

# Characterization of Serra Fishing, (*Scomberomorus brasiliensis*, Collette, Russo & Zavalla-Camin, 1978), In The Amazon Coastline

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**Abstract**— The present study aims to characterize the production of Serra *Scomberomorus brasiliensis* fisheries from the Amazon coast, through historical analysis (1997 to 2007). The capture fishery of Serra *Scomberomorus brasiliensis* on the Amazon coast has great socio-economic importance in fishing communities. Landings, species production during the period, types of vessels, fishing gear were evaluated, verifying the quantity and seasonality of landings based on the database of samples from the National Center for Research and Conservation of Marine Biodiversity of the North (CEPNOR). The research is of an interdisciplinary type and the data were analyzed separately by landing with the aid of spreadsheets and the STATISTICA 7 program. Total landing numbers were observed in the Serra fishing, which totaled 12,360 landings per year. The production landed in this fishery generated a total of 15,298,019 kg of fish, of this total 6,899,516 kg corresponds to the capture of the mountain range. However, continuous studies with a more biological and ecological approach are needed to ascertain the situation of the fishing in the mountains and, therefore, the implementation of public policies aimed at the preservation and conservation of the species.

**Keywords**— Fisheries, Fishery Resources, *Scomberomorus brasiliensis*.

## I. INTRODUCTION

Fishing is an activity from the beginning of the history of man in the world, in which the act of fishing allows for reliable food for different peoples, contributing significantly in times of agricultural scarcity, in the difficulties of collecting different foodstuffs (SALDANHA, 2019 ).

Fisheries in Brazil occupy around 800 thousand workers, including fishermen and aquaculturists, who generate 3.5 million jobs, with production of approximately 1.25 million tons of fish and Gross Domestic Product of R \$ 5 billion (SEDREZ et al , 2018).

In Brazil, commercial fishing is practiced along the entire coastline, which extends over more than 8,500 km from the coast, thus presenting high social and economic

importance for a huge contingent of workers in the regions. The fishing activity is governed by Law 11,959, of June 29, 2009, which provides for the National Policy for the Sustainable Development of Aquaculture and Fisheries.

In 2010, Brazil was in 25th place among the 30 countries with the best production of fish caught both marine and continental, registered a production of 785,366 tons less than the production of 2009 with 825,164 tons (MPA, 2011).

It is important to know the fishing productive chains in order to be successful in relation to measures for ordering and managing fisheries in Brazil. As well as the development of new public policies in the management of the use of fisheries resources in a sustainable way in the

country. The continuous generation of data and statistical information is necessary to boost government action and research towards the management of the sector, since the last data available on the situation of fishing in Brazil was in 2011 through the Fisheries and Aquaculture Statistical Bulletin.

The North Coast of Brazil, also called the Amazon Coast, is 2,250 km long and covers the coastal areas of the states of Pará, Amapá and Maranhão, and has great potential in fishing in general, due to the huge amount of nutrients that are it originates through the mangroves, influenced by the hydrological dynamics of the discharges from the Amazon River and facilitating the life of many aquatic organisms and consequently the exploitation of the fishing resources of these regions (MOURÃO et al., 2009).

On the northern coast of Brazil, different fishing modalities and scales are observed, for example, industrial or large-scale fishing involving vessels with sophisticated navigation and capture equipment capable of reaching distant ocean areas is easily identifiable by its specificity, purpose and economic importance, which facilitates the monitoring of this activity. Small-scale or artisanal fishing is characterized by its diversity in the use of capture methods, fishing power and purpose, it has more than one target resource and fishing power and purpose, (local, regional, national and international markets) , and for this reason, they are difficult to manage (BENTES et al., 2012).

The capture fishery of the mountain range, *Scomberomorus brasiliensis* COLLETTE, RUSSO & ZAVALLA-CAMIN, 1978, on the Amazon coast has a great socio-economic importance in fishing communities. Mountain fishing presents seasonal variations in its production, observable migrations towards the northern and northeastern Brazilian hemisphere. With different fleets from several states and countries, it is verifiable that there are no management policies for saw stocks. On the coast of Pará, the species *S.brasiliensis* stood out among the species of great economic importance in 2007, being responsible for 8% of the marine / estuarine production landed in the state (ESPÍRITO-SANTO, 2012).

The coast of Pará occupies the third position in terms of landing volume of the *S. brasiliensis* mountain range, contributing 9% of the total production of the state. With regard to catch vessels of this species, most are made with small motorized vessels, using a gillnet with a mesh of 40 to 60 mm, with a maximum length around 9,000 m, and the income resulting from this fishing is on average between 0, 8 and 2.3 minimum wages (SILVA et al., 2014).

The objective of the work is to characterize the fishing of the *S. brasiliensis* mountain range from the Amazon coast through the historical analysis from 1997 to 2007, based on the database of samples from the National Center for Research and Conservation of Northern Marine Biodiversity (CEPNOR).

## II. METHODOLOGY

The study area is the Brazilian Amazon Coastal Zone (ZCAB), located specifically between the mouth of the Oiapoque River in Amapá and the São Marcos Bay in Maranhão (Figure 1). Measuring about 2,250 km in length, the ZCAB is a high-energy region, in which environmental processes derived from the high discharge of continental waters loaded with particles and sediments interact (SILVA, 2019). The Amazon coast is an environment of great importance for fishing, they are the largest producers of fish originating from marine fishing, contributing with approximately 24% of national production (MPA, 2011). It covers an ecosystem of wide biodiversity of fishery resources and presents industrial and artisanal fleets that have different characteristics for their purpose (ESPÍRITO-SANTO and ISAAC, 2012).

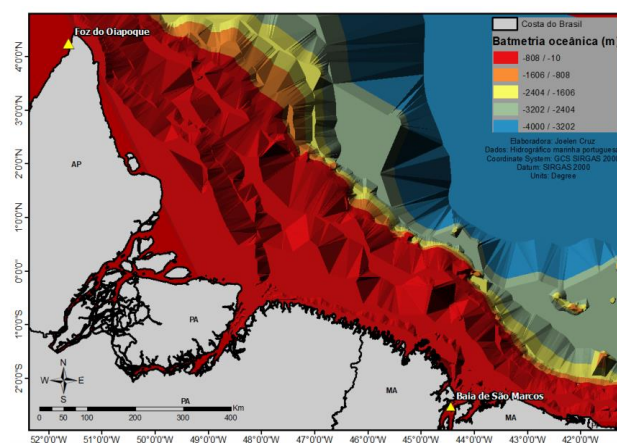


Fig 1: Amazonian coastline with oceanic bathymetry, highlighting the extension points (Foz do Oiapoque - AP and Baía de São Marcos - MA).

Source: Silva, 2019.

The species of study Serra *S. brasiliensis*, has a neritic pelagic characteristic with coastal habits, has a tapered and thin body, relatively short head and small scales, with bluish back, silver flanks with golden dots and white ventral portion. wide distribution, occurring in the Western Atlantic, the Caribbean and Central America and reaching the southern limit of Brazil (COLLATE and RUSSO, 1984).

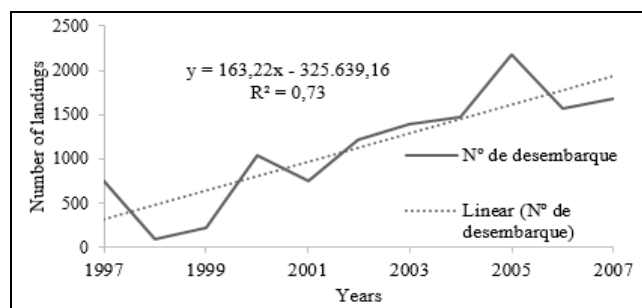
Primary data from 1997 to 2007 were used, obtained through the Center for Research and Management of Fisheries Resources on the North Coast (CEPNOR) by the project “Ecosystem Assessment of Demersal and Pelagic Fisheries Resources on the North and Northeast Coasts: Subsidies for Fisheries Management Sustainable.

### III. RESULTS AND DISCUSSIONS

The Amazon coast includes the states of Amapá, Pará and Maranhão, has an abundance of fishing resources and adequate capacity to exploit these resources (MOURÃO, 2009). They are the largest producers of fish from marine catch fisheries, contributing approximately 24% of national production (MPA, 2011).

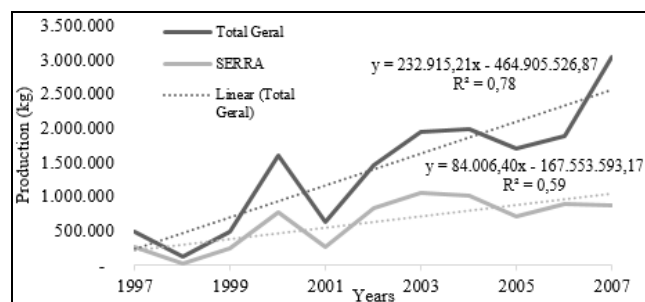
According to CEPNOR data, total landings in fisheries where saws occurred in the years 1997 to 2007, totaled 12.360 landings. The year with the highest number of landings was 2005 with 2.183 landings, followed by 2007 with 1,686 landings. In addition, there was a slight decline between 2005 (2.183) and 2006 (1.571), however, in general, there is a positive linear trend line with a positive correlation, where  $R^2 = 0.73$  (Graph1).

Graph1: Number of landings by the fishing fleet on the Amazon coast, from 1997 to 2007.



According to CEPNOR data, mountain fishing and its accompanying fauna on the Amazon coast showed a total production of 15.298,019 kg of fish, whereas *Scomberomorus brasiliensis* mountain fishing showed 6.899,516 kg of this total, 2007 was the most productive year. with a production of 3.031,781 kg, already the second and third largest production were in the years 2004 and 2003 with 1.983,001 kg and 1.940,089 kg, respectively. However, when analyzing only the production of the saw, it is noted that the most productive year was 2003 with 1.055,612.5 kg of fish and the following years there is a slight decline in the production by sawing Serra (Graph 2).

Graph 2: Productivity of mountain fishing and accompanying fauna in kg, during the years 1997-2007; compared to only saw landings



A positive linear trend line of production per year is observed, with a positive correlation where  $R^2$  is equal to 0.78. However, Serreira production has a positive linear trend in production per year with a correlation of 0.59 (Figure 5). The mountain has great socio-economic importance on the Amazon coast represented by the States of Pará, Amapá and Maranhão. In Pará, the mountain is the third in terms of landed volumes, with 9% of total production and an average of 7.793 t during the period from 1997 to 2007 (IBAMA, 2011). However, a slight decline is noted, which was also evidenced in the work of (BENITAH et al., 2014).

The municipality of Salinópolis presented the highest number of landings with 3.350 total landings, and production of 564,182 kg considered the 7th largest, in percentage generated 4% of production with an average of 168.41 kg. The municipality of São João de Pirabas was the second largest in number of landings with 2.271 and higher production among the municipalities with 7.299,861 kg, representing a percentage of 48% (Table 1).

The municipality of Augusto Correia was the third largest in landings with 1,874 landings and production of 2.095,987 kg representing 14% of production. The municipality of Bragança had a total of 1.701 landings and the second largest production with 2.404,877 kg representing 16% of production. The municipality of Curuçá represented 5% of landings and 6% of production, while the municipalities of Belém and Vigia presented 3% and 5% of landings, respectively, both with 5% production. Therefore, it is clear that the municipality that obtained the best production performance was São João de Pirabas (48%) and second in landings (18%) (Table 1).

Table 1: List of municipalities by number of landings and production.

Counties	Nº. of landings	Nº. of landings%	Production (kg)	Production %	Average production (kg)
Augusto Correia	1.874	15%	2.095.987	14%	1.118,46
Belém	395	3%	721.039	5%	1.825,42
Bragança	1.701	14%	2.404.877	16%	1.413,80
Colares	35	0%	3.712	0%	106,06
Curuçá	642	5%	855.934	6%	1.333,23
Maracanã	304	2%	252.202	2%	829,61
Marapanim	438	4%	58.070	0%	132,58
Quatipuru	139	1%	113.297	1%	815,09
Salinópolis	3.350	27%	564.182	4%	168,41
Salvaterra	47	0%	4.919	0%	104,66
São Caetano Odivelas	267	2%	154.503	1%	578,66
São Joao Pirabas	2.271	18%	7.299.861	48%	3.214,38
Soure	160	1%	15.168	0%	94,80
Vigia	641	5%	726.838	5%	1.133,91
Viseu	96	1%	27.431	0%	285,74
<b>Grand total</b>	<b>12.360</b>	<b>100%</b>	<b>15.298.019</b>	<b>100%</b>	<b>1.238</b>

According to the data analyzed, it was found that the small boat (Bpp) obtained the highest percentages of landing and production, 64% (7,882) and 76% (11,600,567 kg) respectively. The medium-sized boat (Bmp) presented 9% (1,114) and 17% (2,577,209 kg) of production. The Bmp presented 6,617 fishermen on its vessel and 14,257 fishing days. Despite the canoe (Can) presenting 15% (1,836) of landings, it obtained only 1% (205,064 kg) of production. The motorized canoe (Cam) obtained 8% (1,022) of landings and 3% (484,822 kg) of production (Table 2).

Thus, it is evident that the fisheries that capture the mountain range, *Scomberomorus brasiliensis*, are concentrated mainly in small vessels (Bpp, Cam, Can and Mon) totaling 80% of production, this fishery being characterized as small scale artisanal, information corroborated by Isaac et al. (2009).

Table 2: Types of vessels by quantities of landings and production (kg).

Type of vessel	Nº of landings	Nº of landings %	Production (Kg)	Production %	Average Production (Kg)	Production Máx. / Mín.	Dev. Pad.
Bin	15	0%	381.980	2%	25.465	42.037/ 264	16.235
Bmp	1.114	9%	2.577.209	17%	2.313	26.173/ 148	2.041
Bpp	7.882	64%	11.600.567	76%	1.472	16.180/ 5	1.503
Cam	1.022	8%	484.822	3%	474	714/ 7	642
Can	1.836	15%	205.064	1%	112	2.373/ 11	129
Mon	491	4%	48.378	0%	99	2.427/ 7	161
<b>Grand total</b>	<b>12.360</b>	<b>100%</b>	<b>15.298.019</b>	<b>100%</b>	<b>1.238</b>	<b>42.037/ 5</b>	<b>1.814</b>

The Serreira type gillnet is the most used fishing gear in mountain fishing, representing 78% (9,674) of landings and 69% (10,630,513) of total production. According to Mourão et al (2014), the Serreira network is made with monofilament yarn and has a mesh size ranging between 40 and 60 mm, measured between adjacent nodes (Table 3).

The gillnet and line represented 9% (1,078) of shipments and 21% (3,268,226) of production. The Gozeira chain presented 9% (1,108) of landings and 3% (503,764) of production. These three types of fishing gear accounted for 93% of production and 96% of landings. According to the official data made in 2005, which obtained a total registration of 16,678 units in the three states of the north coast of Brazil, of which 5,136 (31%) work with gillnets (IBAMA, 2007) (Table 3).

Table3: Number of total landings and percentage, total production, percentage and average per gear.

Fishing Art	Nº of landings	Nº of landings %	Production (Kg)	Produção %	Average Production (Kg)
Arrasto	12	0%	381.146	2%	31.762
Piramatuba	3	0%	2.479	0%	826
Boinha/Pargo	1	0%	490	0%	490
Caique/Pargo	41	0%	7.887	0%	192
Curral	9	0%	1.734	0%	193
Curral E Rede	69	1%	31.448	0%	456
Espinhel/Bagre	12	0%	12.139	0%	1.012
Espinhel/Tubarão	1.108	9%	503.764	3%	455
Gozeira	46	0%	9.417	0%	205
Linha E Anzol	6	0%	11.257	0%	1.876
Manzua Peixe	12	0%	37.129	0%	3.094
Pargueira	4	0%	5.770	0%	1.443
Pargueira E Manzua Peixe	166	1%	232.539	2%	1.401
Pescadeira	1.078	9%	3.268.226	21%	3.032
Rede De Emalhar E Linha	118	1%	161.630	1%	1.370
Rede E Espinhel	9.674	78%	10.630.513	69%	1.099
Serreira	1	0%	452	0%	452
Zangaria	1	0%	452	0%	452
<b>Grand total</b>	<b>12.360</b>	<b>100%</b>	<b>15.298.019</b>	<b>100%</b>	<b>1.238</b>

Through the data, the 10 most productive species were observed in landings from 1997 to 2007 where the saw was captured. Serra *Scomberomorus brasiliensis* contributed (45%), Tubarão *Carcharhinus* (9%), Timbira *Oligoplites palometa* (6%), Bonito *Katsuwonus pelamis* (5%), Uritinga *Arius* proops (4%), Bijupira *Rachycentron canadum* (4%), Canguira *Trachinotus* spp. (4%), Bandeirado *Bagre* catfish (3%), Corvina *Cynoscion microlepidotus* (2%) and Coraximbora *Caranx latus* (2%), which achieved a combined productivity of 12,984,787 kg (80%) (Figure 2).

The mountain, between 1997 and 2007, obtained 45% of production and the remaining 55% corresponded to its accompanying fauna. In the work of Mourão et al (2014), the fauna accompanying the fishing directed to the capture of mountains had as main representatives Corvina *Cynoscion microlepidotus*, Bandeirado *Bagre* bagre, Timbira *Oligoplites palometa*, Mullet *Mugil curema*, mackerel *Scomberomorus cavalla* and *carcharhinus* e *Sphyrna* (Figure 2).



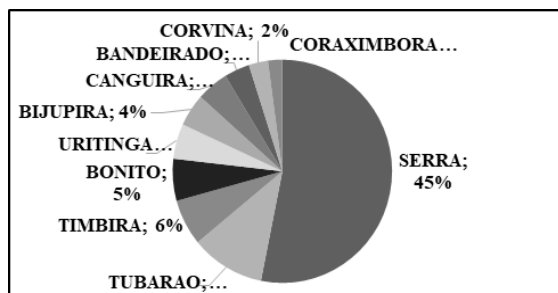


Fig.2: The 10 most productive species on landings from 1997 to 2007 directed to the capture of mountains.

#### IV. CONCLUSION

The fishing of the *Scomberomorus brasiliensis* and the like between 1997 and 2007 totaled 12,360 landings with one of 15,298,019 kg of fish, of this total 6,899,516 kg corresponds to the capture of the saw.

The municipality of São João de Pirabas was the most productive, with 48% of production and second in landings. It is important to mention that the Bragança Region composed of the municipalities Bragança, Augusto Correia and Viseu accounted for 30% of landings and production.

The fisheries that capture the mountain range, *Scomberomorus brasiliensis*, are mainly concentrated in small vessels (Bpp, Cam, Can and Mon) totaling 80% of production.

In the fishing of the mountains the fishing gear of the Serreira type, gillnet and line and the Gozeira type net are mainly used. The Serreira type gillnet accounted for 78% of landings and 69% of total production, the most used in mountain fishing.

Serra *Scomberomorus brasiliensis* contributed 45% of production in the fisheries where it occurred, and 55% of production corresponded to other species. The ten species of importance in the production after the saw were the following species: Tubarão *Carcharhinus*, Timbira *Oligoplites palometa*, Bonito *Katsuwonus pelamis*, Uritinga *Arius proops*, Bijupira *Rachycentron canadum*, Canguira *Trachinotus* spp., Bandeirado *Bagre bagre*, Corvina *Cynoscion microlepidus* and *Microlepidus*.

It is evident and necessary to continue collecting production data by census of fishing landings, in addition to continuous biological and ecological studies in order to have more accurate data about fishing for this species in Brazil, especially for public policies and legislation to be implemented. that contribute to guarantee the continuous exploitation of this fishing resource, aiming at the preservation and conservation of the species, since a

situation of slight decline in the production of the *Scomberomorus brasiliensis* mountain range has been observed in recent years.

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