STOMACHAL CONTENT OF SAILFISH, *ISTIOPHORUS PLATYPTERUS* CAUGHT OFF NORTHERN RIO DE JANEIRO STATE, BRAZIL

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SUMMARY

The purpose of this paper is to characterize the food diet of the sailfish caught by the small-size fleet operating off northern Rio de Janeiro State. The sampling was collected during the seasons from spring to summer, from 1995 to 2006. The stomachs were obtained during the landing in Cabo Frio City, Rio de Janeiro State, Brazil. The items were identified by the taxonomic group, photographed and fixed afterwards. It was applied the quantitative analysis by the Numeric Frequency (NF) in percentage and Relative Abundance (RA) in Dominant (>15%), Abundant (7-15%), Medium (1-6.9%), Less frequent (0.1-0.9%) and Rare (>0.1%). According to the analyses of 482 sailfish stomacal contents, the most important item was as Sardinella brasiliensis, *followed by* Argonauta nodos *and* A. thazard thazard. *Also the pelagic cephalopods represented important food item in its diet. Unusual items were also found as many kinds of plastic materials and hooks. According to the fishermen live sardine is the best live bait for catching this species.*

RÉSUMÉ

L'objectif de ce document vise à caractériser la diète alimentaire des voiliers capturés par une petite flottille opérant au large de l'Etat de Rio de Janeiro. L'échantillonnage a été réalisé au printemps et en été, de 1995 à 2006. Les estomacs ont été obtenus lors des débarquements effectués à Cabo Frio City, dans l'Etat de Rio de Janeiro, au Brésil. Les éléments ont été identifiés par le groupe taxonomique, photographiés et établis par la suite. Une analyse quantitative a été appliquée à partir de la Fréquence numérique (NF) en pourcentage et de l'Abondance relative (RA) selon la classification suivante : Dominant (>15%), Abondant (7-15%), Moyen (1-6.9%), Moins fréquent (0.1-0.9%) et Rare (>0.1%). D'après les analyses de contenus stomacaux de 482 voiliers, les éléments les plus importants étaient de la Sardinella brasiliensis, *suivi du* Argonauta nodos *et du* A. thazard thazard. *Les céphalopodes pélagiques représentaient également un important élément de la diète alimentaire. D'autres éléments peu fréquents ont aussi été observés, tels que de nombreuses matières plastiques et des hameçons. Selon les pêcheurs, la sardine vivante est le meilleur appât vivant pour capturer cette espèce.*

RESUMEN

La finalidad de este documento es caracterizar la dieta del pez vela capturado por la pequeña flota que opera en las aguas septentrionales del Estado de Rio de Janeiro. Se recopiló la muestra durante las temporadas de primavera a verano, desde 1995 hasta 2006. Se tomaron muestras de contenidos estomacales durante los desembarques en la ciudad de Cabo Frio, Estado de Rio de Janeiro, Brasil. Los productos de las muestras de contenidos estomacales se identificaron por grupo taxonómico, se fotografiaron y posteriormente se registraron. Se aplicó un análisis cuantitativo a partir de la frecuencia numérica (FN) en forma de porcentaje y de la abundancia relativa, con una clasificación como predominante (>15%), abundante (7-15%), media (1-6,9%), menos frecuente (0,1-0,9%) y escasa (>0,1%). En el análisis de 482 peces vela, el producto más abundante fue la Sardinella brasiliensis, *seguida por* Argonauta nodos *y* A. thazard thazard. *También se observó que cefalópodos pelágicos eran un producto alimentario importante en la dieta de esta especie. También se encontraron productos poco habituales como muchos tipos de materiales plásticos y anzuelos. Según los pescadores la sardina viva es el mejor cebo vivo para capturar esta especie.*

KEYWORDS

Atlantic sailfish, stomach contenst, sports fishery, Istiophorus platypterus, diet, small-size fleet, Cabo Frio City, Rio de Janeiro State

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1. Introduction

The small-size fleet in Cabo Frio City represented 15% of total yield from Rio de Janeiro State (Marques *et al*., 2000). The mentioned fleet, comprises about 350 boats, chose Cabo Frio city because of the presence of some industries and the landing facilities around Araruama Lake. This fleet, with boats ranging from 12 to 15 meters and under 20 TM boats, is from Espírito Santo, Rio de Janeiro, São Paulo and Santa Catarina States. This fleet uses different equipments, mainly small surface longline and live sardine bait (Pimenta *et al*., 2007).

Cabo Frio upwelling gives to the region high fishery productivity (Moreira-Silva, 1970). The oceanographic conditions facilitate to find small sardine used as bait by that fleet.

There are few papers about the stomach content study in the region as Pimenta *et al*., (2001, 2005).

The goal of this paper is to analyze the feeding habits of the species caught off the Northern Rio de Janeiro State, in Brazil, through the study of stomach contents.

2. Material and methods

The samples were collected during the spring and summer for 12 years in a row, from 1995 and 2006.

The stomachs were collected from the fish landed by the small-size fleet. After the fish was unloaded they were washed, weighed, dressed and cut in pieces for the commercialization. At that moment the stomach was collected and kept in the icebox. At the laboratory they were opened and the material was separated for identification. The items were identified by the taxonomic group, photographed and fixed afterwards. It was applied the quantitative analysis by the Numeric Frequency (NF) in percentage and Relative Abundance (RA). The material was selected according to different categories. More then 15% of the material were Dominant, Abundant ranged from 7 to 15%, Medium ranged from 1 to 6.9%, Less frequent ranged from 0.1-0.9%, and Rare represented less than 0.1%.

The material found was separated according to the taxonomic group, photographed and fixed with 10% formalin in laboratory afterwards, according to Bittar and Di Beneditto, (2006). It was considered quantitative analysis by the Numeric Frequency (NF) in percentage and Relative Abundance (RA) in Dominant (>15%), Abundant (7-15%), Medium (1-6.9%), Less frequent (0.1-0.9%) and Rare (>0.1%).

The fish identification was based in pielou, (1966); Figueiredo, (1977); FAO (1978, 1994, 1999); Figueiredo and Menezes, (1978, 1980); Menezes and Figueiredo, (1980, 1985); Zavala-Camin, (1981, 1982, 1986, 1987).

3. Results and discussion

The sampling of 482 sailfish stomach content was collected during the seasons from spring to summer, of 1995 to 2006 periods. The stomachs were collected from small size fleet during the boat landing in Cabo Frio City, Rio de Janeiro State.

According to the analysis of those stomach contents, the most important item was the *Sardinella brasiliensis*. Also the *Argonauta nodosa* and *A. thazard thazard* were the second and third item. Unusual items were also found as many kinds of plastic materials and hooks. According to the fishermen live sardine is the best live bait for catching this species. Also pelagic cephalopods represented important food item in its diet **(Table 1)**.

Sardinella brasiliensis (NF = 23,1%; RA = Dominant) is the main prey of the species. *Argonauta nodosa* (NF = 12,7; RA = Abundant) and *Auxis thazard thazard* (NF = 7,7%; RA = Abundant) are the second option. Non-identified fish in advanced state of putrefaction represented (NF = 11,3%; RA = Abundant) and empty stomaches represented (NF = 13,6%; RA = Abundant).

It is remarkable the numeric frequency of mollusks in their diet, besides *Argonauta nodosa* (NF = 12.7; RA = Abundant). The list also includes *Loligo* sp (NF = 1.9%; Ra = Medium) and *Argonauta argo* (NF = 0.6%; RA = Scarce). The total of mollusks represents (NF = 15.2; RA = Dominant).

A group of preys that show relative abundance is represented by *Selar crumenophthalmus* (NF = 4%; RA = Medium), *Ariomma bondi* (NF = 3.1%; RA = Medium), *Decapterus punctatus* (NF = 2.9%; RA = Medium), Exocoetus volitans (NF = 2.6%; RA = Medium), *Dactylopterus volitans* (NF = 2.4%; RA = Medium), *Trichiurus lepturus* (NF = 2.2%; RA = Medium), *Loligo* sp (NF = 1.9%;RA = Medium), *Scomber colias* (NF = 1.1%; RA = Medium), *Diodon histrix* (NF = 1.1%; RA = Medium). Those species usually occur in the studied area, and there is data confirming that they are caught by artisanal fisheries and oceanographic researches **(Table 1 and Figure 1)**.

There is also a group of different species of preys, found during their migration through the studied area, represented by *Hemiramphus brasiliensis* (NF = 0.9%; RA = Scarce, *Selene vomer* (NF = 0.9%;Ra = Scarce), *Caranx crysos* (NF = 0.6%; Ra = Scarce), *Priacanthus arenatus* (NF = 0.6%; RA = Scarce), *Lagocephalus laevigatus* (NF = 0.6%; RA = Scarce), *Argonauta argo* (NF = 0.6%; RA = Scarce), *Centropyge aurantonotus* (NF = 0.6%; RA = Scarce), *Prionotus punctatus* (NF = 0.6%; RA = Scarce), *Selene setapinnis* (NF = 0.6%; RA = Scarce), *Eucinostomus gula* (NF = 0.4%;RA = Scarce), *Stephanolepis hispidus* (NF = 0.3%; RA = Scarce), *Bellator brachychir* (NF = 0.3%; RA = Scarce), *Genypterus* sp (NF = 0.3%; RA = Scarce), *Tylosurus acus acus* (NF = 0.3%; RA = Scarce), *Monacanthus setifer* (NF = 0.1%; RA = Scarce), *Benthodesmus alongatus* (NF = 0.1%; RA = Scarce), *Opisthonema oglinum* (NF = 0.1%; RA = Scarce), *Remora remora* (NF = 0.1%; RA = Scarce), Ciclóstomos (NF = 0.1%; RA = Scarce), *Merluccius* sp (NF = 0.1%; RA = Scarce), *Haemulon* sp (NF = 0.1%; RA = Scarce) and *Prionotus* sp (NF = 0.1%; RA = Scarce), observed in **Table 1 and Figure 1**.

According Pimenta *et al*. (2005) studying a small sailfish off Northern Rio de Janeiro State, collected from November 2002 to March 2003, observed the main prey of sailfish was *Auxis thazard thazard*, associated to *Selar crumenophthalmus*. An intermediary group of preference is comprised by *Exocoetus volitans*, *Decapterus punctatus*, *Argonauta* sp, *Trichiurus lepturus*, *Selene* sp and *Priacanthus arenatus*. The mollusks *Argonauta* sp e Loligo sp is important and frequent food in the studied area.

Zavala-Camim, (1978) observing 222 stomach content of sailfish from 1972-85 off southern Brazil, found the following composition: 149 stomach with fish, 56 with cephalopod, 9 with crustacean and 8 empty. According to him sailfish was mainly fish eater.

There are different species of preys that can be found in buoying materials that come in currents, or are aggregated to offshore oil rigs in the Campos Oil Basin, in Rio de Janeiro State, suggesting that sailfish practically eats anything that is available. They also eat species that they have symbiosis with, like: *Remora remora* and *Ciclostome*.

4. Conclusion

Istiophorus platypterus mainly fish eating prefers *Sardinella brasiliensis*. This finding is corroborated by the high occurrence of sardines in the studied region, and also emphasizing that this species is used as a live bait to catch sailfish. According to the analyses the second important item was *Argonauta nodos* and *A. thazard thazard*. Other occurrences show a lot of biodiversity and low occurrence.

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Table 1. Stomach content items of sailfish caught by small size fleet (1995/2006).

Number	*Species*	*NF and RA*
141	*Sardinella brasiliensis*	FN = 23.1%; AR = D
83	*Empty stomaches*	FN = 13.6%; AR = A
78	*Argonauta nodosa*	FN = 12.7%; AR = A
69	*Non-identified digested fishes*	FN = 11.3%; AR = A
47	*Auxis thazard thazard*	FN = 7.7%; AR = A
25	*Selar crumenophthalmus*	FN = 4%; AR = M
19	*Ariomma bondi*	FN = 3.1%; AR = M
18	*Decapterus punctatus*	FN = 2.9%; AR = M
16	*Exocoetus volitans*	FN = 2.6%; AR = M
15	*Dactylopterus volitans*	FN = 2.4%; AR = M
14	*Trichiurus lepturus*	FN = 2.2%; AR = M
12	*Loligo sp*	FN = 1.9%; AR = M
7	*Scomber colias*	FN = 1.1%; AR = M
7	*Diodon histrix*	FN = 1.1%; AR = M
6	*Hemiramphus brasiliensis*	FN = 0.9%; AR = S
6	*Selene vomer*	FN = 0.9%; AR = S
4	*Caranx crysos*	FN = 0.6%; AR = S
4	*Priacanthus arenatus*	FN = 0.6%; AR = S
4	*Lagocephalus laevigatus*	FN = 0.6%; AR = S
4	*Argonauta argo*	FN = 0.6%; AR = S
4	*Centropyge aurantonotus*	FN = 0.6%; AR = S
4	*Prionotus punctatus*	FN = 0.6%; AR = S
4	*Selene setapinnis*	FN = 0.6%; AR = S
3	*Eucinostomus gula*	FN = 0.4%; AR = S
2	*Stephanolepis hispidus*	FN = 0.3%; AR = S
2	*Bellator brachychir*	FN = 0.3%; AR = S
2	*Genypterus sp*	FN = 0.3%; AR = S
2	*Tylosurus acus acus*	FN = 0.3%; AR = S
1	*Monacanthus setifer*	FN = 0.1%; AR = S
1	*Benthodesmus alongatus*	FN = 0.1%; AR = S
1	*Opisthonema oglinum*	FN = 0.1%; AR = S
1	*Remora remora*	FN = 0.1%; AR = S
1	*Ciclostome*	FN = 0.1%; AR = S
1	*Merluccius sp*	FN = 0.1%; AR = S
1	*Haemulon sp*	FN = 0.1%; AR = S
1	*Prionotus sp*	FN = 0.1%; AR = S

Total = 610 exemplars of 34 species in 482 stomachs

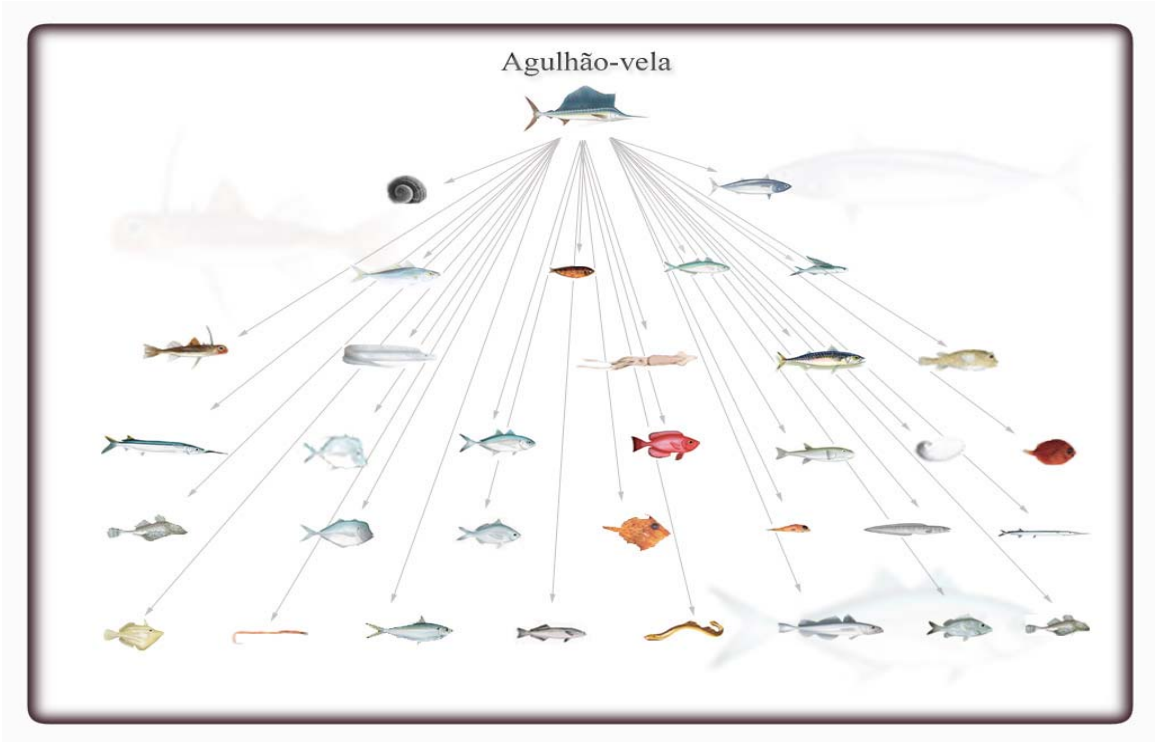

Figure 1. Quantitative analysis by the Numeric Frequency (NF) in percentage and Relative Abundance (RA) of sailfish stomach content (in Dominant, >15%; Abundant, 7-15%; Medium, 1-6.9%; Less frequent, 0.1-0.9%; and Rare, >0.1%).