

ASPECTS OF THE DYNAMIC POPULATION OF BLACKFIN TUNA (*THUNNUS ATLANTICUS* - LESSON, 1831) CAUGHT IN THE NORTHEAST BRAZIL

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SUMMARY

The blackfin tuna is found in Atlantic Ocean from the North of USA to the Southeast of Brazil. The objective of this study is to analyze the aspects of an individual dynamic population caught by the artisanal fishermen in Rio Grande do Norte, during the period of September 1999 to January 2001. The parameters used in this study were total lengths, fork lengths and total weight of the 946 specimens. The total length average for females was 61,1 cm, for males was 64cm, and 63cm for combined sexes. The relationship between fork length and total length for females was $TL = 1,3381 + 1,0449 FL$; for males $TL = 1,3456 + 1,0449 FL$ and for combined sexes $TL = 1,2496 + 1,0459 FL$. The relationship between total weight and total length for females was $TW = 0,0255 TL^{2,8438}$, for males $TW = 0,0108 TL^{3,0588}$ and for combined sexes $TW = 0,0128 TL^{3,0165}$. The sexual proportion was 2.1:0.5. The results allow you to conclude that the population of blackfin tuna is characterized by an allometric growth. It shows a sexual proportion differentiated with larger abundance of males, which indicates larger averages of total length and total weight.

RÉSUMÉ

On rencontre le thon à nageoires noires dans l'océan Atlantique, du Nord des Etats-Unis au Sud-Est du Brésil. La présente étude a pour objectif d'analyser les aspects d'une population dynamique individuelle capturée par les pêcheurs artisanaux à Rio Grande do Norte, au cours de la période courant de septembre 1999 à janvier 2001. Les paramètres utilisés dans cette étude étaient les longueurs totales, les longueurs à la fourche et le poids total des 946 spécimens. La longueur totale moyenne s'élevait à 61,1 cm pour les femelles, à 64 cm pour les mâles et à 63 cm pour les sexes combinés. Le rapport entre la longueur à la fourche et la longueur totale pour les femelles était $TL = 1,3381 + 1,0449 FL$; pour les mâles $TL = 1,3456 + 1,0449 FL$ et pour les sexes combinés $TL = 1,2496 + 1,0459 FL$. Le rapport entre le poids total et la longueur totale pour les femelles était $TW = 0,0255 TL^{2,8438}$, pour les mâles $TW = 0,0108 TL^{3,0588}$ et pour les sexes combinés $TW = 0,0128 TL^{3,0165}$. La proportion sexuelle était 2.1 :0.5. Les résultats permettent de conclure que la population de thons à nageoires noires se caractérise par une croissance allométrique. Elle montre une proportion sexuelle différenciée avec une plus grande abondance de mâles, ce qui indique des moyennes plus grandes de longueur totale et de poids total.

RESUMEN

El atún de aletas negras se encuentra en el océano Atlántico, desde el Norte de Estados Unidos hasta el Sudeste de Brasil. El objetivo de este estudio es analizar los aspectos de una población dinámica individual capturada por los pescadores artesanales de Rio Grande do Norte, durante el periodo de septiembre de 1999 hasta enero de 2001. Los parámetros utilizados en este estudio fueron las longitudes totales, las longitudes a horquilla y el peso total de 946 especímenes. La longitud total media fue 61,1 cm para las hembras, 64 cm para los machos y 63 cm para ambos sexos combinados. La relación entre longitud a horquilla y longitud total fue: para las hembras $TL = 1,3381 + 1,0449 FL$; para los machos $TL = 1,3456 + 1,0449 FL$; y para ambos sexos combinados $TL = 1,2496 + 1,0459 FL$. La relación entre el peso total y la longitud total fue: para las hembras $TW = 0,0255 TL^{2,8438}$, para los machos $TW = 0,0108 TL^{3,0588}$ y para ambos sexos combinados $TW = 0,0128 TL^{3,0165}$. La proporción de sexos hallada

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fue 2,1:0,5. Los resultados permiten llegar a la conclusión de que la población de atún de aletas negras se caracteriza por un crecimiento alométrico. Muestra una proporción de sexos diferenciada con mayor abundancia de machos, lo que indica mayores promedios de longitud total y peso total.

KEY WORDS

Population dynamics, Blackfin tuna, Pelagic fisheries, Length-weight relationships, Sex ratio

1. Introduction

The blackfin tuna (*Thunnus atlanticus*) is the only tuna species whose distribution limits are the western Atlantic, reported from the North of the USA to the Southeast of Brazil. This is a highly migratory species, mainly found on coastal waters, on temperatures above 20°C. They form schools with other species of tuna, their spawn happen next to the coast and they feed on small fishes, octopus, crustaceans, anfipodes and decapods larvae (Collette & Nauen 1983; Hazin 1998).

In the Brazilian Northeast this species frequents the area during last quarter of the year (Monte 1964; Cruz & Paiva 1964; Cruz 1965; Vieira 2000), proportionately an important part of the artisanal fishery. In Baía Formosa, on the Southern coast of Rio Grande do Norte, the blackfin tuna fishing season occurs in traditional methods, using sail boats which vary in size form 7 to 9 m, using the trolling method.

The blackfin tuna is an important resource for the economy of this area. Further intense studies about their environment are necessary, because the last studies of this species in Brazil were date during the 1960 (Paiva 1962b; Monte 1964; Cruz & Paiva 1964 and Cruz 1965). The main objective of this study is to obtain information about the dynamic population of the blackfin tuna, analyzing weight and length classes, biometrical relations and sexual proportion. The present information may help to subsidize the implementation of legislation for exploration of this resource.

2. Material and methods

For the development of this study, 946 specimens of blackfin tuna were studied, from a weekly sample of the traditional local fleets that operates on the Southern coast of Rio Grande do Norte, in depths between 20 and 60 m, from September 1999 to January 2001. All the specimens were identified by the sex, and by the following variables: total length (TL), fork length (FL) and total weight (TW). The weight and length variables were analyzed and co-related to separate and combined sexes, in agreement with the methodology proposed by Fonteles-Filho (1989), Valle-Gómez (1991), Ivo & Fonteles Filho (1997) and Virira (2002). The sexual proportions were estimated, according to Aguilar & Malpica (1993) and Vieira (2002).

3. Results and discussion

The distribution of the population by class of total length (TL) and total weigh (TW) revealed an unimodal tendency of the sampled specimens either for females and males and for combined sexes (**Figures 1 and 2**).

The composition by length class, the total length measure, varied between 46,0 to 74,0 cm for females, and the largest concentration of length is among the classes of 57,0 to 65,5 cm, that corresponds to a percentage of 25% to 75% of the sample, with an average of 61,0 cm. For males, the lengths varied from 47,0 to 86,0 cm and the sample largest concentration has a representation of 25 to 75%. This includes the classes of 59,5 to 68,0 cm, with an average of 64,0 cm.

It can be observed (**Table 1**) that studies developed using the blackfin tunas, in the same area, showed lengths and average of total length (cm) similar of those found in the present study. However, studies done in Cuba with the same species, show specimens with length class and average size inferior to the present study, ever using the same specimens that were sampled in the Southeast area of Brazil.

According to the total population weight, females had smaller lengths with a minimum value of 1,000g and maximum of 5,000g. A percentage corresponding to 25-75% of the population had weights between 2,300 and

5,600g, and an average of 3,154g. Males presented total weights varying from 1,456 to 8,400g, with the largest concentration of the specimens between 2,800 and 4,480g that corresponds to 25-75%, and an average of 3,739g. For combined sexes, the weight varied from 1,120 to 8,400g, with an average of 3,552g, being the largest individual concentration between 2,800 and 4,256g that corresponds to a percentage of 25-75%.

In the proportion weight/length of blackfin tuna, the results observed on the **Table 2**, were similar to Coll (1987b) results in studies accomplished in Cuba, for separate sexes and for Valle & Hirtenfeld (1983), Valle-Gómez (1991) and Freire *et al.* (1998), for combined sexes. The values estimated for the parameter "b" in relations between natural logarithms (ln) of weight/length for females, males and combined sex, were 2,8438, 3,0558 and 3,0165. These results suggest that the present species has an allometric growth. Lagler *et al.* (1962), constant can vary from 2,5 to 4,0 and each species has its own value. However, when that value is 3,0 the growth is called isometric. But when it differs, is considered as allometric.

For the total of 946 specimens sampled, 303 specimens were identified as females and 643 specimens as males, obtaining a sexual proportion of 2,1: 0,5. The sexual proportion of specimens of blackfin tuna caught on the Southern coast of Rio Grande do Norte by Cruz & Paiva (1964) were 1,6: 0,6. In studies accomplished in Cuba, with the same species, Coll (1987b) found a sexual proportion of 1,7: 0,7. For *Katsuwonus pelamis*, the same author found the following proportion, 1,9: 0,5. Freire *et al.* (1998), in studies done on the southern coast of Rio Grande do Norte, found a proportion of 1,8: 1,0.

The results of these studies about sexual proportion corroborate the present study, showing differences in the relation between both sexes and the prevalence of males. In agreement with Schaffer & Orange (1955), mentioned by Schaffer *et al.* (1963) and Coll (1987b), this fact can be connected to a differential mortality, and attached as some kind of sexual behavior, were males are caught more often than big females or to a differential rhythm of growth.

4. Conclusions

The referring results about the population aspects allow to infer that the population of blackfin tuna is characterized by presenting a sexual proportion differentiated with larger abundance of males, and larger length averages and weight. This population has a relatively accentuated maximum length, when compared to the average length of other populations in different locales. The biometrical relationships obtained for the species, indicates an allometric growth.

Comparing the averages obtained from total lengths and weights, with those of the previous studies, can verify that the values are constant during the last thirty years, showing that this population is not in over fishing. Another important point we can link to balance is traditional exploration to reach the levels of the population that concentrate adult specimens, in other words, these with length above of the first sexual maturation, that are 94% of the caught specimens.

According to obtained results, we can consider that the stock of this species, in the studied area, doesn't has an over fishing problem.

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Table 1. Distribution of the lengths minimum, maximum and it measured of blackfin tuna for combined sex.

<i>Authors</i>	<i>Local</i>	<i>TL</i> <i>Minimum</i>	<i>TL</i> <i>Maximum</i>	<i>TL</i> <i>Mean</i>
Cruz and Paiva (1964)	Brazil (Northeast)	51	80	65,5
Monte (1964)	Brazil (Northeast)	51	80	65,6
Coll (1987a)	Cuba	26,5	78,5	45,5
Zavala-Camim (1991)	Brazil (Southeast)	36	73	54,5
Báez-Hidalgo and Bécquer (1994)	Cuba	27	79	52,3
Freire <i>et al.</i> (1998)	Brazil (Northeast)	36,5	86	61,3
This study	Brazil (Northeast)	46	86	63

Table 2. Equations of the correlations among fork length (FL) / total length (TL), total weigh (TW) / total length (TL).

<i>Sex</i>	<i>Equations</i>	<i>R²</i>
Females	TL = 1,3381 + 1,0432 FL	0,980
	TW = 0,0255 TL ^{2,8438}	0,884
	Ln TW = - 3,6687 + 2,8438 ln TL	0,884
Males	TL = 1,3456 + 1,0449 FL	0,980
	TW = 0,0108 TL ^{3,0588}	0,902
	Ln TW = - 4,5251 + 3,0588 ln TL	0,902
Combined sexes	TL = 1,2496 + 1,0459 FL	0,980
	TW = 0,0128 TL ^{3,0165}	0,902
	Ln TW = - 4,3589 + 3,0165 ln TL	0,902

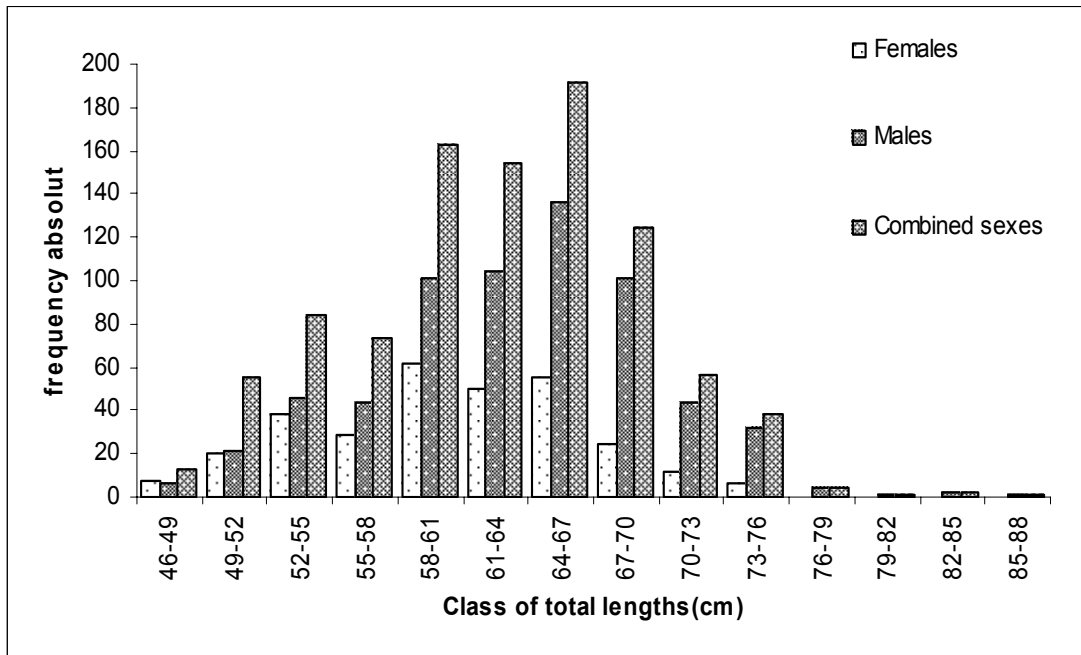


Figure 1. Distribution in class of total length for females, males and combined sexes of blackfin tuna.

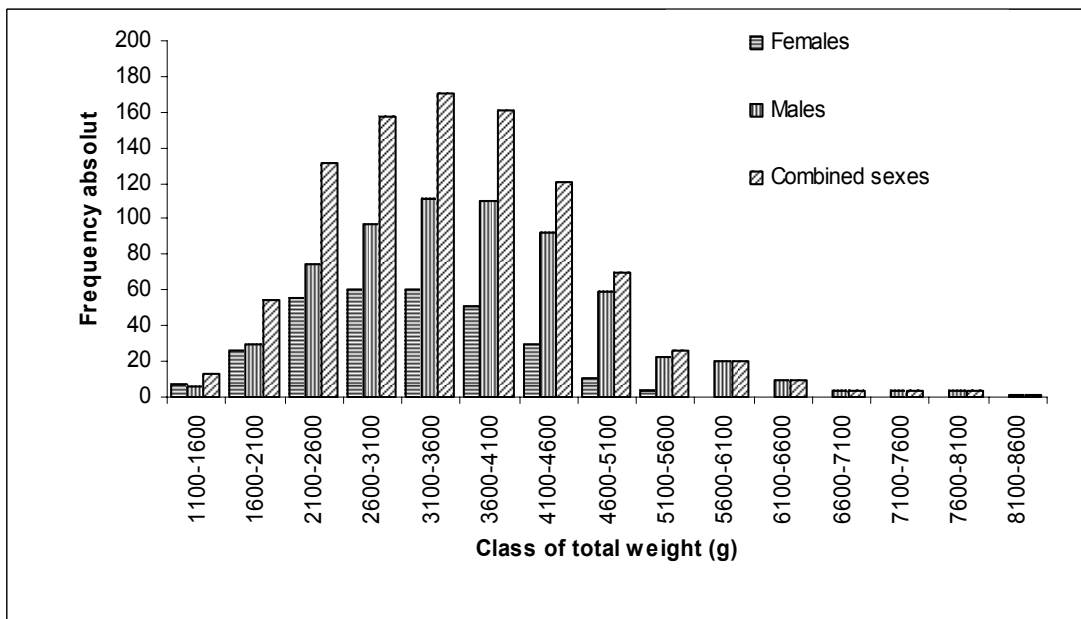


Figure 2. Distribution of class of total weight for females, males and combined sexes of blackfin tuna.