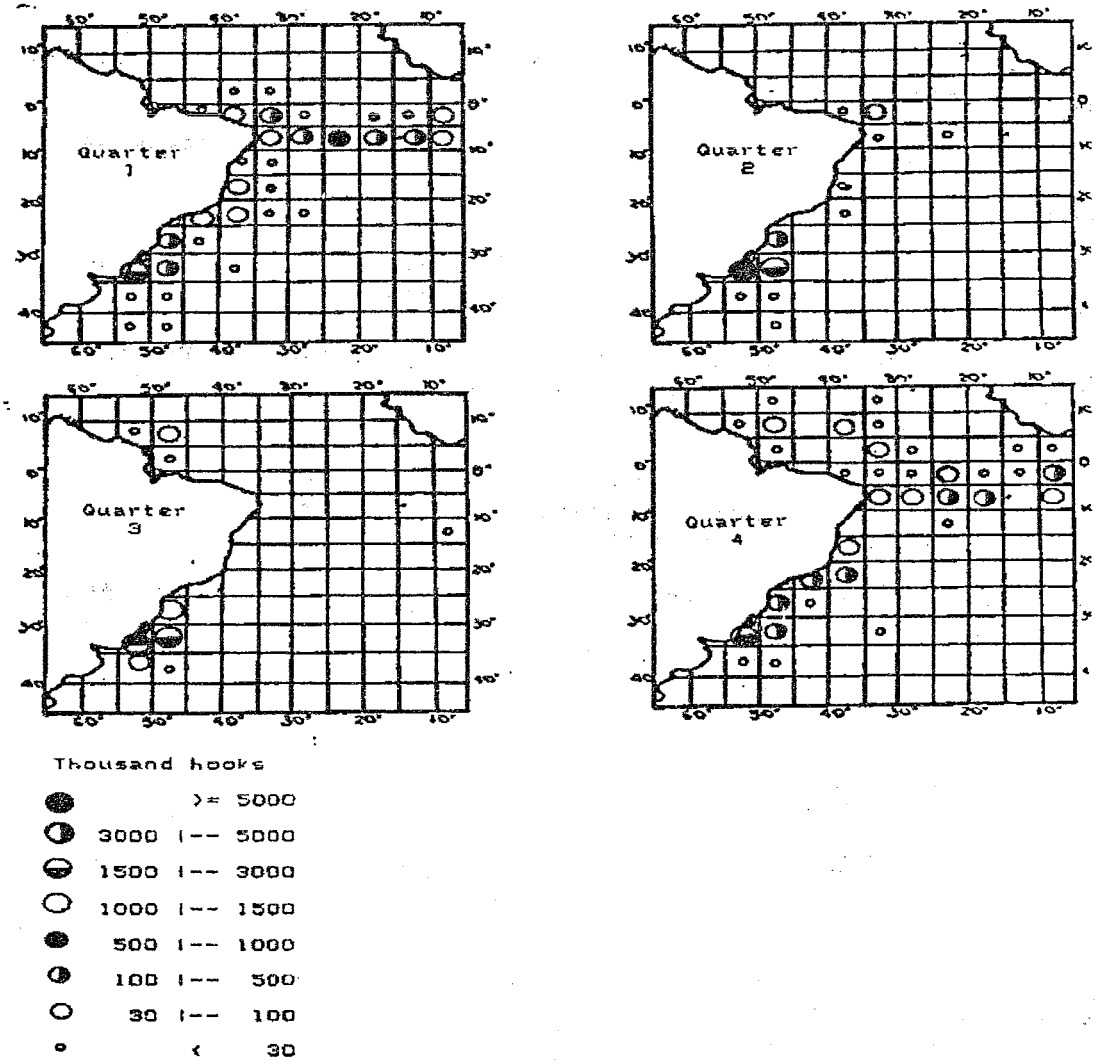


Fig. 2. Quarterly effective fishing effort in thousand of hooks of leased-Japanese longline fleet in the Atlantic Ocean, 1977-1991.

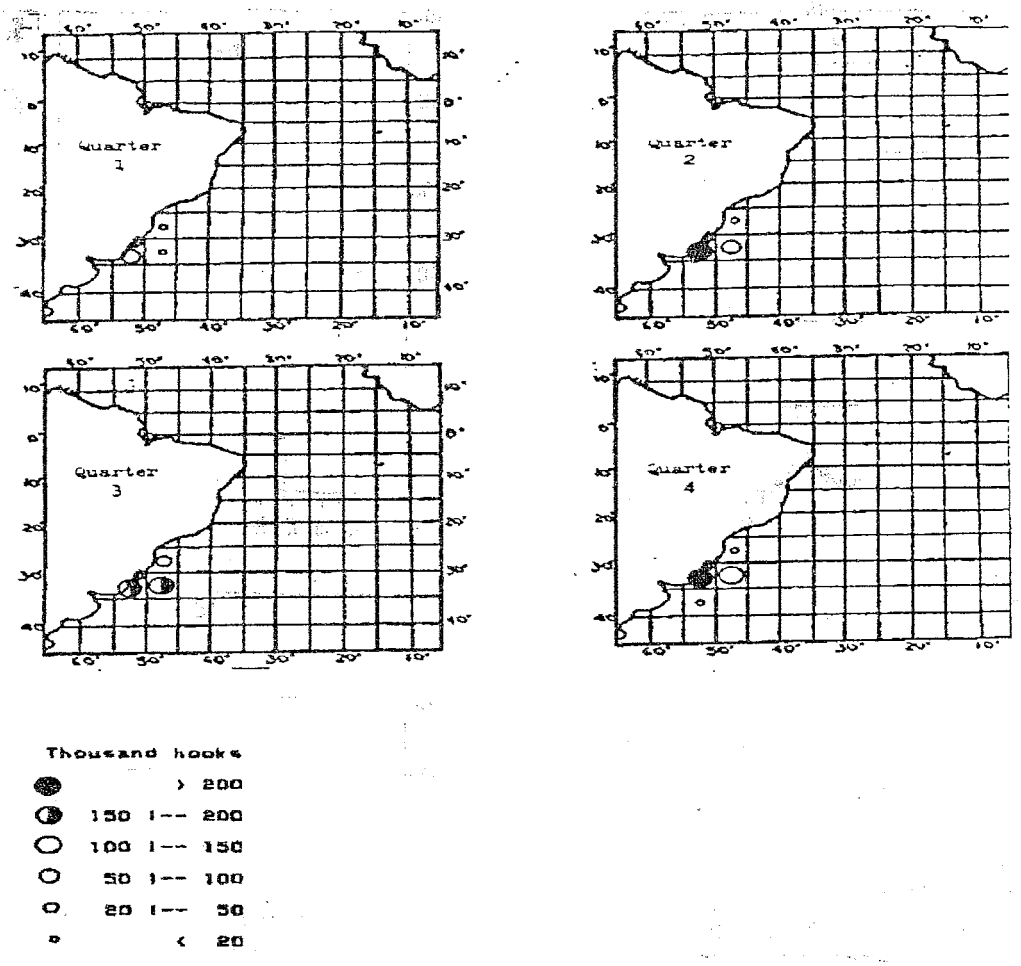


Fig. 3. Quarterly effective fishing effort in thousand of hooks of Brazilian national longline fleet based in Rio Grande do Sul State, 1982 - 87.

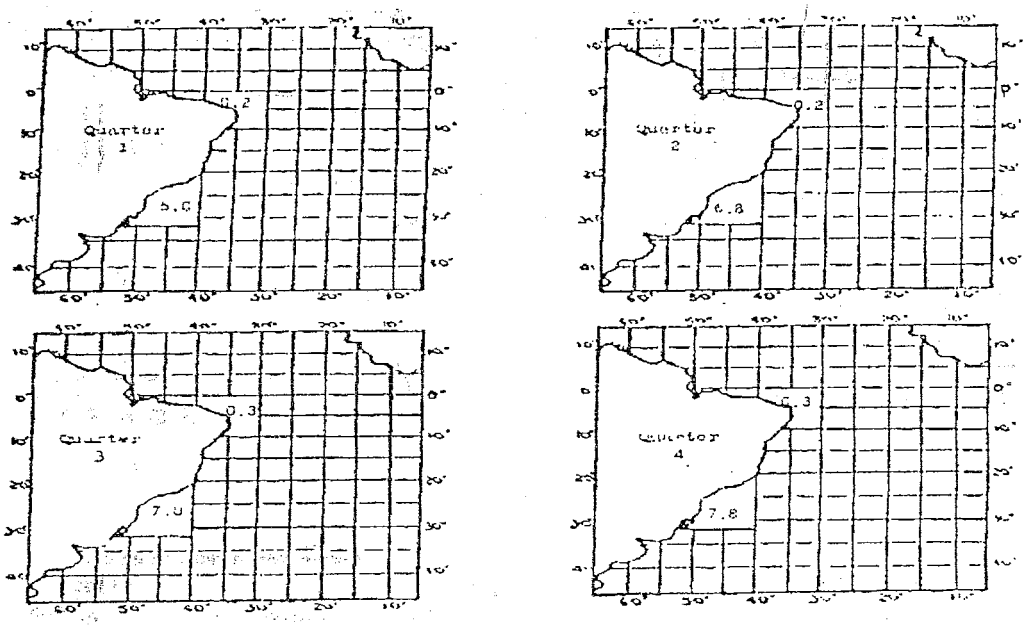


Fig. 4. Quarterly effective fishing effort (1,000,000 hooks) for white marlin by Brazilian longliners based in Santos (1971-90) and in Natal cities (1983-91).

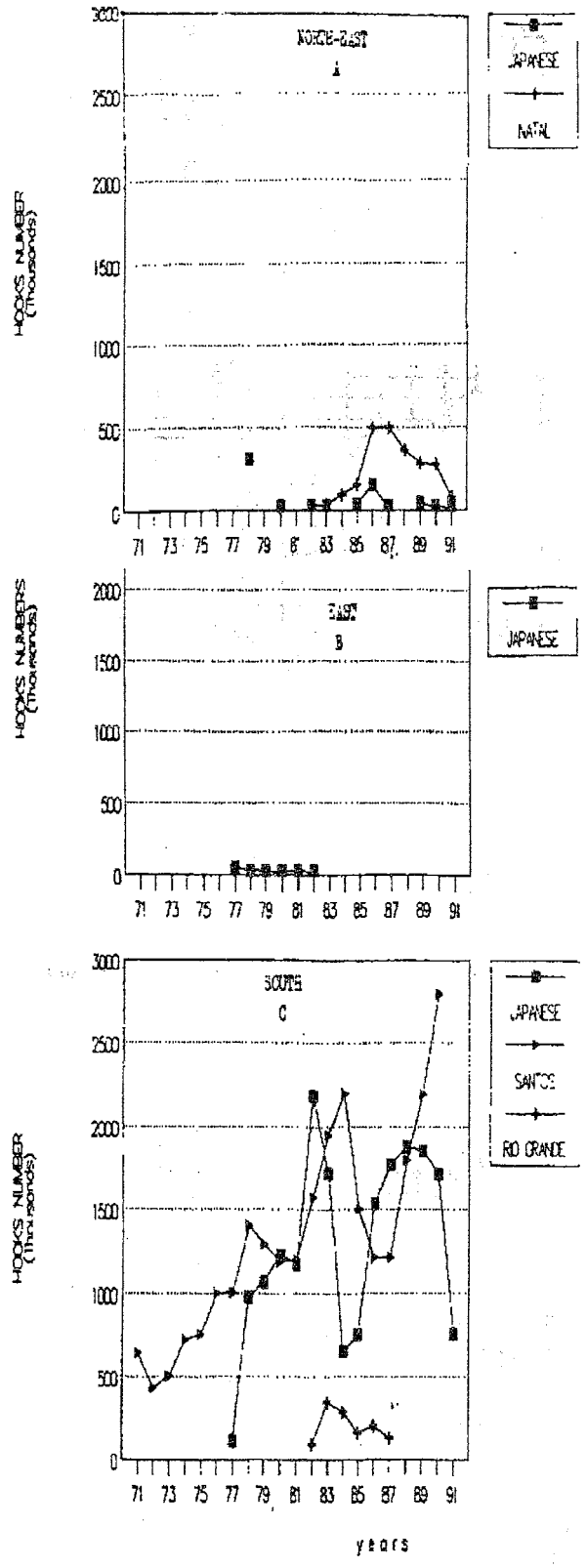


Fig. 5. Annual fishing effort (in thousand hooks) in the Areas A, B and C.

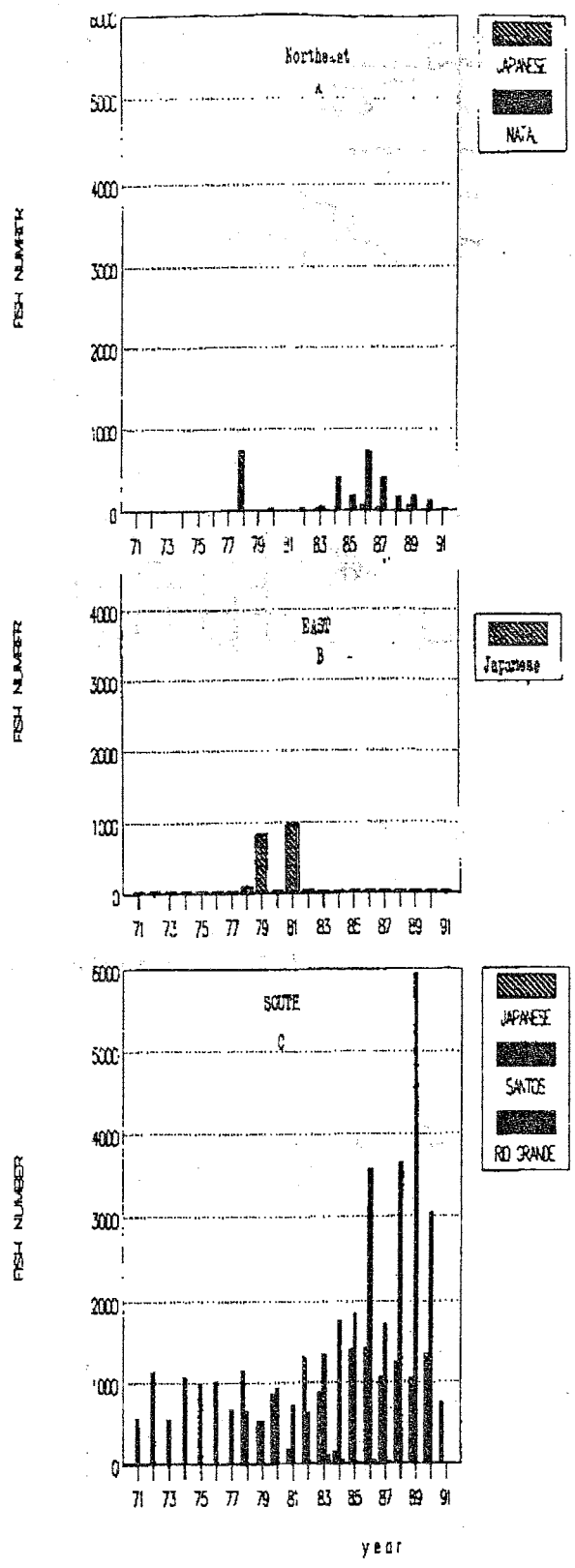


Fig. 6. Annual white marlin catch in number of fish. Area A: by leased Japanese longliners and Brazilian boats from Natal and Recife cities. Area B: by leased Japanese longliners. Area C: by leased Japanese longliners and Brazilian longliners from Santos and Rio Grande cities.

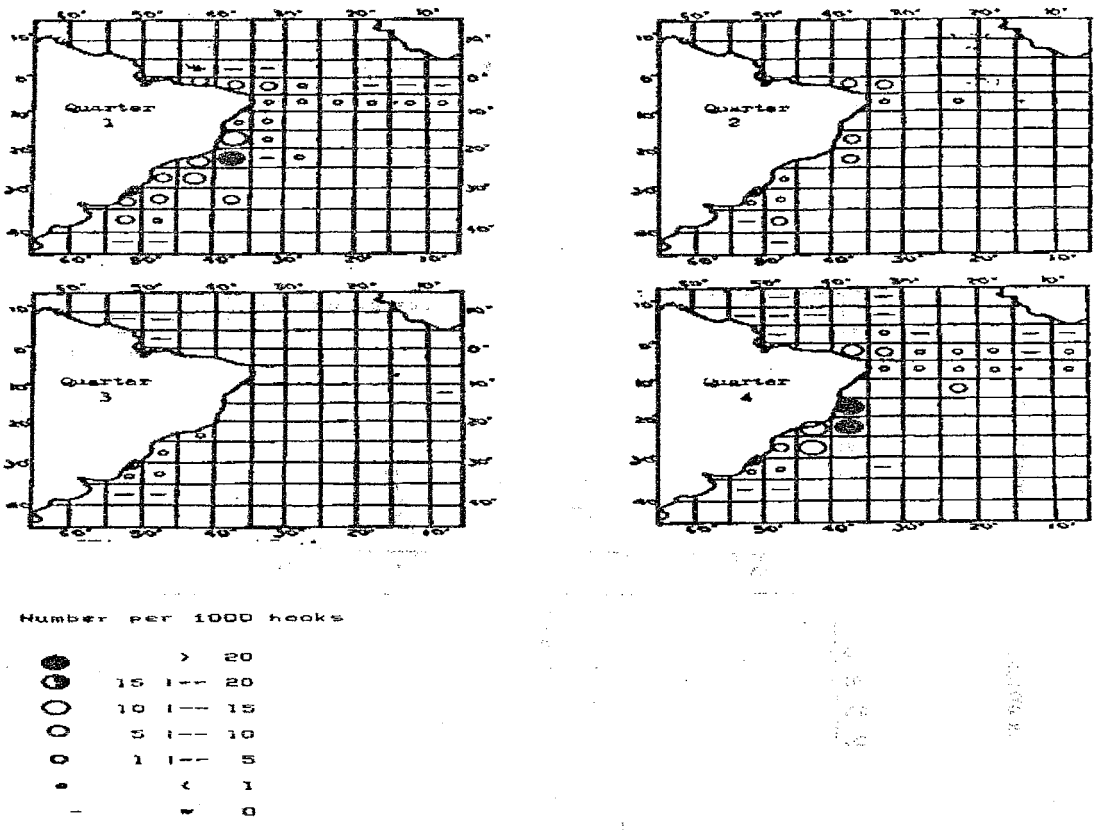


Fig. 7. Quarterly catch per unit of effective effort for white marlin of the leased Japanese longliners, 1977 - 91.

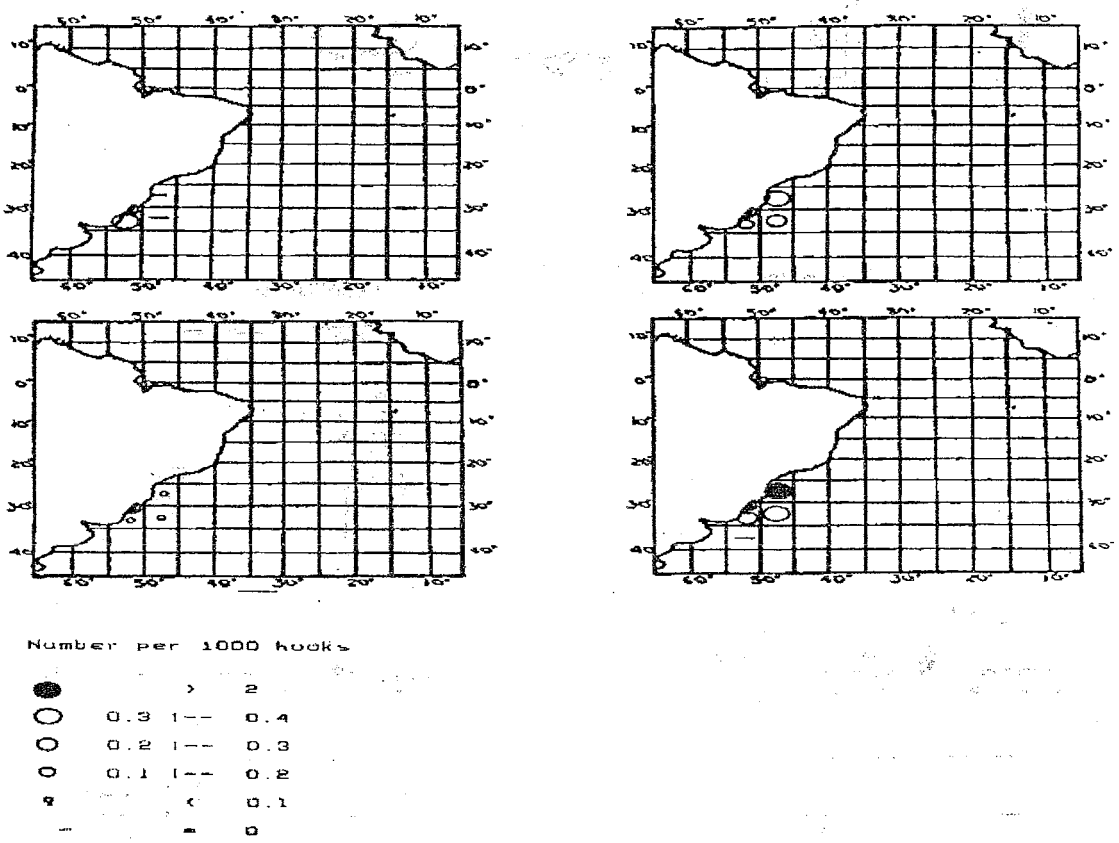


Fig. 8. Quarterly catch per unit of effective effort for white marlin of the Brazilian longliners, 1982 - 87.

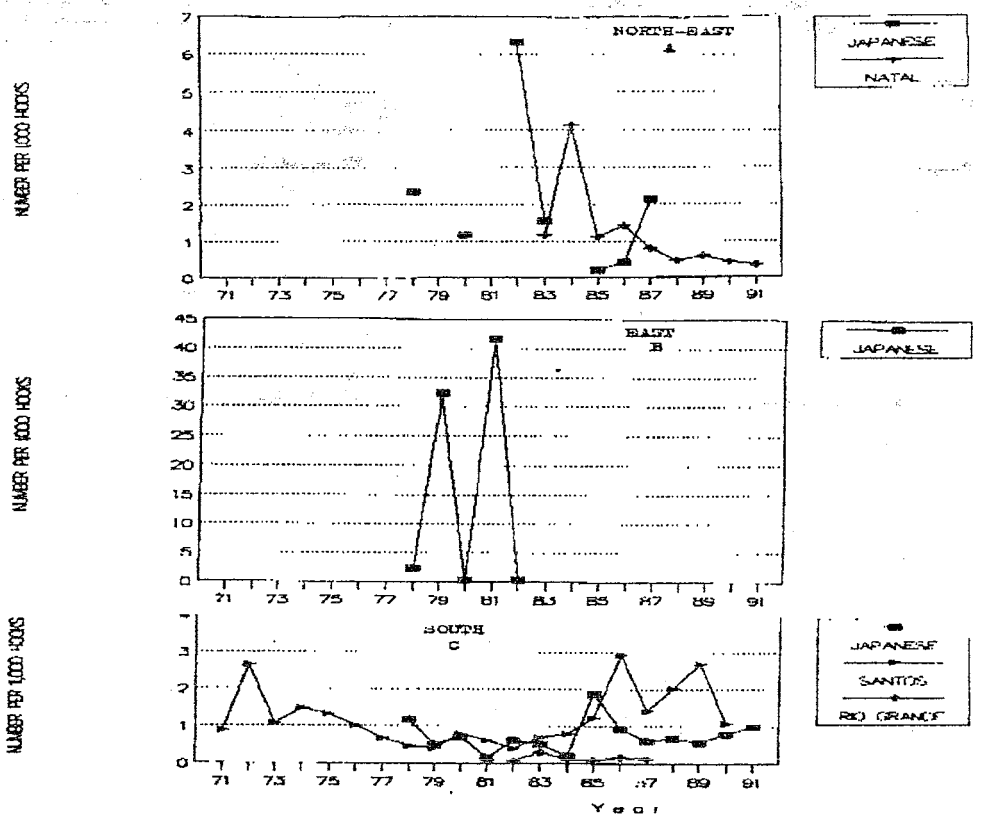


Fig. 9. White marlin annual yield number of fish) from Area A, by leased Japanese longliners and Brazilian boats from Natal city and from Area B, by leased Japanese longliners. Area C, by leased longliners and Brazilian fleet from Santos and Rio Grande.

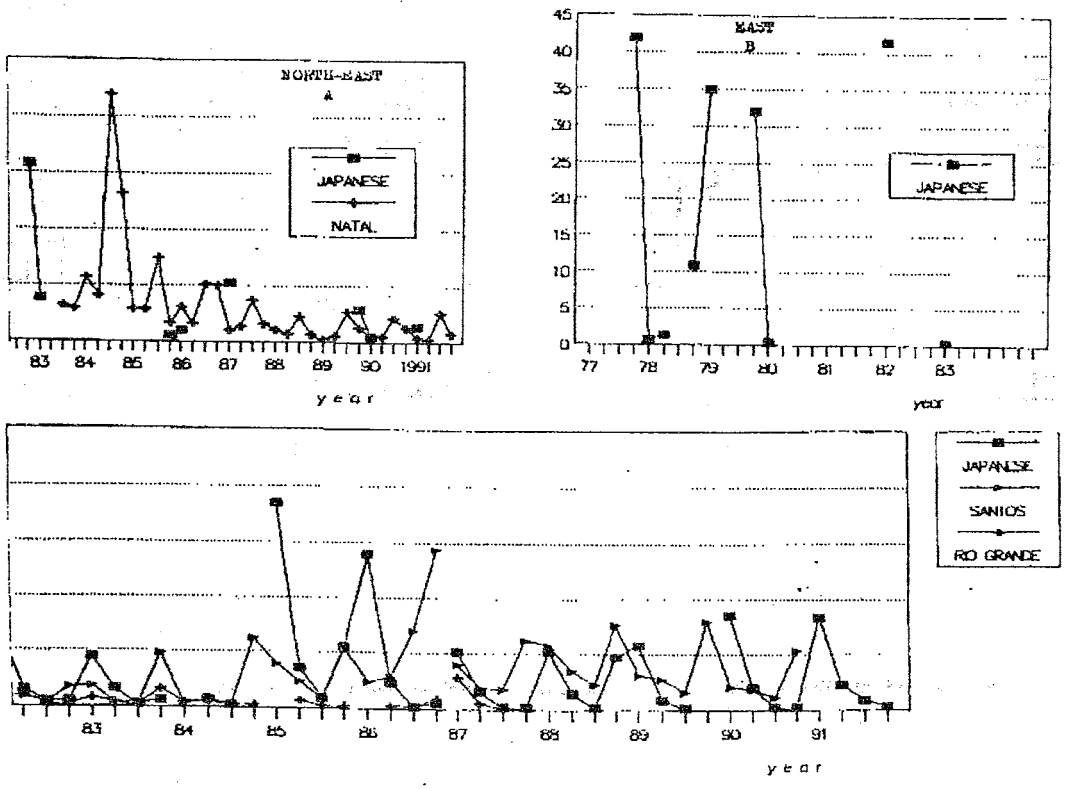


Fig. 10. White marlin quaterly CPUE (per 1000 hooks) in Areas A, B and C of Brazilian and Japanese (leased) longliners.