

MARLIN PROJECT: TAG-AND-RELEASE, BIOMETRICS AND STOMACH CONTENT OF BILLFISH IN CABO FRIO CITY, RIO DE JANEIRO, BRAZIL

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SUMMARY

The Marlin Project is a fishery biology study of blue marlin (Makaira nigricans), white marlin (Tetrapturus albidus) and sailfish (Istiophorus platypterus) caught by Cabo Frio (Rio de Janeiro State, Brazil) yacht clubs. This paper presents Marlin Project analyses of billfish catch by area, length, weight, stomach contents and by-catch. The analysis of billfish stomach contents produced different pelagic species of very common sizes and occurrence in the region during all seasons of the year. Katsuwonus pelamis, Auxis thazard and Euthynnus alletteratus, were most often found in blue marlin stomachs. Sailfish showed a preference for Chilomycterus sp., Caranx caranx and flying fish (Exocoetus volitans). Stomach contents of the by-catch species "Mari mari" (Coryphaena hippurus) showed a preference for Thunnus albacares and seldom for Thunnus obesus.

RESUMEN

El Proyecto Marlines es un estudio biológico de la pesquería de aguja azul (Makaira nigricans), aguja blanca (Tetrapturus albidus) y pez vela (Istiophorus albidus) pescados por los clubes náuticos de Cabo Frío (Río de Janeiro, Brasil). Este documento presenta análisis de dicho Proyecto, de la captura de marlines por zona, talla, peso, contenidos de estómagos y captura fortuita. En el análisis del contenido de estómagos se observaron diferentes especies pelágicas de talla y presencia muy corriente en la región durante casi todo el año. El Katsuwonus pelamis, Auxis thazard y Euthynnus alletteratus, eran las especies más comunes en los estómagos de aguja azul. El pez vela mostraba preferencia por el Chilomycterus sp., Caranx caranx y pez volador (Exocoetus volitans). En el estómago de la especie de captura fortuita lampuga ("Mari-mari", Coryphaemna hippurus) se encontró sobre todo Thunnus albacares y pocas veces Thunnus obesus.

RÉSUMÉ

Le Marlin Project est une étude halieutique sur la biologie du makaire bleu (Makaira nigricans), du makaire blanc (Tetrapturus albidus), et du voilier (Istiophorus platypterus) capturés par les bateaux de plaisance des clubs nautiques de Cabo Frio (état de Rio de Janeiro, Brésil). Le présent document présente les analyses menées dans le cadre du projet sur les prises d'istiophoridés par zone, taille, poids, contenu stomacal et prise accessoire. L'analyse du contenu stomacal des istiophoridés donne diverses espèces pélagiques de tailles très communes et qui sont présentes dans la région à toutes les époques de l'année. Le Katsowonus pelamis, l'Auxis thazard et l'Euthynnus alletteratus se trouvaient le plus souvent dans les estomacs de makaires bleus. Le voilier montrait une préférence pour les Chilomycterus sp., le Caranx caranx et le poisson volant (Exocoetus volitans). Le contenu stomacal de l'espèce accessoire "Mari mari" (Coryphaena hippurus) montrait la préférence de l'espèce pour le Thunnus albacares, rarement pour le Thunnus obesus.

KEYWORDS

Biometrics, Body size, Stomach content, Sport fishing, Tuna fisheries, By catch, Catch composition, Fish catch statistics, Length-weight relationships, Tagging

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INTRODUCTION

The main goal of the Marlin Project is to conduct fishery biology studies of the Cabo Frio City billfish sport fishery in Rio de Janeiro State, Brazil, during the sport fishing season of blue marlin (*Makaira nigricans*), white marlin (*Tetrapturus albidus*) and sailfish (*Istiophorus platypterus*), caught by Cabo Frio yacht clubs. Starting in 1995, tag and release has become a common practice by anglers. The Project is conducted by researchers from *Grupo de Estudos da Pesca* (GEPESCA), *Coordenação de Programas de Pós-graduação em Engenharia* (COPPE) of the *Universidade Federal do Rio de Janeiro*, the *Instituto de Pesca* (I.P. - São Paulo), and by anglers from the *Iate Clube do Rio de Janeiro-ICRJ* and the *Costa Azul Iate Clube-CAIC*, who follow the championships of yacht clubs.

First of all, through lectures in the yacht clubs, the Project helps anglers better understand the decline of billfish populations, and shows the release of fish as a common practice in other countries. Secondly, statistical and biological studies of billfish are initiated – in conjunction with the release and tag and release practice. Most of the billfish brought to the clubs provide an opportunity for biological studies, like biometric data and stomach-content analysis.

The present report contains analysis of the Cabo Frio sport fishery of billfish, including results such as catch by area, length, weight, stomach content and bycatch.

MATERIALS AND METHODS

The 91 individuals of billfish (blue marlin, white marlin and sailfish) and 40 individuals caught as bycatch (mari mari, yellowfin tuna and bigeye tuna) were tagged and released or sampled in the Iate Clube do Rio de Janeiro, in Cabo Frio from 1995 to 2000 (December to February).

Length-weight relationship for billfish was based on the Table of Instituto de Pesca (SP). In order to establish a relationship between length and weight, billfish data were recorded and send to Instituto de Pesca (SP).

The 3,600² -mile fishing area based on *Carta Náutica, DHN n° 1500* was divided in equal parts. Subsquare 42/23-2 means longitude of 42° W and latitude of 23° S - subsquare 2 (Figure 1).

The logbooks of ICRJ, and also anglers' interviews during billfish tournaments were used to obtain the fishing area and effort of yachts.

Blue marlin of large size and almost all other billfish that were brought to the yacht club had their stomach content collected, as did the bycatch such as mari mari and tunas. The billfish stomach content index was estimated following Netto (1991) as: Dominant (>15%), Abundant (7-15%), Medium (1-7%), Few (0.1 –1%) and Rare (0.0001-0.1%).

RESULTS AND DISCUSSION

Fishing areas

Tables 1 to 5 show the subsquares of the fishing area and the respective species caught or released.

Length-weight relationship

The length-weight relationship for Blue Marlin Table (Amorim and Arfelli 1995) gave 270 cm corresponding to 200 kg, the minimum weight (Table 6). The sailfish correspondence (Amorim and Arfelli 1995) was 18 kg for 160 cm (Table 7).

Billfish stomach content

Most of the billfish caught were blue marlin, with sixty-nine individuals and 76% occurrence, followed by sailfish, with twenty-one individuals and 23% , and then by white marlin, with 1% and only one fish.

Sixty-nine blue marlin stomachs were examined, of which 56 were full and 13 were empty (Table 8). The stomach examinations showed three individuals of jacks: *Katsuwonus pelamis*, *Auxis thazard* and *Euthynnus alletteratus*, as well as specimens of *Coryphaena hippurus*, *Canthidermis sufflamen*, *Exocoetus volitans* and *Thunnus obesus*. Stomach context index values calculated following Netto (1991) are given in Table 9.

Twenty-one sailfish stomachs were examined, 17 of which were full and 4 were empty (Table 10), showing five different species: *Chilomycterus spinosus*, *Exocoetus volitans*, *Caranx crysos*, *Sardinella brasiliensis*, and *Genypterus brasiliensis* (Table 11).

The stomach of the only white marlin caught was empty (Table 12).

By catch stomach content

Caught as bycatch were mari mari (*Coryphaena hippurus*) with 60% of occurrence and 24 individuals, yellowfin tuna (*Thunnus albacares*) with 35% and 14 individuals, and bigeye tuna (*Thunnus obesus*) with 5% and two individuals.

Twenty-four mari mari stomachs were examined, with 14 full and 10 empty ones (Table 13). The following species were found in the mari mari stomachs: *Trachurus lathami*, *Trichiurus lepturus*, *Exocoetus volitans*, *Katsuwonus pelamis*, *Monacanthus ciliatus*, *Lagocephalus laevigatus* and *Sardinella brasiliensis* (Table 14).

Fourteen yellowfin tuna stomachs were examined, all full (Table 15). The stomach contents were: *Canthidermis sufflamen*, *Trachurus lathami* and *Katsuwonus pelamis* (Table 16).

The 2 bigeye tuna stomachs examined were full (Table 17), containing *Chilomycterus spinosus*, and *Katsuwonus pelamis* (Table 18).

CONCLUSIONS

The billfish and bycatch analysis of stomach contents revealed different pelagic species and sizes of very common occurrence in the region during all seasons of the year.

Jacks *Katsuwonus pelamis*, *Auxis thazard* and *Euthynnus alletteratus*, were often found in the stomach content of Blue marlin. Sailfish preference species were *Chilomycterus spinosus*. *Caranx crysos* and *Exocoetus volitans*. Mari mari showed preference for *Trachurus lathami*, *Trichiurus lepturus* and *Exocoetus volitans*.

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Table 1. Species caught or released in subsquare 41/23-1.

Species	Yield %
<i>Istiophorus platypterus</i>	6.78
<i>Makaira nigricans</i>	2.86
<i>Tetrapturus albidus</i>	1.45
Total = 11.09%	

Table 2. Species caught or released in subsquare 41/23-3.

Species	Yield %
<i>Istiophorus platypterus</i>	8.57
<i>Makaira nigricans</i>	46.63
<i>Tetrapturus albidus</i>	0.25
Total = 55.45 %	

Table 3. Species caught or released in subsquare 41/23-4.

Species	Yield %
<i>Istiophorus platypterus</i>	2.58
<i>Makaira nigricans</i>	1.07
<i>Tetrapturus albidus</i>	0
Total = 3,65 %	

Table 4. Species caught or released in subsquare 41/23-2.

Species	Yield %
<i>Istiophorus platypterus</i>	23.50
<i>Makaira nigricans</i>	0
<i>Tetrapturus albidus</i>	0.59
Total = 24.09 %	

Table 5. Species caught or released in subsquare 43/23-2.

Species	Yield %
<i>Istiophorus platypterus</i>	5.72
<i>Makaira nigricans</i>	0
<i>Tetrapturus albidus</i>	0
Total = 5.72 %	

Table 6. Length-weight relationship for *Makaira Nigricans*.

250 cm	150 Kg
270 cm	200 Kg
Total weight = 7.10^{-7} Length ^{3.47}	

Table 7. Length-weight relationship for *Istiophorus platypterus*.

170 cm	22 Kg
165 cm	20 Kg
160 cm	18 Kg
Total weight = 8.10^{-7} Length ^{3.37}	

Table 8. Stomachs examined for blue marlin.

Full	Empty	Total
56	13	69

Table 9. Stomach contents for blue marlin.

Vulgar name	SPECIES		QUANTITIES	
	Latin name	%	Index	
Atlantic little tuna	<i>Euthynnus alletteratus</i>	40	D	
Skipjack tuna	<i>Katsuwonus pelamis</i>	19	D	
Frigate tuna	<i>Auxis thazard thazard</i>	16	D	
Mari mari	<i>Coryphaena hyppurus</i>	10	A	
Filefish	<i>Canthidermis sulfflamen</i>	5	M	
Flyingfish	<i>Exocoetus volitans</i>	5	M	
Bigeye tuna	<i>Thunnus obesus</i>	5	M	

Table 10. Stomachs examined for sailfish.

Full	Empty	Total
17	4	21

Table 11. Stomach contents for sailfish.

Vulgar name	SPECIES		QUANTITIES	
	Latin name	%	Index	
Spiny boxfish	<i>Chilomycterus spinosus</i>	40	D	
Flying fish	<i>Exocoetus volitans</i>	26	D	
Blue runner	<i>Caranx crysos</i>	20	D	
Sardine	<i>Sardinella brasiliensis</i>	7.4	A	
Conger	<i>Genypterus brasiliensis</i>	6.6	M	

Table 12. Stomachs examined for white marlin.

Full	Empty	Total
0	1	1

Table 13. Stomachs examined for “mari mari”.

Full	Empty	Total
14	10	24

Table 14. Stomach contents for “mari mari”.

Vulgar name	SPECIES	QUANTITIES	
	Latin name	%	Index
Rough scad	<i>Trachurus lathami</i>	23.2	D
Largehead hairtail	<i>Trichiurus lepturus</i>	19.3	D
Flyingfish	<i>Exocoetus volitans</i>	15.5	D
Skipjack tuna	<i>Katsuwonus pelamis</i>	13.5	A
Fringed filefish	<i>Monacanthus ciliatus</i>	10.6	A
Smooth puffer	<i>Lagocephalus laevigatus</i>	9.3	A
Sardine	<i>Sardinella brasiliensis</i>	8.6	A

Table 15. Stomachs examined for yellowfin.

Full	Empty	Total
14	0	14

Table 16. Stomach contents for yellowfin.

Vulgar name	SPECIES	QUANTITIES	
	Latin name	%	Index
Filefish	<i>Canthidermis sulfflamen</i>	55.64	D
Rough scad	<i>Trachurus lathami</i>	22.18	M
Skipjack tuna	<i>Katsuwonus pelamis</i>	22.18	M

Table 17. Stomachs examined for bigeye.

Full	Empty	Total
2	0	2

Table 18. Stomach contents for bigeye.

Vulgar name	SPECIES	QUANTITIES	
	Latin name	%	Index
Spiny boxfish	<i>Chilomycterus spinosus</i>	85.7	D
Skipjack tuna	<i>Katsuwonus pelamis</i>	14.3	A