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PRELIMINARY BIOMETRIC STUDIES ON *THUNNUS ALBACARES* FROM SOUTHWESTERN EQUATORIAL ATLANTIC

Lessa, R., M. N. Amorim, F. Hazin, M. R. Coimbra, R. C. Souza
Departamento de Pesca, Universidade Federal Rural de Pernambuco,
Av. Dom Manuel Medeiros s/n, Dois Irmaos, 52071, Recife, Brasil

SUMMARY

A morphometric study of *Thunnus albacares* was conducted using specimens caught in the area frequented by Brazilian vessels located between 2-4°S and 32-34*o*W. Relationships were established for both sexes and then for each sex separately. From a total of 15 relationships, two showed no significant differences between sexes. Data present in literature allowed comparison of morphometric characteristics with samples caught off Angola. Significant differences were found for seven relationships.

RESUME

Une étude morphométrique de *Thunnus albacares* a été menée à bien en utilisant des individus capturés dans la zone fréquentée par les bateaux brésiliens situés entre 2 et 4°S et 32 et 34°W.

La relation a été établie entre les deux sexes et ensuite par sexe séparément.

Sur un total de 15 relations, deux d'entre elles n'indiquaient aucune différence entre les sexes. Les données présentées dans les ouvrages cités ont permis d'établir une comparaison des caractéristiques morphométriques avec les échantillons capturés au large de l'Angola.

On a observé d'importantes différences dans sept relations.

RESUMEN

Se llevó a cabo un estudio morfométrico sobre el *Thunnus albacares* utilizando especímenes capturados en el área frecuentada por barcos de Brasil entre 2 y 4°S y 32 y 34°W.

Se establecieron relaciones para ambos sexos y para cada sexo por separado.

De un total de 15 relaciones, 2 no mostraron diferencias significativas entre sexos. Los datos contenidos en la literatura permitieron la comparación de las características morfométricas con muestras obtenidas en el litoral frente a Angola.

Se hallaron diferencias significativas en 7 relaciones.

INTRODUCTION

The hypotesis of two discrete populations of *Thunnus albacares* in The Equatorial Atlantic continues to be espoused by ICCAT . These two population would be separated at 30° W (Cayré et alii, 1991).

Morphometric data has been used to provide evidences for differences between stocks of *Thunnus albacares* caught in several different areas as demontrated by Schaefer & Walford (1950). Schaefer (1956) showed that morphometric evidences pointed out distinct stocks of tuna in Pacific Ocean. After him, there would be three different stocks.

Based on data from commercial fisheries morphometric relations were established for *Thunnus albacares* caught in the area between 2 and 4° S / 32 and 34° W.

These morphometric relations may contribute to characterize the part of the population caught by longliners in the study area.

In the same way, our results were compared with those presented in literature concerning the Southeastern Equatorial Atlantic in order to allow comparisons between samples of these two areas.

MATERIAL AND METHODS

The sample used for morphometric studies was composed by 76 specimens collected by longliners from 28 October to 14 December 1991. Other 234 specimens sampled from May 1991 to March 1992 were used to establish a length-weight relationship.

On board all the catch was preserved in ice. The sex identification was processed and gonads were taken off. Gills and stomachs were also removed.

Specimens were chosen at random during landings. Measures were taken according to Collette & Nauen (1983), Ishii (1965), Marr (1949) and Schaefer (1948). All morphometric measures used are shown in table 1. As meristic data, only the number of dorsal and anal finlets were recorded.

Concerning morphometric measurements, the fork length has been recommended for studies aiming at the establishment of morphometric relationships (Anonimous, 1933). Frade (1920, 1931) and Heldt (1931) used this criterium to compare tuna respectively from Mediterranean and Atlantic; Godsil & Byers (1944) did the the same for Pacific tuna.

Differences in proportions between males and females were compared. As fish grows, differences in the growth of several parts of the body appear (Schaefer & Walford, 1950).

That is why the comparision should take into account specimens of the same length classes.

Yang et alli. (1969), refers to a progressive difference in morphological characters in the direction North-South appears to exist among yellowfin samples from Equatorial waters. The same authors, consider that the morphological differences among samples lined to an east-west direction are not as remarkable as that among samples lined in North- south direction.

Schaefer & Walford consider that body proportions are not, in general, satisfactory for comparing tunas of different sizes because the differential growth of different body parts causes the value of a proportion to change as fish grows.

The growth of the different parts of *Thunnus albacares*'s body can be considered to follow linear or curvilinear models like many other animals. These models are simple and allow easy comparison. They have been used by Godsil (1948), Schaefer (1948) and Schaefer and Walford (1950).

For statistical treatment we followed Steel & Torrie (1980). For all statistical analises the 5% level of significance was used.

RESULTS

a) Biometrics Characteristics of *Thunnus albacares* of the study area.

From 76 caught specimens, only 35 had their sexes recorded. From these 17 were males and 18 females.

Despite the small number of data, length frequencies are shown in fig. 1. Both sexes had unimodal distributions and the specimens belong to few length classes. The Fork length of males varied between 90 and 168 cm (76,5% of them measured between 90 and 130 cm). In the same way, the fork length of females ranged from 96,5 and 166 cm (77,8% of them belonged to length classes ranging from 110 to 150 cm).

Through the table 2 we can compare several different measures presented as a percentage of the fork length. Measures were taken separately for each sex. We can consider that there is a great similarity comparing both sexes. There is only one significant difference which refers to the length of second dorsal basis.

The length-weight relationship was established separately for each sex , using as sample the same 17 males and 18 females. The transformed regressions were compared using F tests as shown in fig. 2. No significant difference between sexes was observed. That is why we established a length weight relationship for 234 specimens considering both sexes together (Fig. 3).

In order to characterize the caught population in the study area and supply elements by allowing conversions to the fork length, several regressions were established as shown in table 3 . These regressions were established for the whole sample and when it was possible, for each sex separately (table 4).

b) Comparision with Southeastern *Thunnus albacares*.

Schaefer and Walford (1950) presented a biometric study on *Thunnus albacares* collected off Angola. In order to compare our data with theirs we established the regressions shown in table 5 and figs. 4 to 13.

Significant differences were found for 7 out 10 regressions as demonstrated by the meanings of the F test.

Figs. 5, 6, 7 and 8 demonstrate that the yellowfin from Angola has head length, pectoral fin, anal fin, and the distance from the snout to pelvic fin bigger than fish caugth from Brazil.

Figs. 9, 10 and 11 demonstrate relations in wich smaller differences were noticed. These differences are still significant. They refer to the distance from the snout to anal fin, length of the second dorsal fin and distance from the snout to the second dorsal fin respectively.

The pattern presented in figs. 7, 9 and 10 for length classes from 100 to 125 cm indicates that there is a real change in the relative growth (Schaefer e Walford, 1950).

The regressions between the distance from the snout to the first dorsal fin and first dorsal fin length do not demonstrate any significant difference when using F test.

The number of dorsal and anal finlets is shown in figs. 13 and 14. There is no conclusion that can be drawn from the analises.

CONCLUSIONS

The present study characterizes the population caught by longliners in the study area during the sampled period.

These informations can be useful cause they allow easy conversion to the fork length.

Unfortunately, due to the small number of sexed specimens comparison between sexes were not reliable.

The area study is supposed by Mahon & Mahon (1987) to receive, specimens from the Northern hemisphere population, depending on the period. In order to prove this hypotesis data should be taken all year round, and detailed analises are required.

In a recent ICCAT meeting held in Miami (1991), the hypotesis of a two stocks separated at 30o W. was discussed. The general opinion was in the sense that tagging studies do not support this hypotesis or allow any definitive conclusion.

If the area receives representants of two different stocks, as suposed by Mahon & Mahon (1987), it would be possible that these differences are reflected in morphometric characteristics.

Results presented in this paper indicate that clear differences were noticed between specimens caught off Brazil and off Africa. These results indicate that more detailed studies are needed including genetic ones which can show similarities or differences in mitochondrial DNA (mtDNA) in order to distinguish accurately different populations.

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0	Fork length	10	First dorsal fin length
1	Snout to pectoral fin	11	Basis of the first dorsal fin
2	Head length	12	Second dorsal fin length
3	Snout to anal fin	13	Basis of the second dorsal fin
4	Snout to pelvic fin	14	Greatest Depth
5	Snout to 1st dorsal fin	15	Iris diameter
6	Snout to 2nd dorsal fin	16	Length maxillary
7	Pectoral fin length		
8	Pelvic fin length		
9	Basis of anal fin		

TABLE 01 - Morphometric measures used in the present study

	Female	Male	Total	Real
Snout to pectoral fin	25.5	25.9	-0.40	1.7
Snout to anal fin	56.1	56.4	-0.3	0.6
Head length	24.9	25	-0.1	0.5
Snout to pelvic fin	27.8	27.3	0.3	1.3
Snout to 1st dorsal fin	27.7	28.2	-0.6	2.3
Snout to 2nd dorsal fin	50.7	50.3	0.3	0.5
Pectoral fin length	25.3	25.4	-0.1	0.5
Pelvic fin length	9.9	9.9	0	0.6
Basis of anal fin	7.1	7.2	0	0.4
First dorsal fin length	11.3	11.4	-0.1	1.2
Basis of the first dorsal fin	21.9	21.6	0.3	1.5
Second dorsal fin length	20.8	20.0	0.7	3.4
Basis of the second dorsal fin	10.2	11.7	-1.5	15.2
Greatest depth	24.4	24.2	0.2	0.9
Iris diameter	1.9	1.8	0.07	4.11
Length maxillary	8.9	9.3	-0.3	4.0

TABLE 02 - Average propotional dimension in percentage of fork length total = difference ; real = relative difference in % (smallester value).

Distance from Snout to Pectoral Fin	a - 5.3310	b - 0.2140	r^2 - 0.89
Head Length	a - 3.8512	b - 0.2170	r^2 - 0.85
Distance from the Snout to anal Fin	a - 7.2854	b - 0.5021	r^2 - 0.94
Distance from the Snout to Pelvic Fin	a - 3.5112	b - 0.2471	r^2 - 0.85
Distance from Snout to 1st. dorsal Fin	a - 4.3110	b - 0.2441	r^2 - 0.81
Distance from Snout to 2nd Dorsal Fin	a - 4.8409	b - 0.4664	r^2 - 0.94
Pectoral Fin Length	a - 8.9130	b - 0.1854	r^2 - 0.73
Anal Fin Length	a - -26.3663	b - 0.4452	r^2 - 0.80
Basis of Anal Fin Length	a - -0.5812	b - 0.0756	r^2 - 0.53
First Dorsal Fin Length	a - 0.2224	b - 0.1112	r^2 - 0.86
Basis of First Dorsal Fin Length	a - 3.7383	b - 0.1832	r^2 - 0.84
Second Dorsal Fin Length	a - -24.7362	b - 0.4076	r^2 - 0.74
Basis of Second Dorsal Fin Length	a - 1.4023	b - 0.0699	r^2 - 0.47
Greatest depth	a - -4.3495	b - 0.2756	r^2 - 0.86
Greatest Dorsal Fin	a - -0.6090	b - 0.0357	r^2 - 0.72
Iris diameter	a - 1.3400	b - 0.0077	r^2 - 0.23
Length maxillary	a - 1.8439	b - 0.0780	r^2 - 0.66
Weight n = 234	$Wt = 1.2933 \times 10^{-5} \times FL^{3.048}$		r^2 - 0.950

TABLE 03 - REGRESSIONS ESTABLISHED BETWEEN FORK LENGHT AND SEVERAL MORPHOMETRIC MEASURES.

RELATION	TEST STUDENT FOR MALE AND FEMALE
Snout to pectoral fin	1.3106 NS
Head length	0.8107 NS
Snout to anal fin	0.4216 NS
Snout to pelvic fin	2.4739 **
Snout to 1st dorsal fin	0.4467 NS
Snout to 2nd dorsal fin	0.9405 NS
Pectoral fin length	0.3533 NS
Basis of anal fin	2.9090 **
First dorsal fin length	0.5021 NS
Basis of the first dorsal fin	0.3854 NS
Second dorsal fin lenght	1.2660 NS
Basis of the second dorsal fin	0.3834 NS
Greatest depth........................	0.4498 NS
Iris diameter.........................	0.5486 NS
Length maxilary.......................	0.7763 NS

TABLE 04 - Comparasions between regressions established for males and females caught off Brazil.
NS - No significant ** - Significant

RELATION		F de Snedecor
Fork Length / Head Length	(fig 04)....	33.31**
Fork Length / Pectoral fin length.....	(fig 05)....	28.93**
Fork Length / Pelvic fin length.......	(fig 06)....	22.44**
Fork Length / Snout to pelvic fin.....	(fig 07)....	15.86**
Fork Length / Snout to anal fin.......	(fig 08)....	6.26**
Fork Length / Second dorsal fin length	(fig 09)....	5.05**
Fork Length / Snout to 2nd dorsal fin	(fig 10)....	4.7 **
Fork Length / Snout to 1st dorsal fin	(fig 11)....	1.97NS
Fork Length / First dorsal fin length	(fig 12)....	1.63NS
Fork Length / Weight..................	(fig 13)....	3.32NS

TABLE 05 - Comparasion between regressions established for sample caught of Brazil and of Angola.
NS - No significant differences** - Significant differences.

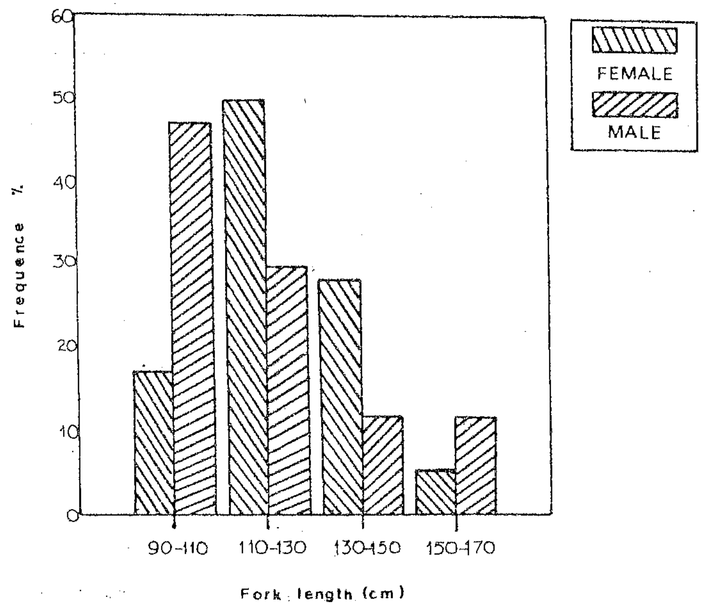


FIGURE 01 - Frequence distribution of fork length of males (full bar) and females (hachured bar).

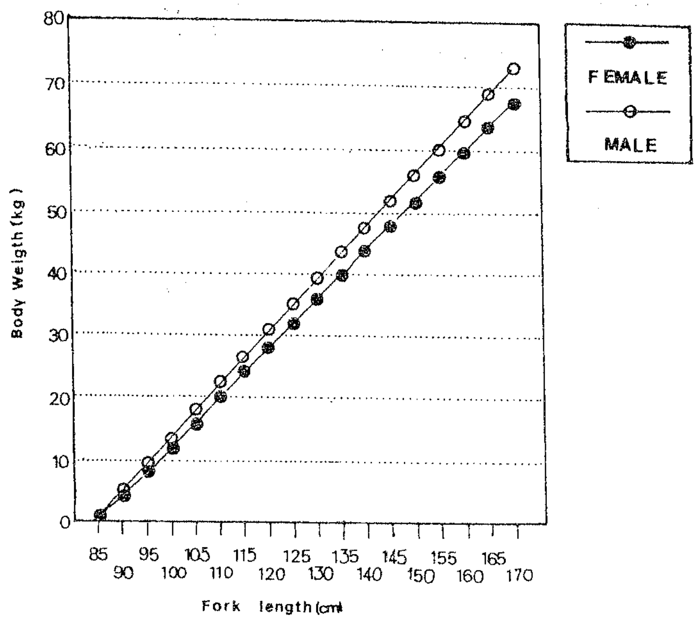


FIGURE 02 - Relationship between fork length and body weight of males (empty square) and females (full square) both from Brazilian Coast.

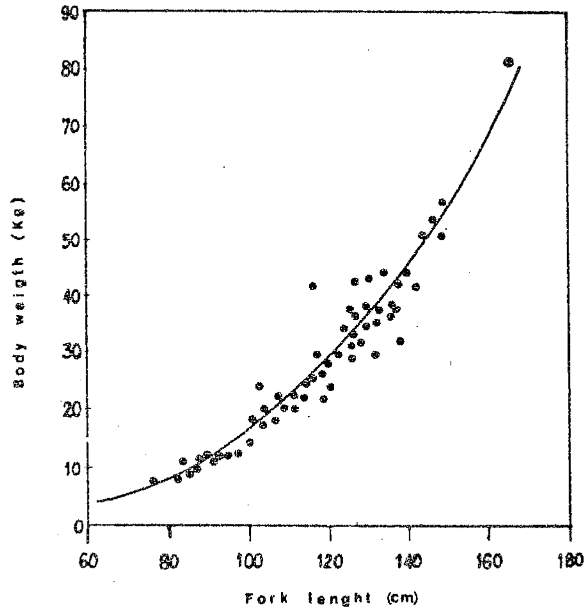


FIGURE 03 - Relationship between body weigth and fork length (*Thunnus albacares*).

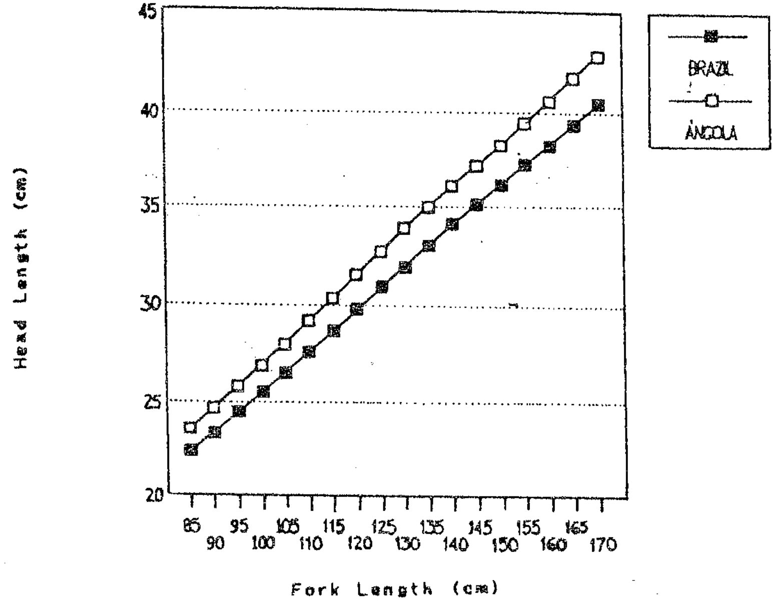


FIGURE 04 - Relationship between the head lenght and fork lenght of yellowfin from Brazilian Coast (full square) and Angola Coast (empty square).

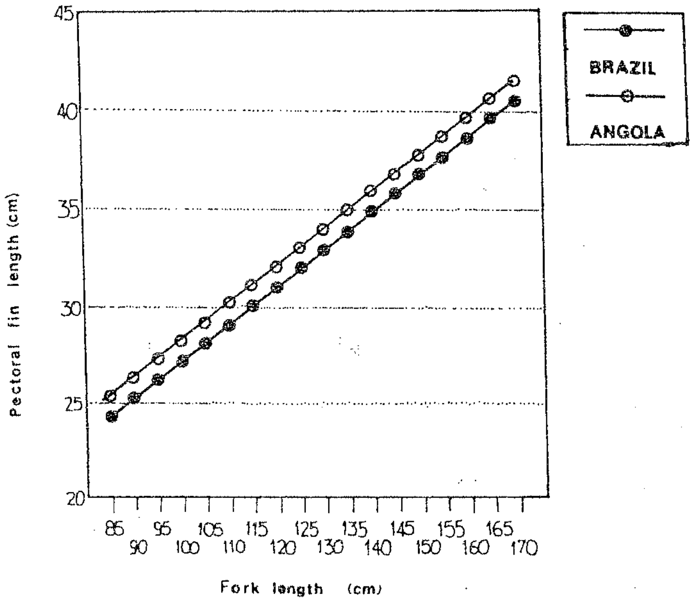


FIGURE 05 - Relationship between pectoral fin length and fork length of yellowfin from coast of Brazil (full square) and of Angola (empty square).

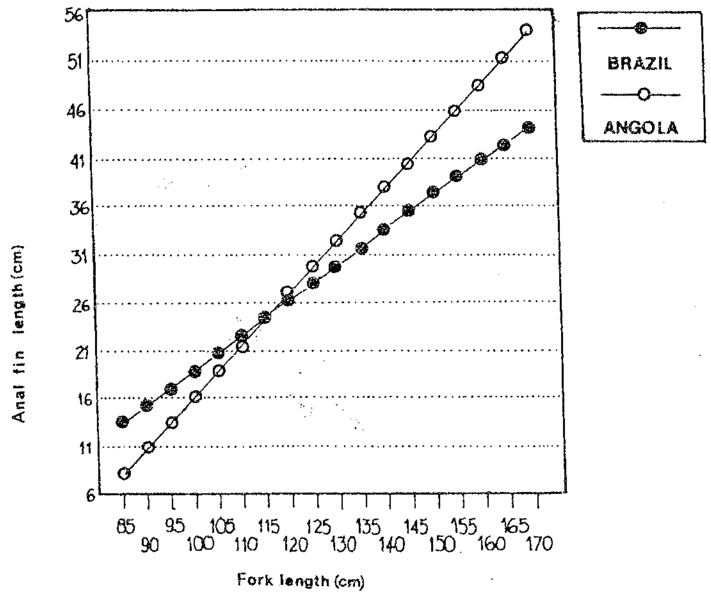


FIGURE 06 - Relationship between anal fin length and fork length of yellowfin from Brazilian Coast (full square) and Angola Coast (empty square).

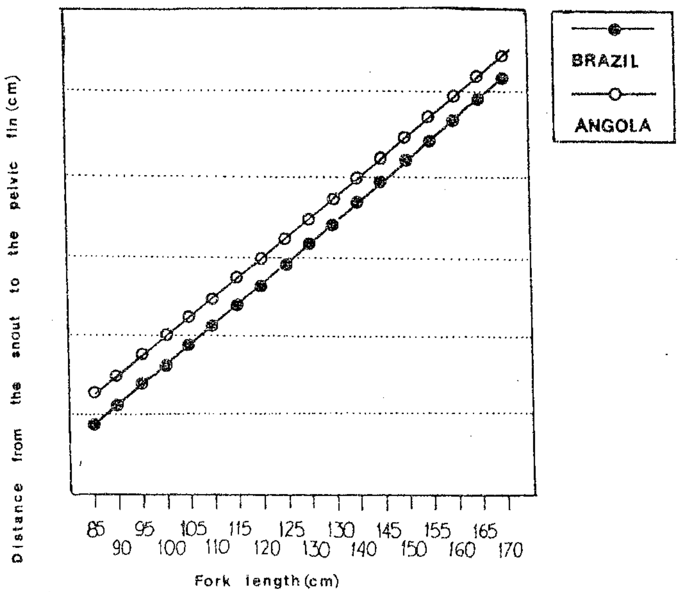


FIGURE 07 - Relationship between the distance from the snout to the pelvic fin and the fork length of yellow-fin from Brazilian Coast (full square) and Angola Coast (empty square).

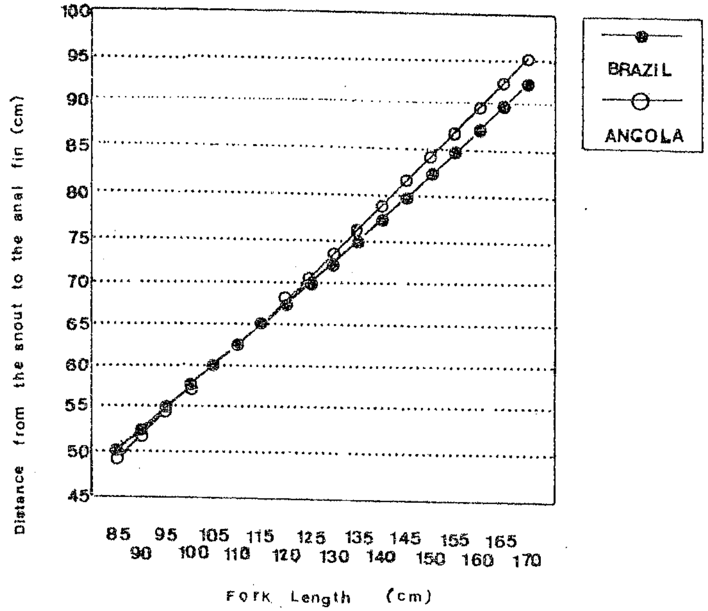


FIGURE 08 - Relationship between the distance from the snout to the fork length of yellowfin from Brazilian Coast (full square) and Angola Coast (empty square).

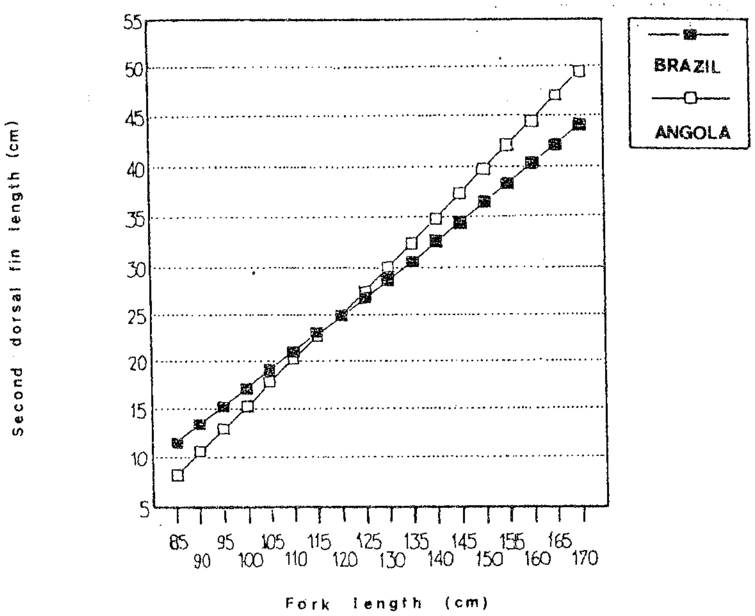
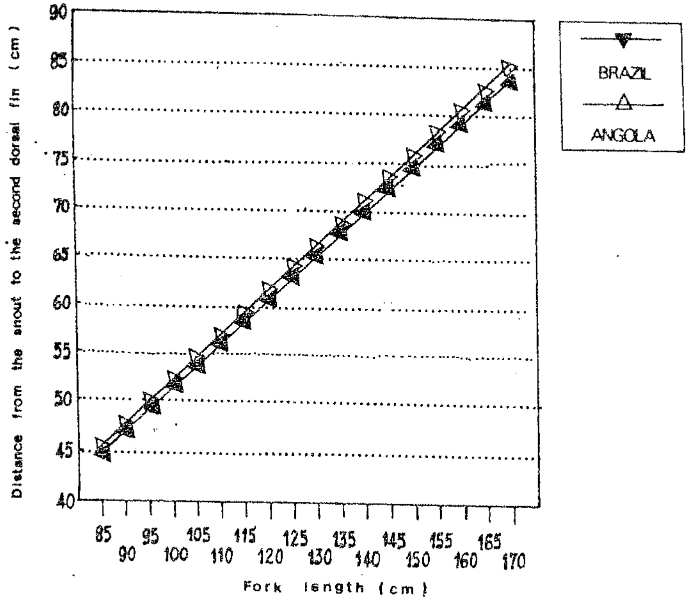


FIGURE 09 - Relationship between the second dorsal fin and the fork length of yellowfin from Brazilian Coast (full square) and Angola Coast (empty square).



10 - Relationship between the distance from the snout to the second dorsal fin and the fork length of yellowfin from Brazilian Coast (full square) and Angola Coast (empty square).

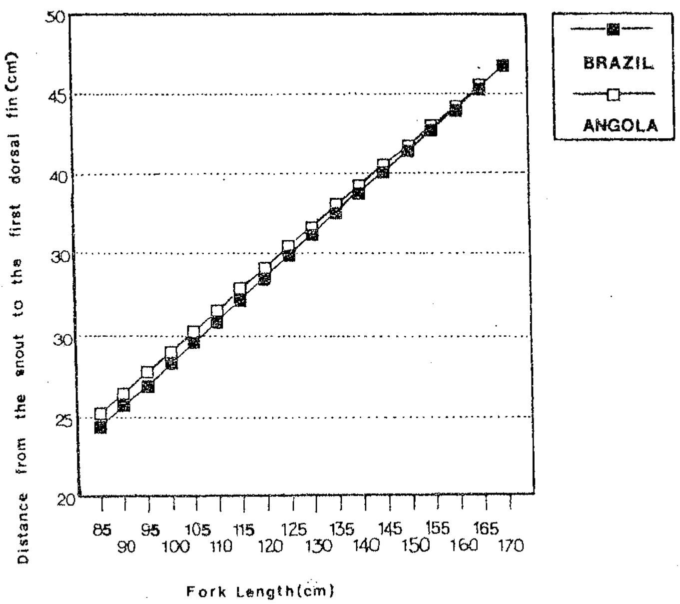


FIGURE 11 - Relationship between the distance from the snout to the first dorsal fin and the fork length of yellowfin from Brazilian Coast (full square) and Angola Coast (empty square).

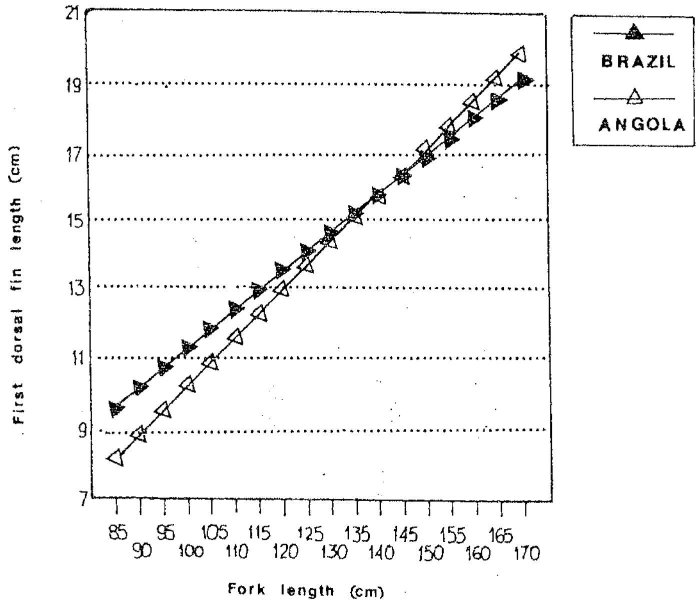


FIGURE 12 - Relationship between the first dorsal fin length and the fork length of yellowfin from Brazilian Coast (full square) and Angola Coast (empty square).

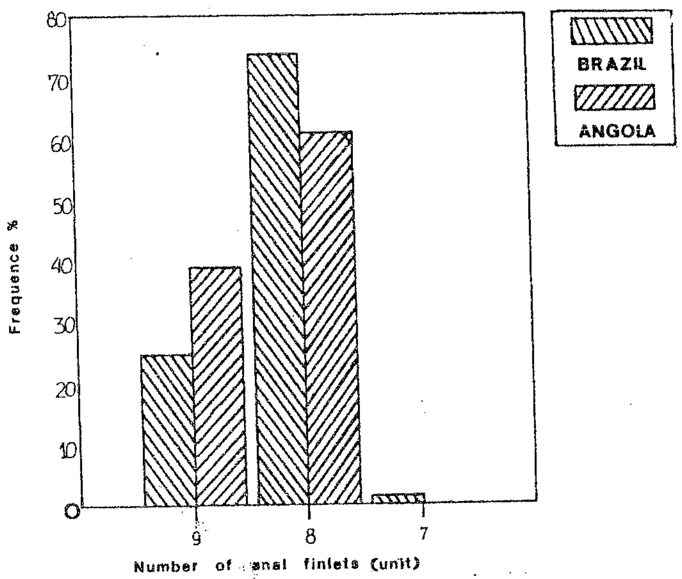


FIGURE 13 - Anal finlets frequence of yellowfin from Brazil and Angola.

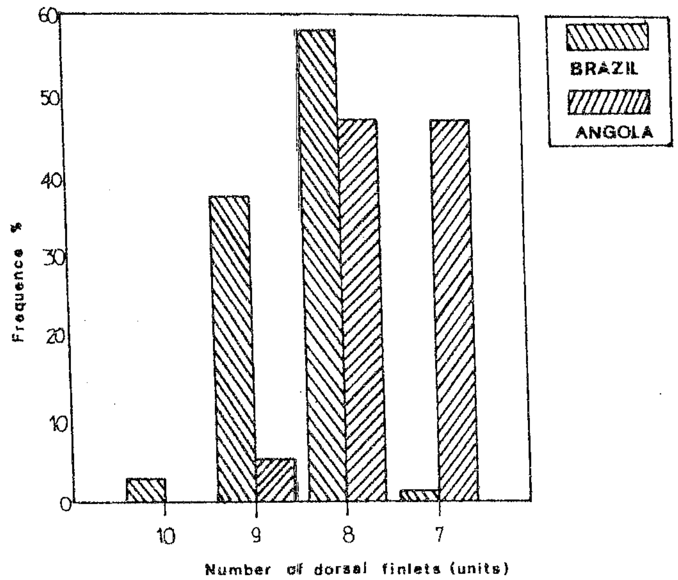


FIGURE 14 - Dorsal finlets frequency of yellowfin from Brazil and Angola.