REVISION ON STATISTICAL DATA OF THE BRAZILIAN LONGLINERS BASED IN SANTOS-SP (1971-90).

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ABSTRACT

The revision of statistical data from the Brazilian longliners of Santos, SAO Paulo state, was based on log commercial sheet records. This fleet operated in the area 20^0-33^0 S to 39^0-50^{0}W. This paper presents results and analysis of billfish, tuna, shark and other fish caught by longline. Data obtained included yield, fishing effort and CPUE. The longliner total catch has gradually.increased from an average of 580 t (1971-73) to an average of 1,200 t (1974-78) and to an average of 1,700t (1979-90), with a maximum value of 2,600 t (1990). Tuna represented more than 50% of the total catch in the beginning period (1971-79) and decreased to about 20% in the following period (1980-90). Sharks represented 14% (1971-76), increasing this percentage to 531 (1990). In the period 1971-79 the three tuna species were the goal of the fisheries, but from 1989-91 the longliners also aimed at the catch of sharks and sometimes swordfish.

RESUME

La révision des données statistiques des palangriers brésiliens basés à Santos, Etat de Sao Paulo, se basait sur les registres commerciaux des livres de bord. Cette flottille a pêché dans la zone qui va de 20°S à 33°S et de 39°W à 50°W. Le présent document présente les résultats et l'analyse des istiophoridés, thonidés, requins et autres poissons pris à la palangre. Les données obtenues comprennent la production, l'effort de pêche et la CPUE. La prise palangrière totale s'est graduellement accrue d'une moyenne de 580 TM (1971-73) à une moyenne de 1.200 TM (1974-78), et de 1.700 TM (1979-90), avec une valeur maximum de 2.600 TM en 1990. Les thonidés constituaient plus de 50 % de la prise totale pendant la première période (1971-79), puis ont décru à environ 20 % pendant la période suivante (1980-90). Les requins représentaient 14 % (1971-76), ce pourcentage s'accroissant ensuite à 53 % en 1990. Pendant la période 1971-79, les trois espèces de thonidés constituaient l'objectif des pêcheries, mais de 1980 à 1991 les palangriers ont également visé les requins et parfois l'espadon.

RESUMEN

La revisión de los datos estadísticos de los palangreros brasileños de Santos, Estado de Sao Paulo, se basó en registros de cuadernos de pesca comerciales. Esta flota faenó en la zona 20°-33°S a 39°-50°W. El documento presenta resultados y análisis de marlines, túnidos, tiburones y otros peces capturados con palangre. Los datos obtenidos incluían rendimiento, esfuerzo de pesca y CPUE. La captura total palangrera se ha incrementado gradualmente desde una media de 580 t (1971-73) hasta una media de 1.200 t (1974-78) y una media de 1.700 t (1979-90), con una cifra máxima de 2.600 t (1990). Los túnidos constituían mas del 50% del total de la captura en el período inicial (1971-79), declinando hasta alrededor de un 20% en el siguiente período (1980-90). Los tiburones representaban el 14% (1971-76), aumentando este porcentaje hasta el 53% (1990). Durante el período 1971-79, la pesquería estaba dirigida a las tres especies de túnidos, pero entre 1980 y 1991 los palangreros buscaban también tiburón y, en ocasiones, pez espada.

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1. INTRODUCTION

In Santos city, Sao Paulo State, the fishery began in 1958 with 3 boats that fished till 1961. In 1965/66, also in Santos another company started to operate with 2 boats. This fleet increased to 3 in 1971, and to 8 in 1984, after decreasing to 6 in 1985, keeping the same number through 1987 (Arfelli & AMORIM, 1988). From 1988 to 1992 the fleet increased to 17 longliners (5 of wood and 12 of steel). el).

These boats operated at 20^0-33^0 S and 039^0 - 050^0 W (Figure 1) using the longline. Aiming at more productivity, these longlines directed their fisheries to determined areas, according to the season of the year. From the beginning of Bay to the middle of October they fished to the South of parallel 25- S and during the rest of the year to the North of parallel 27^0 S (Arfelli & Amorim, 1981). However, since 1979 the fishing areas have suffered some changes, according to the season : the longliners basically followed the mentioned scheme, but sometimes fished in an area not very usual for the season (Arfelli & Amorim, 1985). After 1985 the boats fished in all places of the above mentioned area, independently of the season.

Swordfish, sailfish, white marlin, yellowfin and bigeye tunas, albacore, dolphin and blue, shortfin mako, bigeye thresher, oceanic whitetip and night sharks and scalloped and smooth hammerheads were caught in large quantities. They also caught in small number the following species : blue marlin, blackfin tuna, skipjack, wahoo, escolar, oilfish, sunfish, other 9 different shark species and 1 species of skate. Other species were seldom caught, like southern bluefin tuna, longbill spearfish, 9 different bony fish, 12 different species of sharks and 1 species of ray.

The present paper contains results and analysis of yield, fishing effort, and CPUE of the main longliner species.

2. MATERIALS AND METHODS

Basically the methodology used in this paper follows the same presented in other papers: Amorim; Arfelli; Galhardo-Amadg (1986) and Arfelli & Amorim (1981, 1985).

The data utilized in this study were obtained from Brazilian longliners settled in Santos-SP.

The numbers of fish and weight were obtained from log commercial sheets (Figure 2) of fisheries companies (Cooperativa Mista de Pesca Nipo-Brasileira and Companies Irmaos Ono, Akama Comercio de Pescados Ltda., Imaipesca Industria e Comercio de Pescados Ltda., Taiyo Industria de Pesca S/A and Kawai-Suisan Comercio e Industria de Pescados Ltda.).

The fishing effort (number of hooks) was obtained from -Secao de Controle da Producao Pesqueira - Divisao de Pesca Naritima, Instituto de Pesca-, except for the-period from 1971 to 1973, and 1983 to 1990, which was estimated an the basis of the effective fishing days to an average of 1,290 hooks per day.

The data from boats that arrived in the beginning of the month were considered as belonging the previous month, when mast of the catch had really occurred (Arfelli & Amorim, 1985).
The yield (metric ton) is presented by quarter and year and fishing effort and CPUE (weight) are presented per thousands hooks by year, from 1971 to 1990. The data of third and fourth quarters of 1975 have been lost and they were estimated on the basis of an average of the period 1973-77.

3. RESULTS AND DISCUSSION

In the beginning of the operations the catches were around 580 t. In 1971-73 increasing to an average of 1,260 t in 1974-78. And after they have kept an average of 1,500 t for the last ten years (1981-90). The highest catch occurred in 1990 with 2,600 t (Figure 3). From 1971 to 1979 tunas represented 50% (540 t), by weight, of the total catch of longliners. From 1980 to 1990 they represented only an average of 22% (400 t) with a declining trend. Billfish represented about 30% for the

whole period except 1980 that they represented 51% (1,060 t), where only the swordfish comprised 46% (Arfelli & Amorim, 1985) (Figure 4A and 4B). From 1971 to 1976 sharks represented 13.5% (118 t) of the catch of these longliners. After 1977 the percentage of sharks increased, reaching 50% (1,400 t) of the catch for these boats in 1990 (Figure 5).

Yield, fishing effort and CPUE

In the whole period the fishing effort presented an increasing tread ranging from 400 thousands hooks (1972) to 2,300 thousands hooks (1990) and the CPUE for all the species presented a slight decreasing trend (Figure 6).

Sailfish

Sailfish was caught only from October (occasionally in September) to March (fishing season), but has great importance from November to February (Arfelli & Amorim, 1981)- The yield showed an increasing trend for the whole period- The catch ranged from 31.2 t (1973) to 187.1 t (1986) (Figure 7, Table 2) (Amorim; Arfelli; Galhardo-Amado, 1985). Sailfish analyses are in SCRS/92/52.

White Marlin

White marlin was caught all year round by these longliners. Analyzing the annual catch of this species, for the whole period, it was observed an increasing trend ranging from 13.8 t (1971) to 88.7 t (1988) (Figure 7, Table 2). The quarterly catches were always higher in the fourth quarter (Amorim; Arfelli; Galgardo-Anado, 1985 and Arfelli; Amorim; Galgardo-Anado, 1986). White marlin analyses are in SCRS/92/51.

Blue marlin

The blue marlin is caught in low number all year round. The annual catch fluctuated greatly alternating high and low catches, ranging from 2.6 t (1973) to 17.1 t (1981). The yield presented a slight declining trend (Figure 7, Table 2). The quarterly catches were almost always higher in the fourth quarter. Some analyses were made by Amorim; Arfelli; Galgardo-Anado (1985); Amorim & Arfelli (1987) and others are in SCRS/92/53.

Swordfish

The catch of swordfish off the South and Southeast of Brazil was occurred all the year round by Brazilian and leased longliners (Arfelli & Amorim, 1985). This species was a very important product for exportation. Before 1974 this fish had a low price in the market, but after the initial period the swordfish started getting a better price. The highest catches of swordfish occurred from the middle of 1980 to the beginning of 1981. The annual catch ranged from 86.4 t (1972) to 974.6 t (1980) (Amorim & Arfelli, 1984) (Figure 8, Table 2). For the whole period the yield presented an increasing trend. The quarterly catches (by number and weight) were always higher in the third quarter, except in 1973. In this year the highest number of fish occurred in the second quarter, but the highest catch in weight occurred in the third quarter. The highest values of average weight (live round) occurred in the third quarter, except in 1971 and 1979 (fourth quarter) and in 1978 (first quarter). The annual average weight fluctuated from 48.8 to 72.5 kg in the period 1971-81 (Arfelli & Amorim, 1985). This species was also analyzed by Amorim; Arfelli; Galgardo-Anado (1985), Arfelli & Amorim (1988) and MORA et al. (1991).

Dolphin fish

Dolphin fish was also caught by the longliners from Santos mainly from September to February. The annual yield ranged from 7.9 t (1976) to 62.6 t (1986) (Figure 8, Table 3). In the studied period the quarterly catch of dolphin fish was always higher in the fourth quarter (Figure 9A and 9B) except in 1976 and 1983. The annual analysis of yield and CPUE, for the whole period, showed a fluctuation without a definite trend (Figure 10).

Yellowfin

The yellowfin was the most important species caught by longliners until 1979. It was used mainly by the cannery. The yield ranged from 113 t (1987) to 615 t (1979). The yellowfin yield has increased from 1971-1979. After this period a decreasing trend was observed (Figure 11, Table 3). The quarterly catches were always higher in the fourth quarter except 1979, 1981 and 1982 in the third quarter (Figures 12A and 12B). The fishing effort ranged from 8.6 (1985) to 47.5 (1979). The annual CPUE had an increasing trend from 1971 to 1979 and a decrease till the end of the period. For the whole period it presented a decreasing trend (Figure 13)

Bigeye tuna

The bigeye tuna was also important and the most expensive meat species, caught all year round. The annual catch of the bigeye tuna fluctuated greatly, alternating high and low catches, ranging from 25 t (1972) to 232 t (1978) (Figure 11, Table 3)- The quarterly catches in weight were always higher in the second and third quarters (Figure 14A and 14B). The annual analysis shows that CPUE from 1971-1979 had an increasing trend and a remarkable decreasing trend from 1980 to 1990 (Figure 15).

Albacore

The albacore was an important fish meat in the internal market. This is the most appreciable species for the Brazilian people because it has a light meat color. It is the cheapest meat compared with the other tuna. It is caught by longliners all year round. From 1971 to 1973 presented low values of catch increasing in 1974 and keeping the same value till 1982. After that the next period (1985-90) showed a declining trend. The annual yield ranged from 14 t (1972) to 164 t (1980) (Figure 11, Table 3). The quarterly catches were always higher in the third quarter except 1976, 1978, 1984 and 1986 (in the second quarter) (Figures 16A and 16B). The annual CPUE fluctuated from 1971 to 1980 and presented a high decreasing trend for the next period (Figure 17).

Shortfin mako shark

Figure 18 and Table 4 shows that the annual yield of shortfin mako shark ranged from 21 t (1971) to 125 t (1990).

Bigeye thresher shark

The annual yield of thresher shark ranged from 0.7 t (1971) to 66.6 t (1989) with an increasing trend (Figure 18, Table 4). The quarterly catches were almost always higher in the third quarter (Figure 19A and 19B). The annual CPUE for the studied period presented an increasing trend (Figure 20).

Blue shark (Amorim, 1992)

Blue shark yield presented very low values from 1971 to 1974 (annual average 6 t), due to the very low commercial value that the species used to have. From 1975 tuna boats increased the utilization of blue shark, initially putting on board the specimens caught during the last 10 days, and after bringing all the specimens caught. For this reason the yield started increasing year by year seaching 740 t in 1990. From 1983 to 1990 it was the mostly caught species by tuna boats settled in Santos (Figure 18). The highest catches were in the third quarter from 1971 to 1979 and in the second from 1980 to 1990 (Figures 21A and 21B). The highest and lowest monthly CPUE were 10.8 (1987) and 0.1 (1972) respectively, yield, effort and CPVE presented the same increasing trend from 1971 to 1984, reaching 2,205,000 hooks; even with a decline of yield after this period, and the CPUE continued increasing until 1987, because the effort has suffered a drastic reduction in the period 1985/87 (1,430,000 hooks). So even with a reduction in the yield from 1984 to 1987, it was observed a CPVE with an increasing trend (Amorim, 1992). In 1990 the effort started increasing again and the catch and the CPUE followed this trend (Figure 22).

Comparing the annual CPVE, for the whole period, it was observed a straight line with an increasing trend, following the effort increasing trend (Figure 23A). The general trend assumed by the points might have been influenced by the fact that the fisheries stock of blue shark was still in the beginning of its

have been influenced by the fact that the fisheries stock of blue shark was still in the beginning of its exploitation in 1971-82, when the data started to be collected and the fisheries was 9 still incipient. Analyzing again the graphic of two sequences 1971-82 and 1983-90 separately a different trend of the points was observed. From 1971 to 1982, the trend of the points increased and from 1983-90, the trend declined, as expected (Figure 23B).

4. CONCLUSION

It has been a gradual increase in the fishing effort due to the expansion of the number of boats. In the beginning of the fisheries, tunas represented more than 50% of the yield of tuna boats settled in Santos. When the tuna yield declined the longliners started bringing sharks, and the percentage reached 53% (1990). Some species presented CPUE with an increasing trend and others a decrease, although in a general way the CPUE of the longliner fisheries presented a slight decreasing trend.

5. ACKNOWLEDGEMENTS

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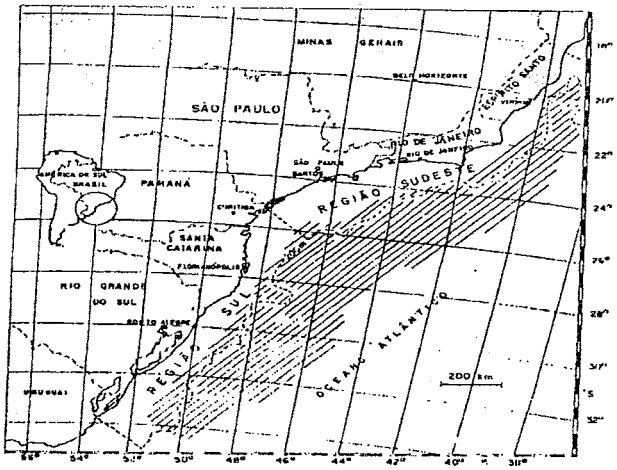


Fig. 1. Tuna and tuna-like fish fishing area of longliners settled in Santos City - Sao Paulo State.

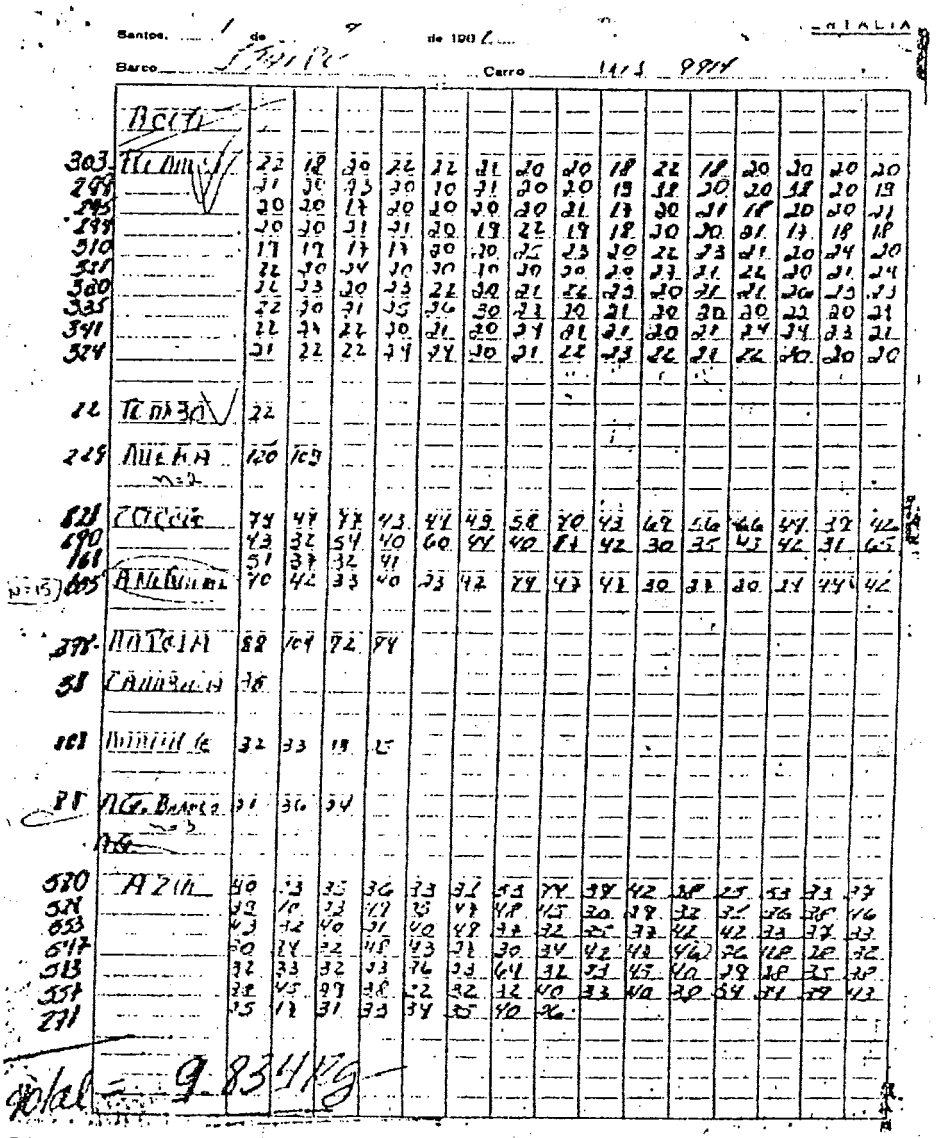


Fig. 2. Itaipu I long commercial sheet of Irmaos Ono Comapny. It is represented in reduced size, with the individual dressed weight, by species or group of species.

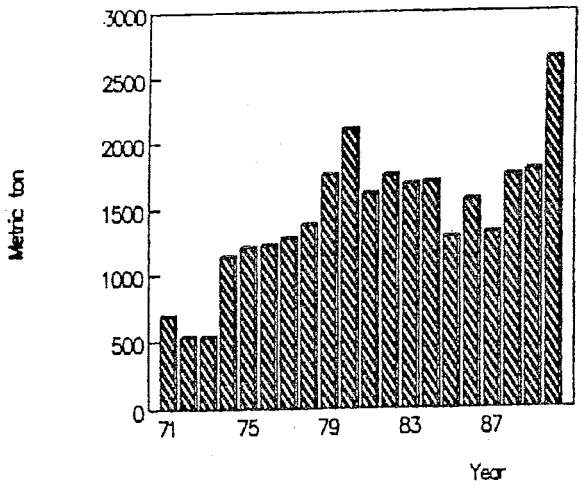
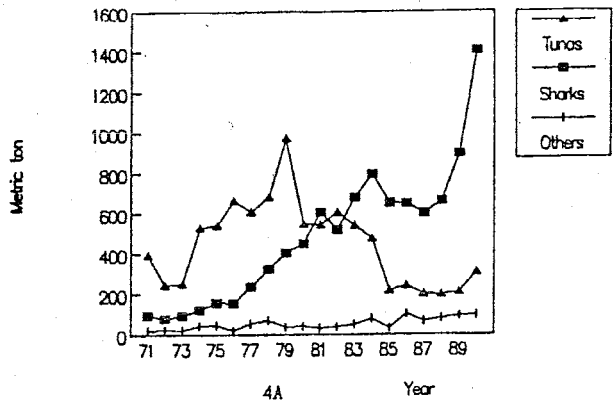


Figure3. Total yield of longliners from Santos-SP.



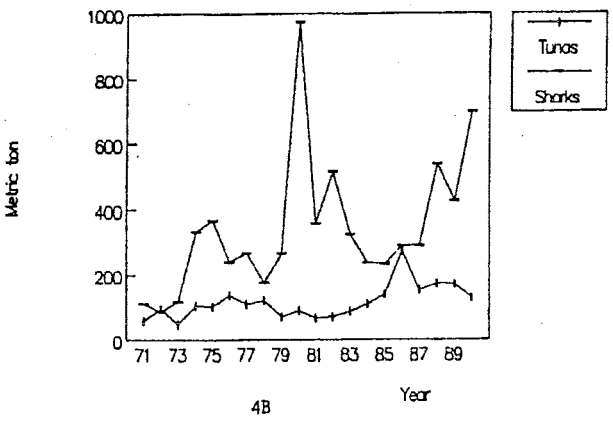


Figure4. Yield of tuna, shark and others (4A) and swordfish and billfish (4B) by longliners from Santos-SP(1971-90).

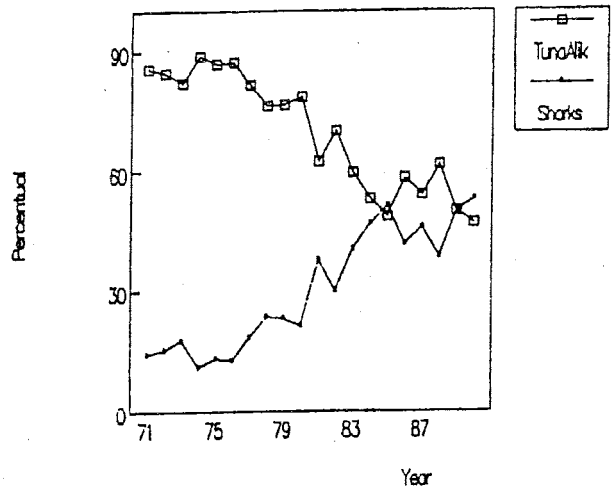


Figure5. Percentual of sharks and others (tuna and alike) caught by longliners from Santos-SP(1971-90).

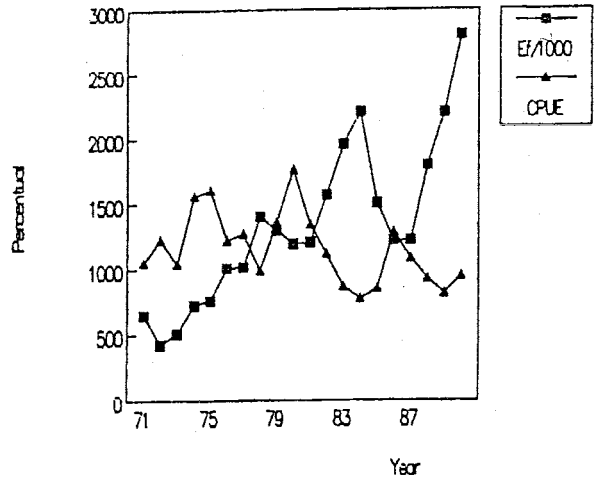


Figure6. Total fishing effort and CPUE (tuna and alike) related to longliners form Santos-SP(1971-90).

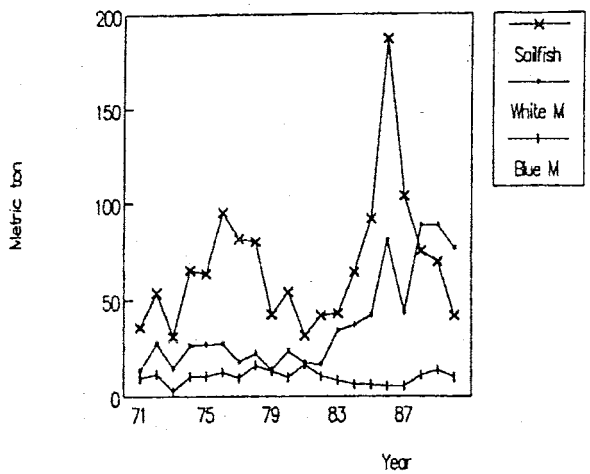


Figure7. Yield of white marlin, sailfish and blue marlin by longliners in Santos - SP (1971-90).

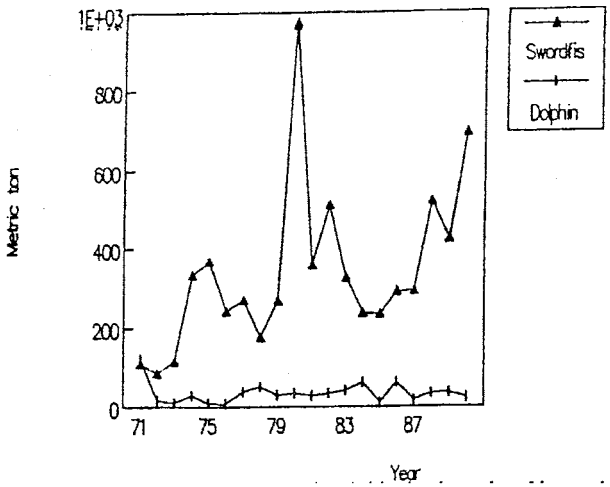


Figure8. Field of Swordfish and dolphin by tuna longliners in Santos-SP (1971-90).

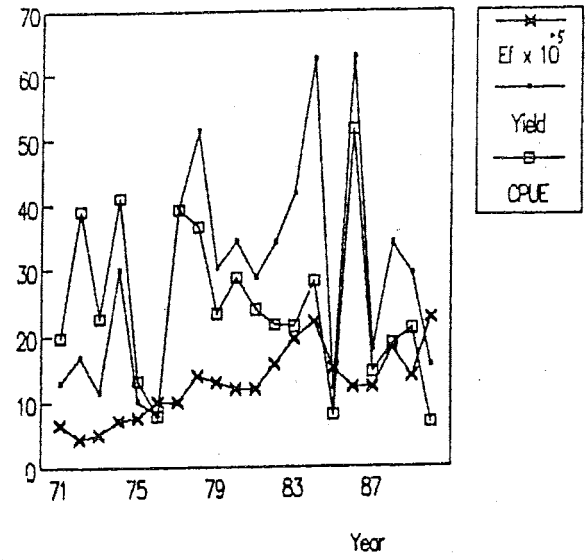
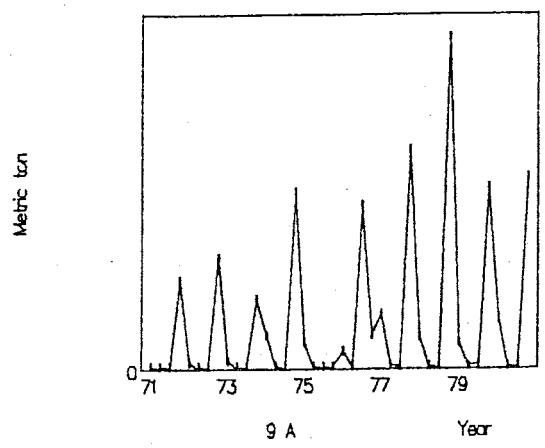


Figure10. Yield, fishing effort and CPUE of dolphin caught by longliners in Santos-SP(1971-90).



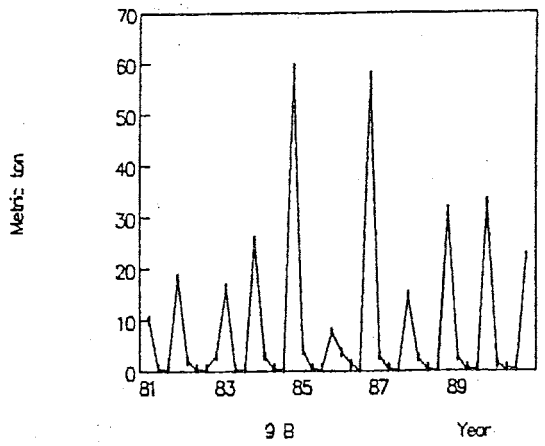


Figure9. Quaterly dolphin yield by longliners of Santos-SP, 1971-80(9A) and 1981-90(9B).

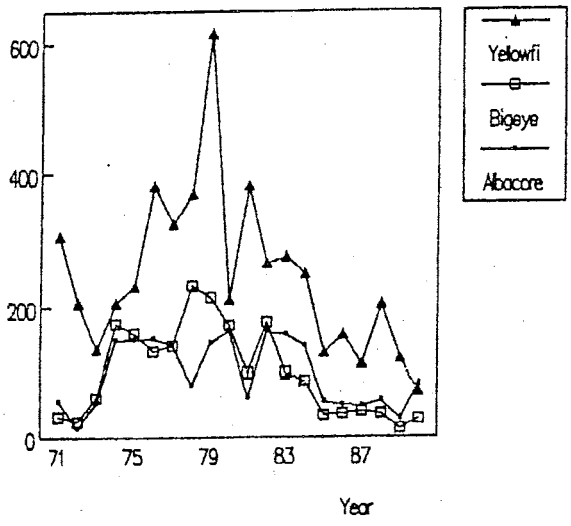
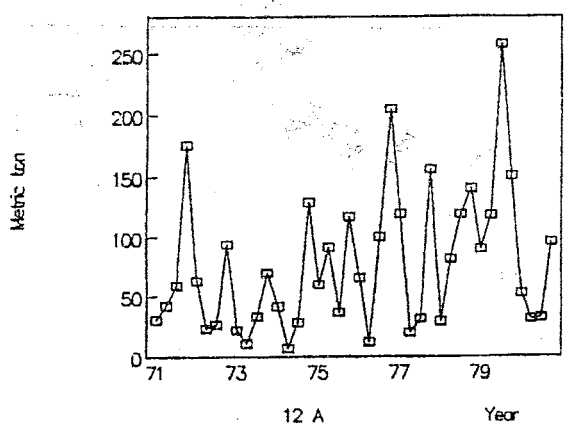


Figure11. Catch of yellowfin and bigeye tunas and albacore by longliners in Santos-SP(1971-90)



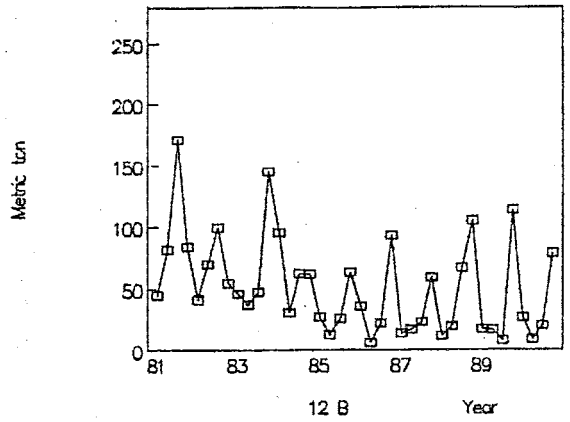


Figure12. Quaterly yellowfin yield by longliners of Santos-SP, 1971-80(12A) and 1981-90(12B).

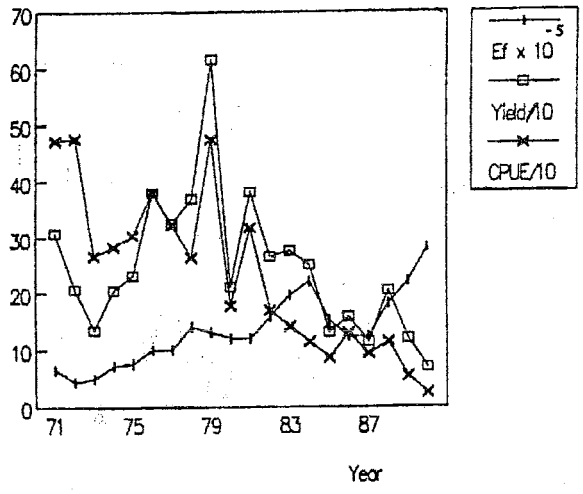
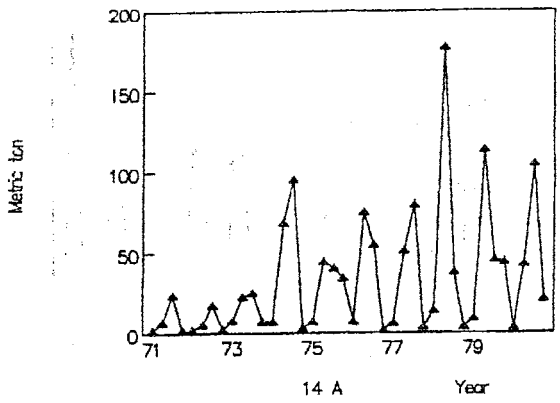


Figure13. Yield, fishing effort and CPUE of yellowfin caught by longliners of Santos-SP(1971-90).



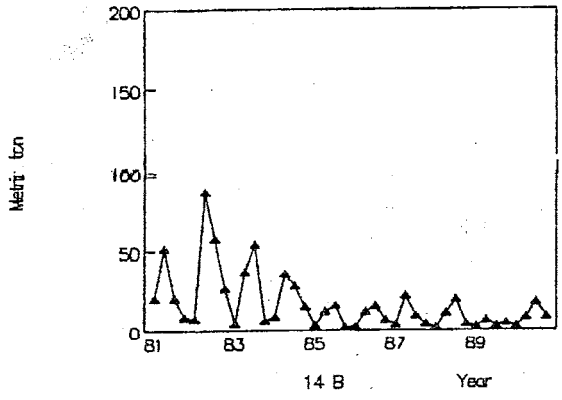


Figure14. Quaterly bigeye yield by longliners of Santos-SP, 1971-80(14A) and 1980-90(14B).

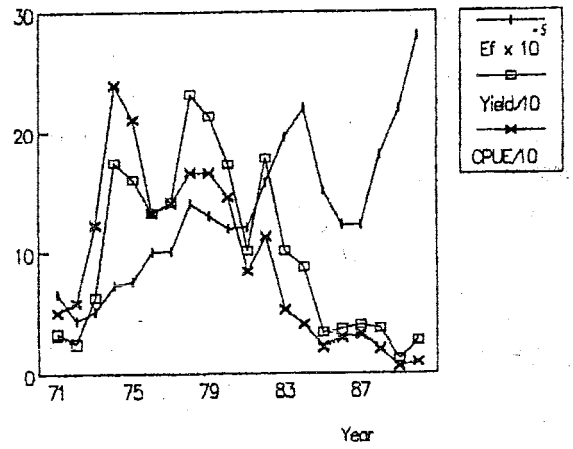
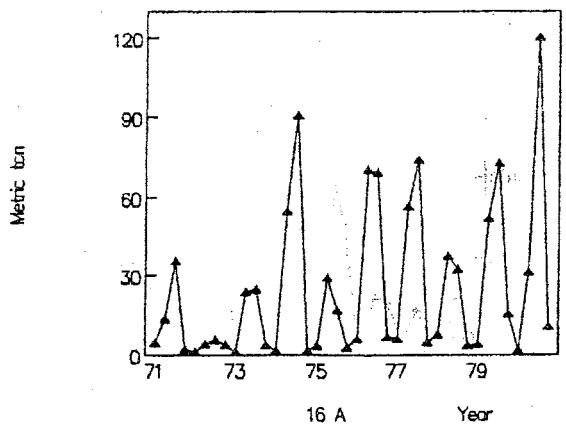


Figure15. Yield, fishing effort and CPUE of bigeye caught by longliners of Santos-SP(1971-90).



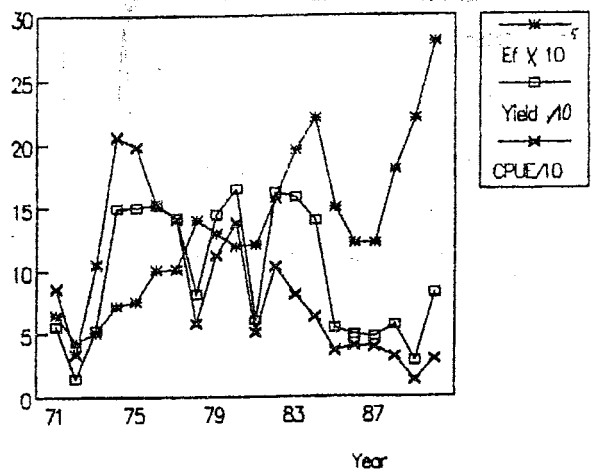
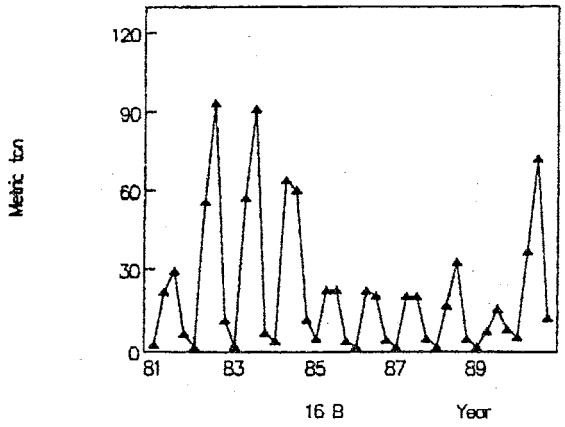


Figure17. Yield, fishing effort and CPUE of albacore caught by longliners of Santos - SP (1971-90).



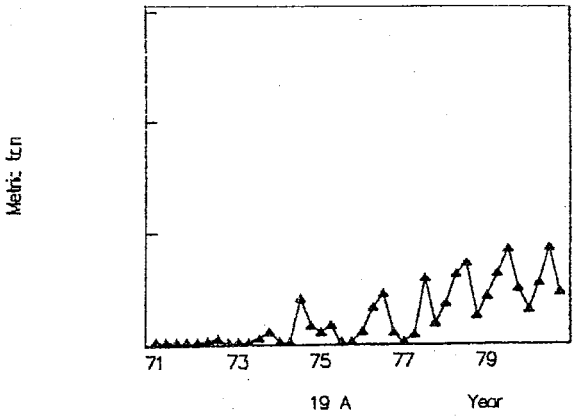


Figure 16. Quarterly albacore yield by longliners of Santos-SP, 1971-80 (16A) and 1981-90 (16B).

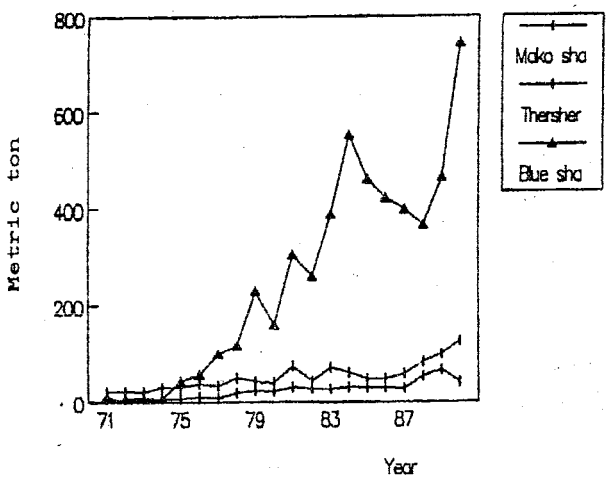


Figure18. Catch of shortfin mako and bigeye thresher and blue sharks by longliners of Santos-SP(1971-90).

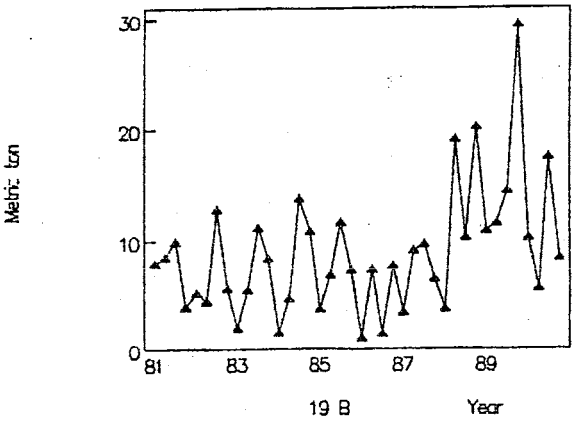


Figure19. Quaterly bigeye threshers sharks catch by longliners of Santos-SP,1971-80(19A) and 1981-90(19B).

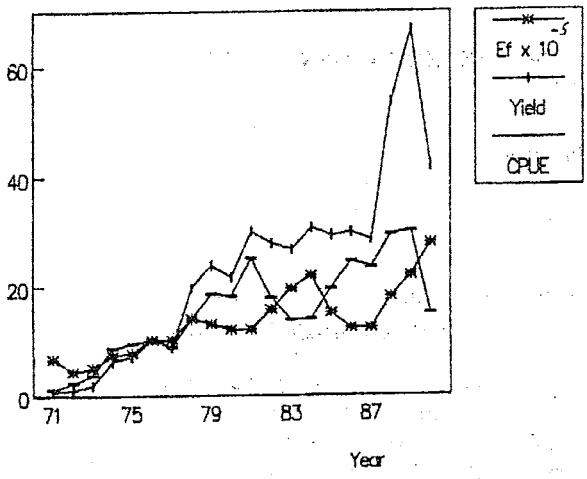


Figure20. Yield, fishing effort and CPUE of bigeye tresher shark caught by longliners of Santos-SP(1971-90).

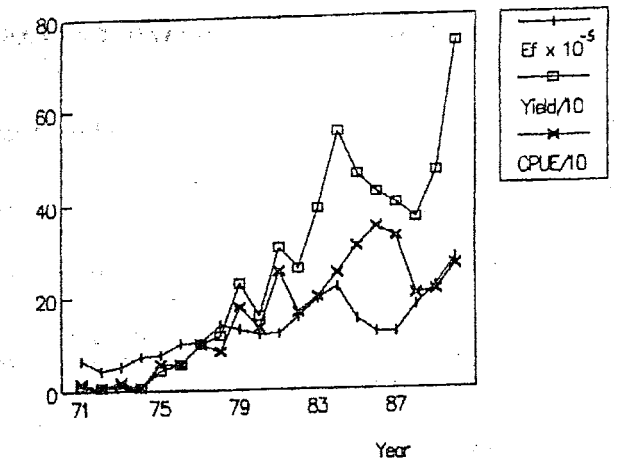
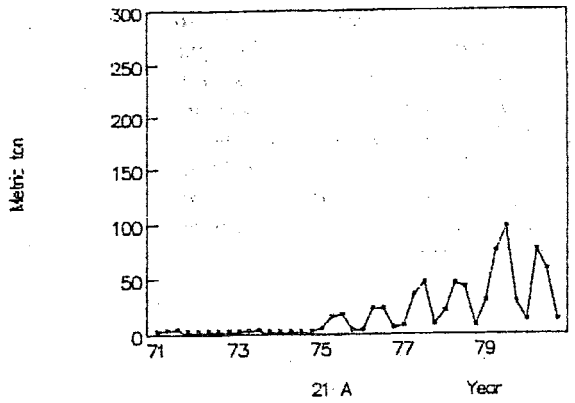


Figure22,Yield, fishing effort and CPUE of blue shark caught by longliners of Santos - SP (1971-90).



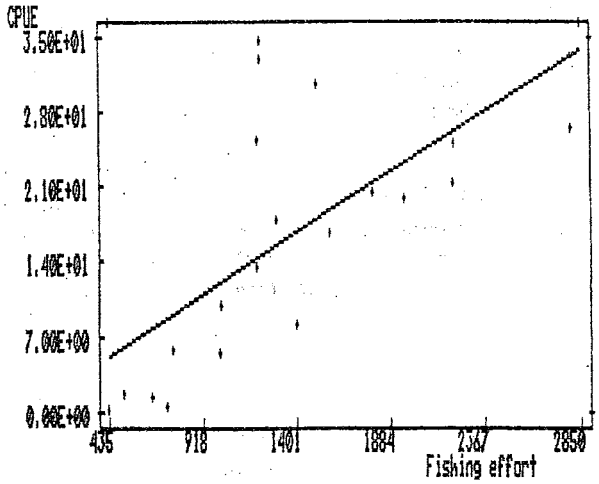
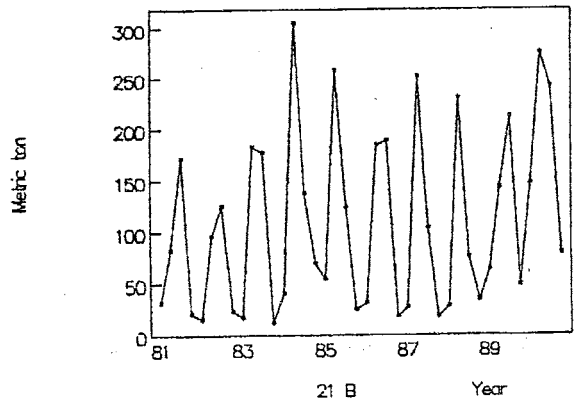


Figure23A. Fishing effort/CPUE relationship of blue shark caught by by longliners of Santos-SP(1971-90).



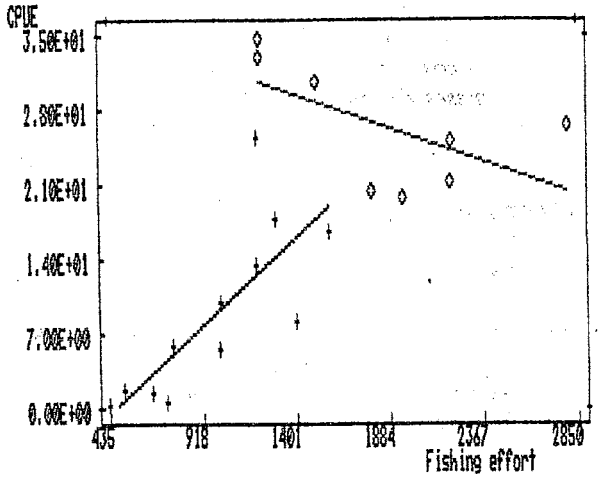


Figure21. Quarterly blueshark catch by longliners of Santos-SP,1971-80 (21A) and 1981-90(21B).

Figure23B. Fishing effort/CPUE relationship of blue shark caught b by longliners of Santos-SP(1971-90).Initialperiod 1971-1 (+) and posterior period (1983-90)(O).