

MORPHOMETRIC RELATIONSHIPS TO SAILFISH, *Istiophorus albicans*, CAUGHT OFF NORTHEASTERN BRAZIL

[Relações morfométricas para o agulhão-vela, *Istiophorus albicans*, no Nordeste do Brasil]

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ABSTRACT

Sailfish, *Istiophorus albicans*, is the most exploited species among billfishes of the Family Istiophoridae in Northeastern of Brazil. The objective of this paper is to determine main morphometric relationships between length measurements and between weight and length for *Istiophorus albicans* captured off this region. Samples were collected from August/1996 to March/1997 in fishing companies, research vessels, artisanal landings, commercial vessels and game fishing. Specimens have been caught by surface longline and gillnet, handline, and trolling. Total length - TL (cm), lower jaw-fork length - LJFL (cm), eye-keel length - EKL (cm), eye-fork length - EFL and dressed weight - Wd (kg) were determined for 126 specimens, ranging from 107 to 288 cm (TL) and from 12.9 to 28.8 kg (Wd). Relationships between these length measurements and between length and weight were significant. Comparison with relationships obtained for specimens off Brazilian South-Southeast Region agrees with the presumption of just one population. However results are different from those obtained for sailfish from Northwestern Atlantic possibly indicating different populations.

Key Words: *Istiophorus albicans*, morphometrics, sailfish, billfish, Northeastern Brazil

RESUMO

O agulhão-vela, *Istiophorus albicans*, é a espécie da Família Istiophoridae mais capturada na Região Nordeste do Brasil. Este trabalho tem o objetivo de determinar as principais relações morfométricas entre diferentes medidas de comprimento e entre comprimento e peso para *Istiophorus albicans* capturados nesta região. No período de agosto de 1996 a março de 1997 foram amostrados 126 agulhões com comprimento total entre 107 e 288 cm, e peso eviscerado entre 12,9 e 28,8 kg. As amostragens foram realizadas em desembarques de empresas de pesca, em embarcações de pesquisa, a bordo de embarcações comerciais, em desembarques da pesca artesanal e na pesca esportiva. As artes utilizadas na captura dos exemplares foram espinhel, rede de emalhar de superfície, linha de corso e molinete. O comprimento total - TL (cm), o comprimento mandíbula inferior-forquilha - LJFL (cm), o comprimento olho-quilha - EKL (cm), o comprimento olho-forquilha - EFL (cm) e o peso eviscerado - Wd (kg) foram determinados para cada exemplar. As relações obtidas entre as medidas de comprimento e entre o comprimento e o peso foram significativas e parecem indicar que os exemplares capturados nas Regiões Nordeste e Sudeste-Sul do Brasil integram uma mesma população, porém diferente da população do Atlântico Noroeste.

Palavras-chave: *Istiophorus albicans*, agulhão-vela, morfometria, agulhão, Nordeste

Introduction

In Southwest Equatorial Atlantic Ocean are found five species of billfishes belonging to Family Istiophoridae (Sailfish - *Istiophorus albicans*; White marlin - *Tetrapturus albidus*; Longbill spearfish -

Tetrapturus pflugeri; and Blue marlin - *Makaira nigricans*) and to Family Xiphiidae (Swordfish - *Xiphias gladius*) (Nakamura, 1985).

Sailfish is the most exploited species of the Family Istiophoridae caught off Northeastern Brazil by industrial, artisanal and sport fisheries. However its

catches are considered occasional and are made by longliners whose main target are tunas, swordfishes and in last decade, sharks.

It is widely distributed in tropical and temperate waters (50°N to 40°S), being usually found in the upper layers of warm water above thermocline. Its highest abundance is observed off Northeastern Brazil during the fourth trimester of the year when specimens usually migrate to the Brazilian Southeast-South Region in order to spawn (Arfelli and Amorim, 1981; Hazin *et al.*, 1994).

The Brazilian Permanent Group for Tuna and Tuna-like Studies recommended in 1995 that new data related to billfishes should be generated due to

the scarcity of information about this group. The objective of the present study is to determine the main morphometric relationships for the sailfish, *Istiophorus albicans*, caught off Northeast of Brazil according to the International Commission for Conservation of Atlantic Tuna (ICCAT, 1990).

Material and Methods

Sampling area corresponded to Northeastern Sector of Brazilian Exclusive Economic Zone limited to the north by Parnaíba River/PI (2° 40' S e 41° 51' W) and to the south by Salvador City/BA (12° 30' S e 39° 10' W) (Figure 1).

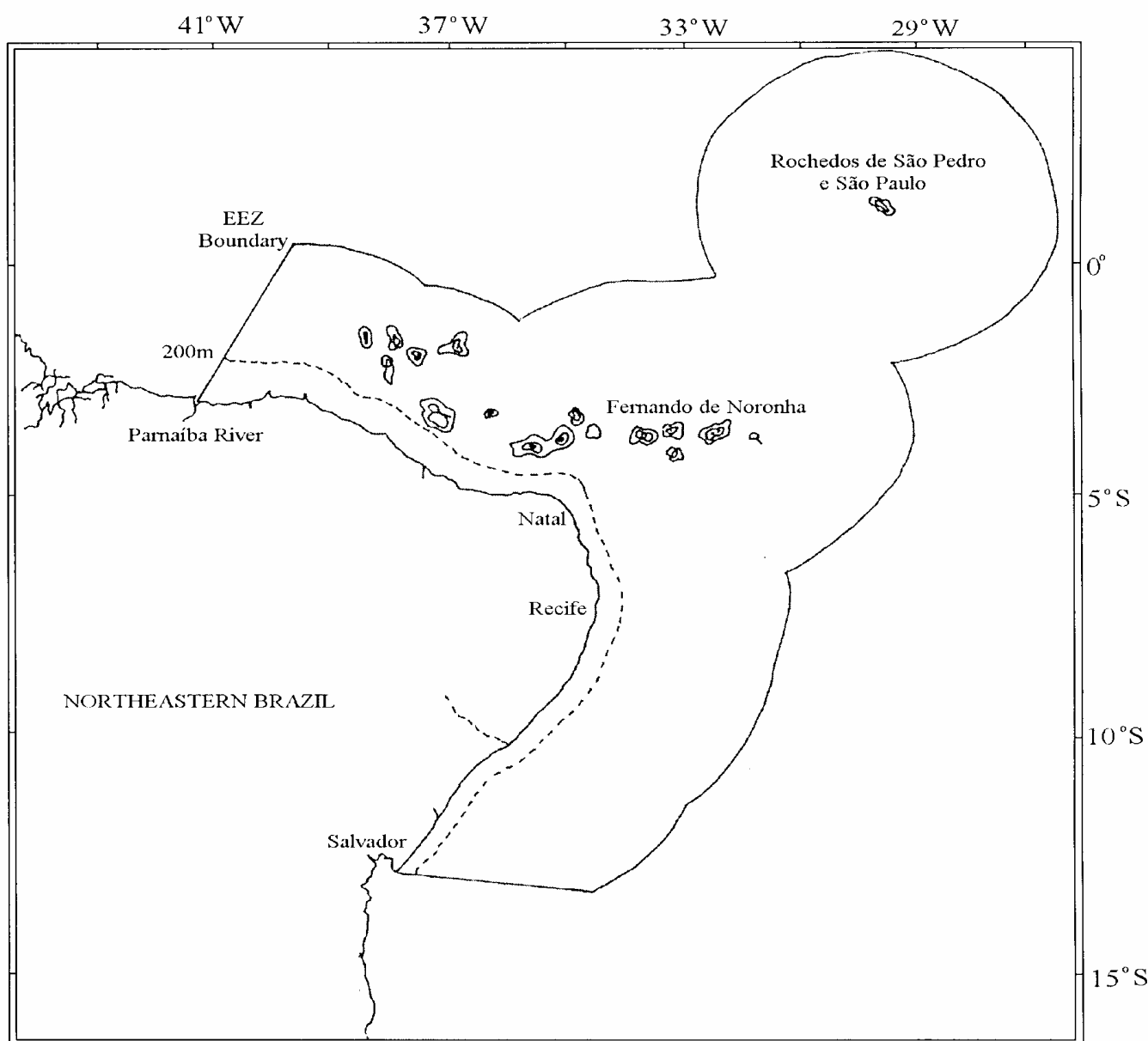


Figure 1. Sampling area of sailfish *Istiophorus albicans* caught off Northeastern Brazil

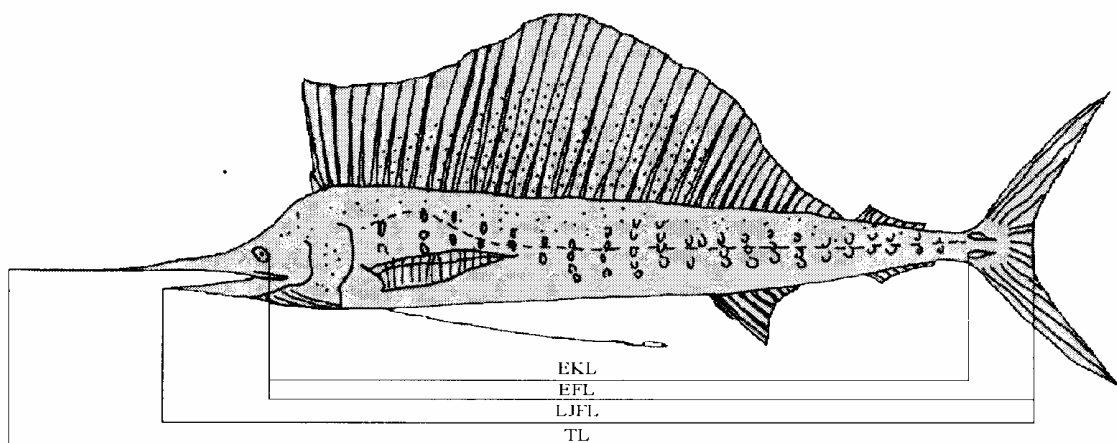


Figure 2. Morphometric data of sailfish, *Istiophorus albicans*, according to ICCAT (1990) and Nakamura (1985)

Sailfishes (*Istiophorus albicans*) were sampled during August/1996 to March/1997 in: a) Fishing companies (Natal/RN - Norte Pesca S.A./UFRPE Agreement); b) RV.Riobaldo (CEPENE/IBAMA); c) Artisanal landings in Natal, Baía Formosa and Caiçara do Norte (RN) and in São José da Coroa Grande (PE); d) Commercial vessels; e) Game fishing (Natal/RN). Catch gears have included: surface longline and gillnet, handline and trolling.

Morphometric data were collected according to ICCAT(1990) and Nakamura (1985): a) TL - Total length (cm); b) EKL - Eye-keel or trunk length (cm); c) EFL - Eye-fork length (cm); d) LJFL - Lower jaw-fork length (cm); and e) Wd - Dressed weight (kg)/without viscera, bill and both dorsal and anal fins (Figure 2). All length measurements were taken with a tape of fiber glass over the curve of the body contour of the fish (curved body length).

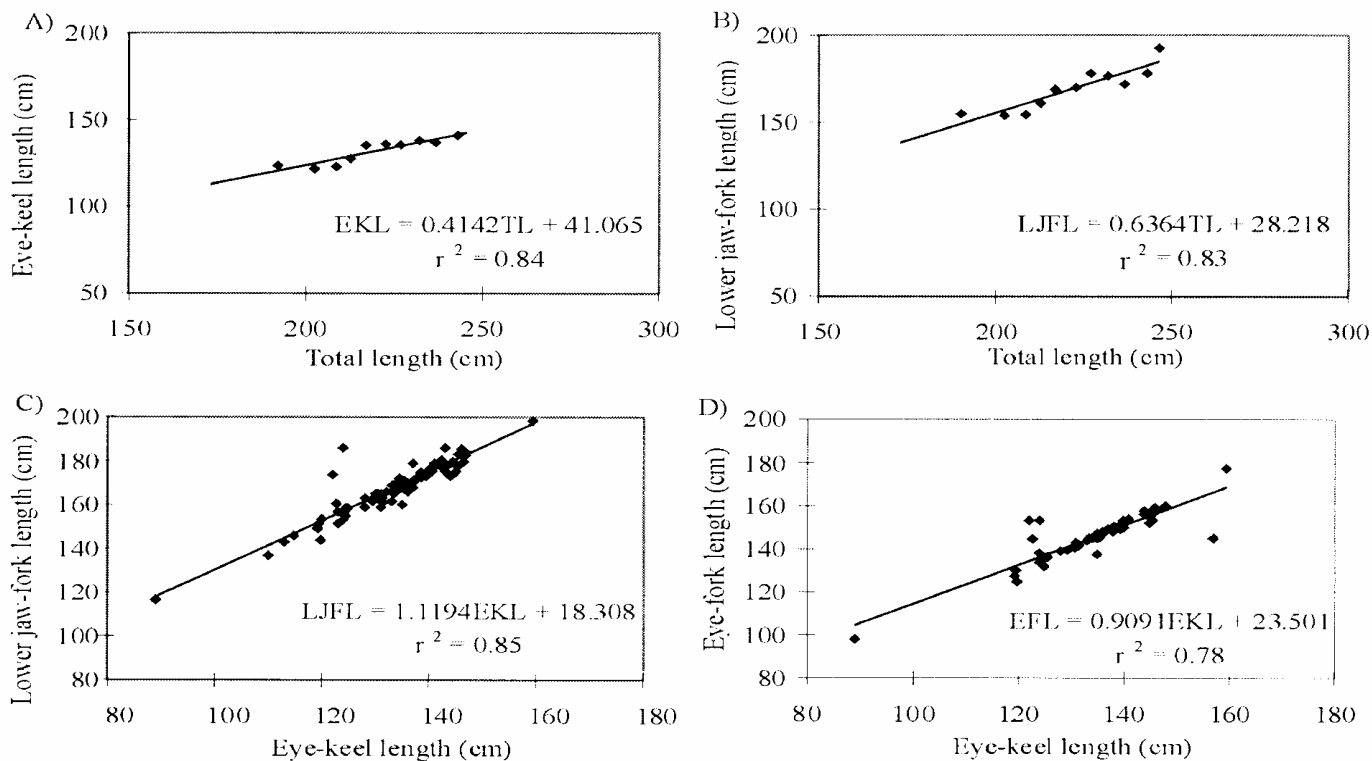


Figure 3. Morphometric relationships to sailfish (*Istiophorus albicans*) between: A) Eye-keel length and total length; B) Lower jaw-fork length and total length; C) Lower jaw-fork length and eye-keel length; D) Eye-fork length and eye-keel length

Morphometric relationships were determined between: a) eye-keel length and total length; b) lower jaw-fork length and total length; c) lower jaw-fork length and eye-keel length; d) eye-fork length and eye-keel length; e) dressed weight and lower jaw-fork length; f) dressed weight and eye-fork length; g) dressed weight and eye-keel length. The significance of these relationships was tested using Student t-test (Zar, 1984).

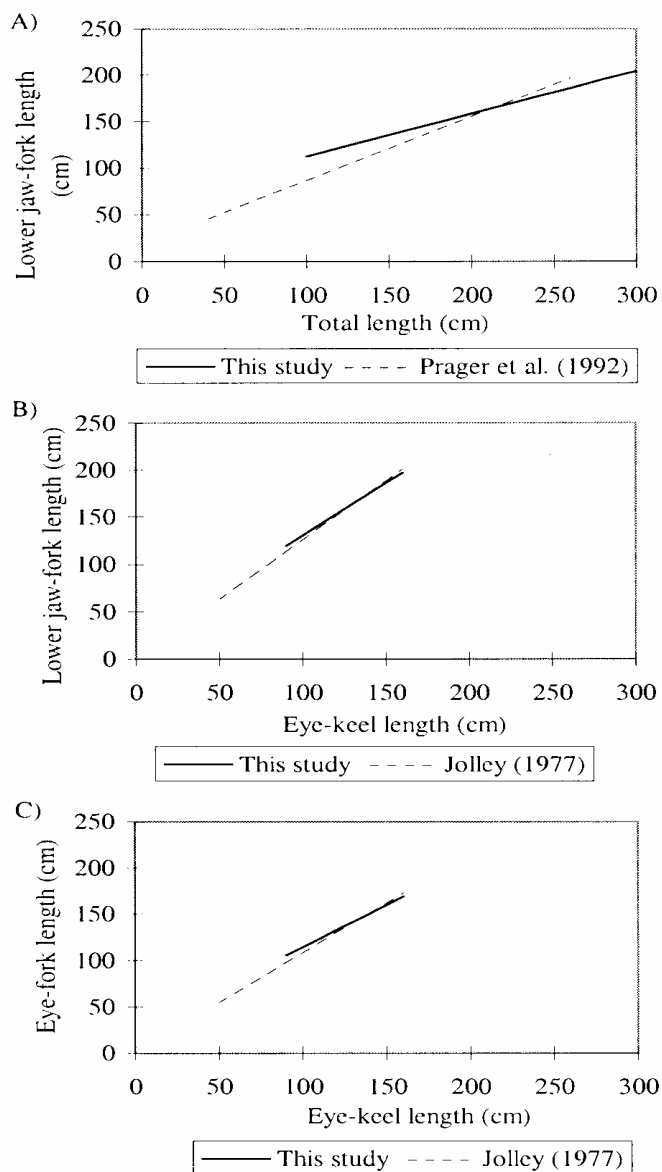


Figure 4. Comparison between some morphometric relationships obtained from this study and those obtained by: A) Prager *et al.*, 1992 (Lower jaw-fork length versus total length); B) Jolley, 1977 (Lower jaw-fork length versus eye-keel length); C) Jolley, 1977 (Eye-fork length versus eye-keel length)

Results and Discussion

A total of 126 sailfishes were sampled ranging from 107 to 288 cm TL, 89 to 160 cm EKL, and 12.9 to 28.8 kg Wd. Main relationships between length measurements for *Istiophorus albicans* were significant and presented the following determination coefficients (r^2): 0.84, 0.83, 0.85 and 0.78 (Figure 3). A comparison between the lower jaw-fork length and

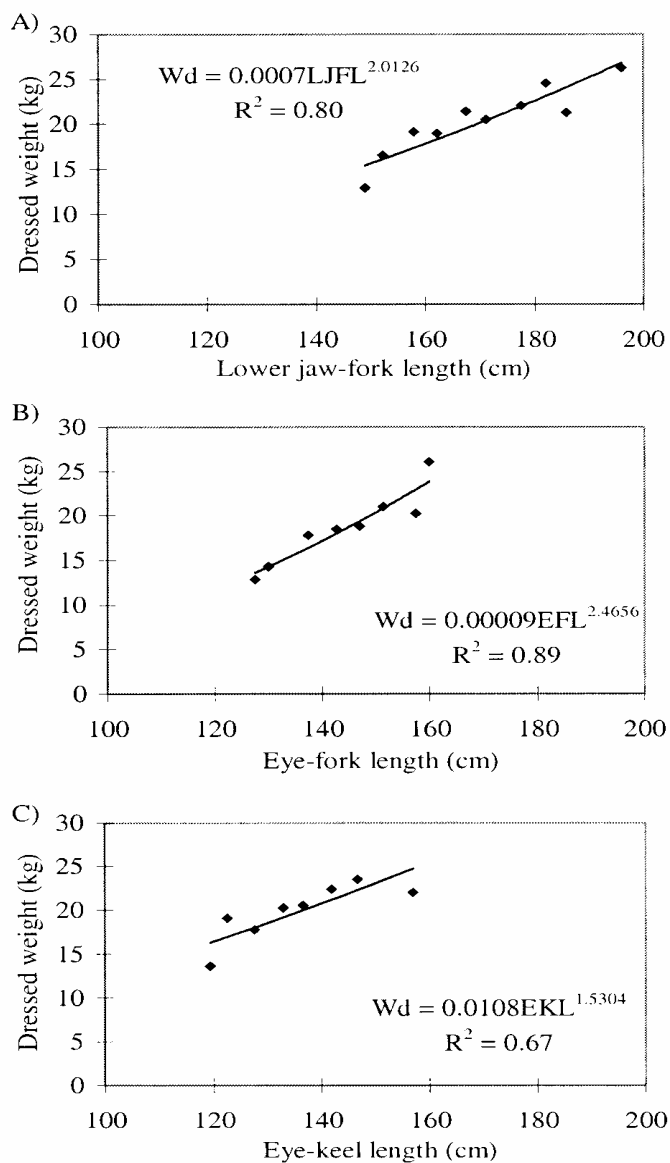


Figure 5. Relationships between dressed weight and: A) Lower jaw-fork length; B) Eye-fork length; C) Eye-keel length

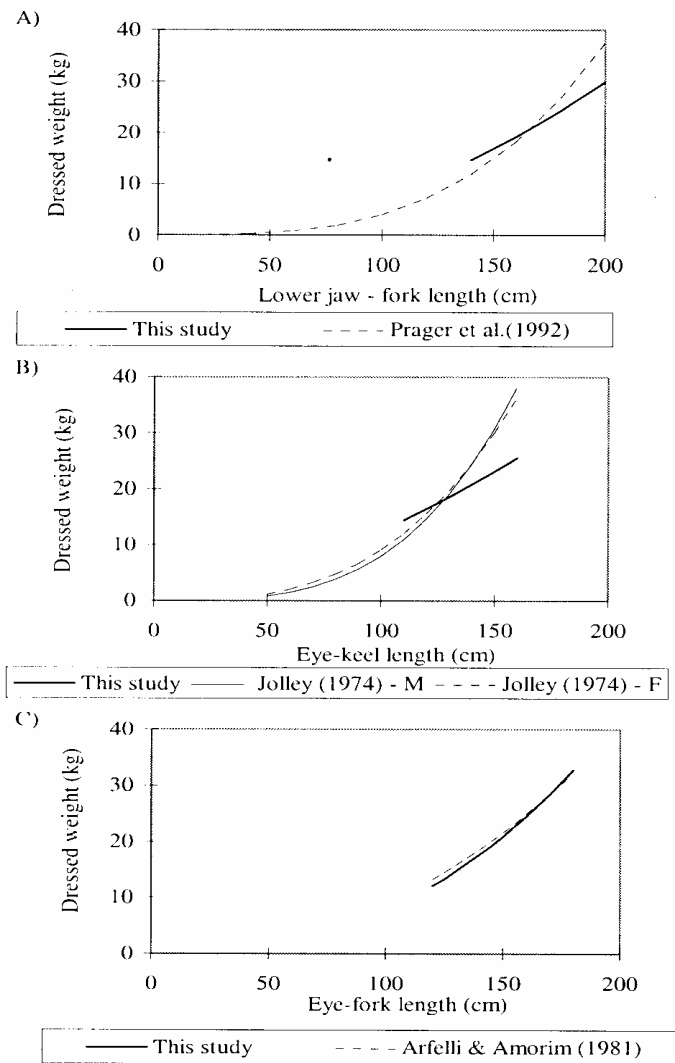


Figure 6. Comparison between the relationships obtained from this study and those obtained by: A) Prager *et al.*, 1992 (Dressed weight versus lower jaw-fork length); B) Jolley, 1974 (Dressed weight versus eye-keel length, for male and female); C) Arfelli and Amorim, 1981 (Dressed weight versus eye-fork length)

total length relationships obtained in this study and by Jolley (1977) and Prager, Lee and Prince (1992) showed that these authors have found a steeper regression line for *Istiophorus platypterus* in Northwestern Atlantic (Figure 4).

Relationships between weight and length also were significant with high determination coefficients: 0.80 and 0.89 (Figure 5). Comparison between the dressed weight and lower jaw-fork length relationships obtained in this study and by Prager, Lee & Prince (1992) showed a evident difference (Figure

6A). The same difference is observed in the comparison between dressed weight and eye-keel length relationship obtained by both this study and Jolley (1974) for Northwestern Atlantic (Figure 6B).

Probably there are at least two different populations of sailfish in Atlantic Ocean off North America and South America with differential growth. Powers (1994) points out a difference in the frequency of spots on the dorsal fin: they are absent in sailfish of the northwest Atlantic, and they occur in the Brazilian, west African and Indian Ocean sailfish. Besides this author reports that recaptures of sailfish tagged in the Northwestern Atlantic had never taken effect south of the Equator. In South America there is no reason so far to think about the existence of different populations between Northeastern and Southeastern regions at least in relation to the relationship between dressed weight and eye-fork length that showed to be very close to each other (Figure 6C). Arfelli and Amorim (1981) suggest that this species migrates from Northeastern Brazil to the Southeast-South in order to spawn during summer. In fact no mature specimens have been captured off Northeastern Region (Souza, Lessa and Hazin, 1994), mainly during the fourth trimester of the year when its highest capture is observed (Hazin *et al.*, 1994).

Arfelli and Amorim (1981) and Hazin *et al.* (1994) have used *Istiophorus platypterus* to name the species that is captured off Brazil. However this study have used *Istiophorus albicans* based into Nakamura (1985) that retains the use of *I. albicans* for the Atlantic sailfish and *I. platypterus* for the Indo-Pacific sailfish, although recognize the importance of further study to clarify the speciation problem of these two species. Graves and Mcdowell (1994) have presented some results about genetic analysis of billfishes that indicate a considerable genetic differentiation between Atlantic and Pacific specimens, with more genetic heterogeneity related to former where there could be different populations. A hypothesis was presented that there has been taken place some recent gene flow from the Pacific to the Atlantic.

All evidences presented above suggest the existence of more than one population of Atlantic sailfish. Same authors of this paper have estimated growth curve for sailfish from Northeastern Brazil and results are different from those estimated for Northwestern Atlantic, with a lower growth rate. However it has to be considered that all morphometric relationships were estimated for both sexes together as all landed specimens are already eviscerated. So results have to

be carefully analyzed in order to support a stronger hypothesis about migration patterns and population structure of this species in Atlantic Ocean.

Conclusions

- Significant relationships were estimated between length measurements for sailfish captured from Northeastern Brazil:

a) $EKL = 0.4142 TL + 41.065$;

b) $LJFL = 0.6364 TL + 28.218$;

c) $LJFL = 1.1194 EKL + 18.308$;

d) $EFL = 0.9091 EKL + 23.501$

- Estimated relationships between weight and length were also significant:

a) $Wd = 0.0007LJFL^{2.0126}$;

b) $Wd = 0.00009EFL^{2.4656}$;

c) $Wd = 0.0108EKL^{1.5304}$

- Comparisons between these relationships and those estimated by another authors suggest that there is just one population of sailfish in Brazil, but different from the population of Northwestern Atlantic.

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