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Target fishes from subsistence fishing in a riverine community from lower Pará River, Northern Amazonia

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Abstract

The goal of the present study was to realize an inventory of target fish of the subsistence fishery from Genipaúba Village, Santa Bárbara do Pará, Brazil. The inventory was carried out during local fisheries throughout the main river between March and April 2018. The collections were performed with gillnets of 25 to 40 mm of mesh size, and length variable according to fisherman. The collected specimens were preserved in 10% formaldehyde and posterior wash in running water to preservation in 70% alcohol solution. In the laboratory all fish were identified to the current taxonomic species level, measured in standard length (cm), and in total weight (g), then cataloged in the fish collection of the Aquatic Ecology Group at Federal University of Pará (GEA-UFPA). Overall 19 fish species belonging to 13 families and five taxonomic orders were recorded. Most individuals were represented by species (family), the South American silver croaker *Plagioscion squamosissimus* (Sciaenidae), Yellowfin river *Pellona Pellona flavipinnis* (Pristigasteridae), Mapará *Hypophthalmus marginatus* (Pimelodidae), Driftwood catfish *Trachelyopterus galeatus* (Auchenipteridae). Some important species for commercial trade were recorded as well, such as the Goliath catfish *Brachyplatystoma filamentosum* (Pimelodidae) and the Common snook *Centropomus undecimalis* (Centropomidae). In spite of the collections consisting of few species, the study is the first inventory of the most common fish species used by riverines from Pará River for subsistence.

Keywords: Neotropical region, taxonomic inventory, ichthyofauna, fisherman

Introduction

Small and/or large scale fishing has a huge influence in the economic activities in the Amazon region [1]. Initially, this fishing was focused on the livelihood of riverside families and over time the focus has shifted to the consumer market [2, 3, 4]. In particular, in the Amazonian region, the fishery stands out in relation to the other Brazilian regions, due to greater diversity of exploited species, the highest fishery yield, just like in dependence of the traditional population on this activity [5, 6, 7]. The target of this fishery is fish for the subsistence of the riverside communities, where it is usually characterized by the participation of few fishermen who use few kinds of fishing gear such as gillnets and/or castnets, mainly due to its easy handling and maintenance [8-42]. Whether for subsistence or fish trade, fishermen generally use small boats due to the easy navigation into small stretches of river, lowland areas and other habitats of difficult access, but the small boats make limited productions [9]. The impediment of small storage, the cheap fish are sold at very low cost to make it easy to sell or discarded in order to store species with greater commercial value only [10]. Additionally, the fish surplus is traded, which is the main actor in this process is the “middlemen” (“atravessadores” in Portuguese) who mediate the sale seeking the markets of urban centers [11, 12].

In addition to fishing aimed for protein consumption in the Amazon, ornamental fishing stands out, which is a modality focused on capturing small fish species destined for aquariums [13, 14]. In some regions it is exclusively artisanal, developed by the traditional knowledge of fishermen called “piabeiros” [15]. Among the consumer markets such as Japan, USA, and Germany stand out [16, 17]. However, the target species of this type of fishery have high mortality rates, due to stress of capture, management and conservation until the final destination, so the capture is characterized by high abundances.

The knowledge status about fish fauna destined for trade is generally derived from surveys of fishing landings, which provides a limited insight of them [18, 19]. In this way, surveys of the fish fauna in locu better contribute with the knowledge of species with commercial value, destined for subsistence, and ornamental species [20, 21]. It is worth mentioning that fishing in the Amazon basin has been a recurring subject for the scientific community and, especially, in its estuarine stretch due to the high increase of recruits to fishery stocks [22, 23, 24, 25]. For this, the estuarine zones are considered the high priority areas for conservation and protection, thus guaranteeing fisheries viability for future generations [26, 27]. In this context, the aim of the present study was to contribute with the knowledge of ichthyofauna of the main tributaries of the Pará River in Marajó Bay, Northern Brazil.

Material and Methods

The study was carried out in tributaries of the Pará River, near to the Genipaúba village (01°13'25 "S e 48°17'40" W) in the Belém municipality (1 ° 27 ' 18 "S e 48 ° 30 ' 9" W). The city is located in the Estuary of the Marajó Bay (Fig. 1) with tributaries such as the Furo da Marinha River in Mosqueiro Island [28]. The region represents the highest precipitation between January and June, and the lowest between July and December. Besides that, this Estuary is characterized by a transition zone between fluvio-marine (i.e., salinity between 5 to 18), where the semidiurnal tide effect extends for several

kilometers upstream river [29, 30, 31]. The predominant vegetation is mangrove of *Rhizophora mangle* L., *Avicennia germinans* (L.) L. and *Conocarpus erectus* L. [32].

Samples were carried out during March and April 2018 in cooperation with local fishermen and at two points along the estuaries of Ceará and Tauá River. Fish were caught using gillnets of three different mesh sizes (25, 30 and 40 mm stretch mesh size), and to better capture fish species, gillnets were placed at river banks during 12 h on average (with verification every 6 h). The fresh samples were immediately chilled in ice on site and fixed with 10% formalin solution upon arrival at the laboratory and deposited in the ichthyological collection of the Aquatic Ecology Group at Federal University of Pará (institutional catalog code GEA available in Table 1). Fish identification was based on specific literature [33, 34, 35], and individually measured (standard length SL, and total length, TL) to the nearest 0.1 cm and weighed (total wet weight, W) at a precision of 0.1 g. The fish species were classified according to their trophic guild (TG) following [36] and [37] as: zooplanktivore (ZP), detritivore (DV), piscivore (PV), zoobentivore (ZB), herbivore (HV), oportunist/omnivore (OP), piscivore/zoobenthivore (PV/ZB), and insectivore (IS). Additionally, they were classified according to estuarine use (EU), [37] as: marine stragglers (MS); marine migrants (MM); estuarine species (ES); freshwater migrants (FM), and freshwater stragglers (FS).

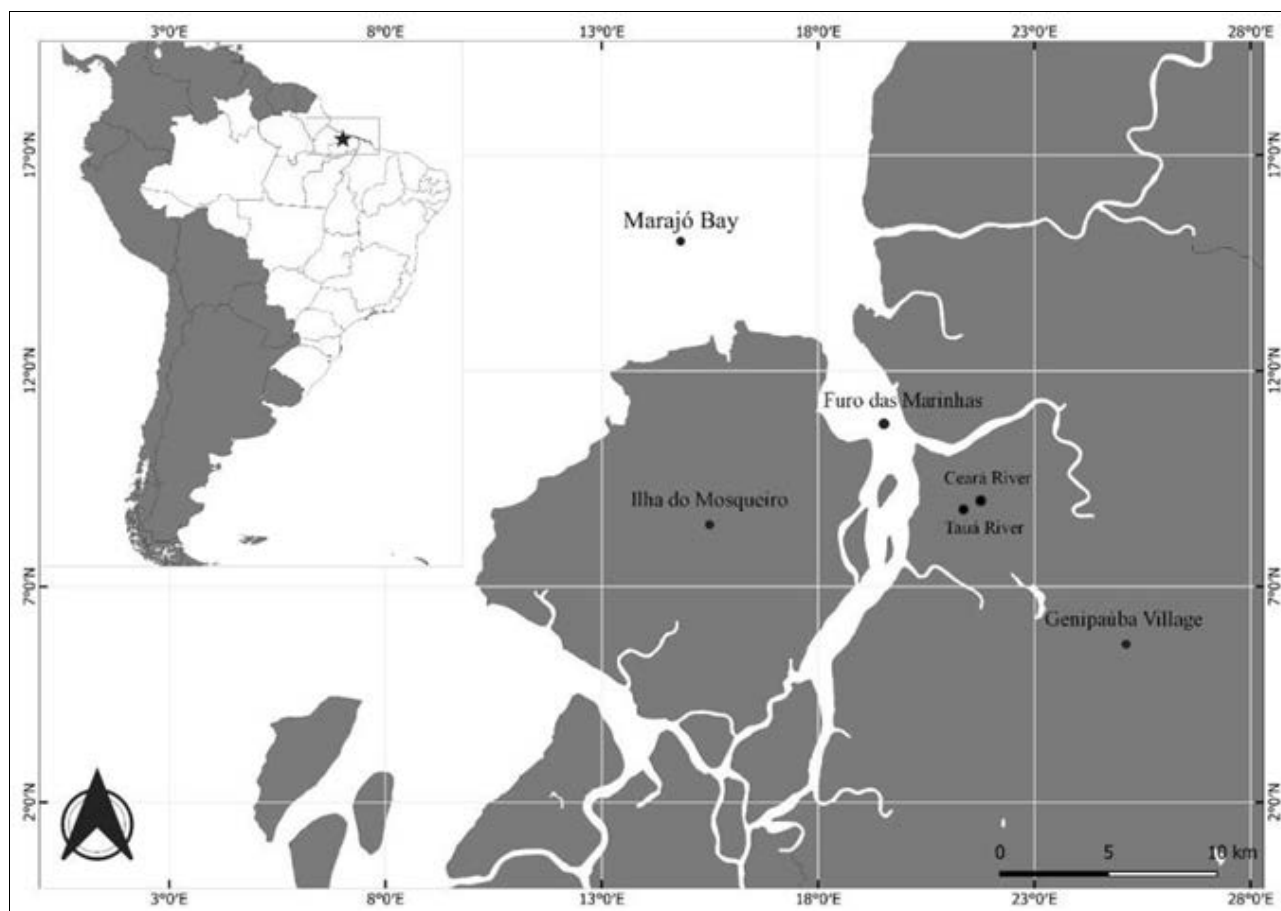


Fig 1: Study area in Ceará and Tauá Rivers, Santa Bárbara do Pará at Marajó Bay, Brazil.

Results

Overall, 91 specimens representing 19 different fish species belonging to 14 families and five orders were captured by artisanal fishermen in estuaries of Ceará and Tauá Rivers

(Table 1). The most diverse order was Siluriformes (six families and nine species collected), followed by Perciformes (three families and four species) (Table 1).

The order Siluriformes was best represented in our study (40

%), followed by the orders Clupeiformes (20 %), Perciformes (20 %), and others (20 %) (Fig. 2). The Sciaenidae was the best represented family (34.1% of specimens captured), followed by the families Aspredinidae (13.2 %) and Curimatidae (13.2 %), other families corresponded to 40% (Fig. 3).

Of the all caught species, a total of 10 are consumed by fishermen in the region and are also commercialized: *T. angulatus*, *P. atherinoides*, *B. bagre* (also used as bait for the fishery of *C. acoupa* - pescada-amarela), *H. marginatus*, *H. platyrhynchus*, *T. galeatus* (important to local consumption due to the large size), *P. auratus*, *P. squamosissimus*, *B. filamentosum*, and *C. undecimalis*. Five species are

considered to be of ornamental importance: *S. trigonocephalus*, *Hypostomus* sp., *H. plecostomus*, *G. proximus*, and *A. anablepis* (see photographs of some captured species in Fig. 4). Species of no importance for consumption and/or ornamental market were *P. amazonica*, *P. flavipinnis*, *A. tibicen*, and *L. grossidens*, they are usually used as bait to catch other fish. Considering estuarine use (EU) for each point of sample, were found more species freshwater stragglers (FS) totaling eight species and in sequence seven estuarine species (ES) from two trophic categories which were seven zoobentivore (ZB) and four piscivore/zoobenthivore (PV/ZB) (Table 1).

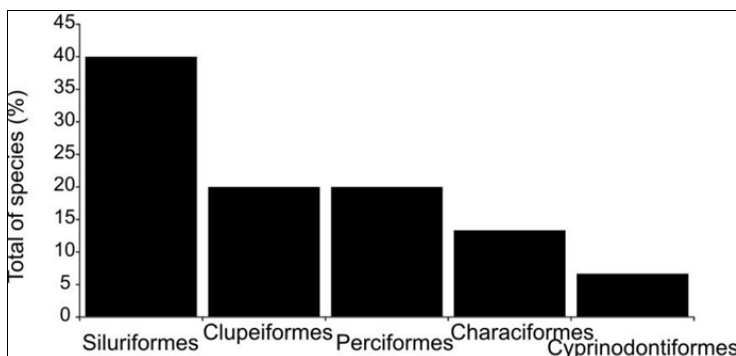


Fig 2: Percentages of the total number of sampled species in each order from Ceará and Tauá rivers, Santa Bárbara from Pará at Marajó Bay, Brazil.

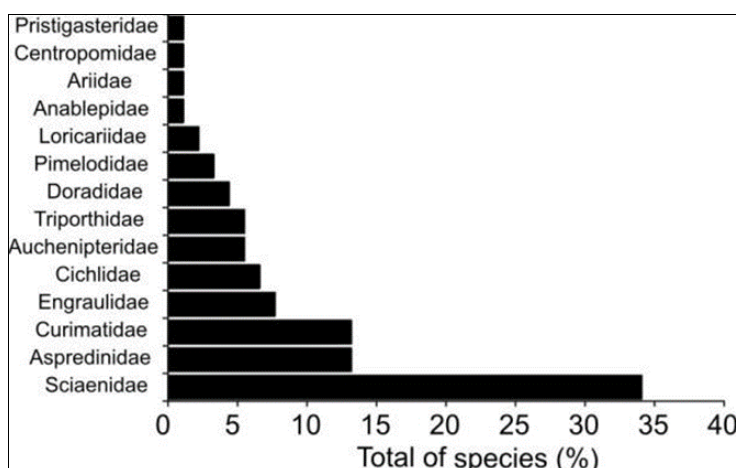


Fig 3: Percentages of the total number of sampled species in each family from Ceará and Tauá rivers, Santa Bárbara from Pará at Marajó Bay, Brazil.

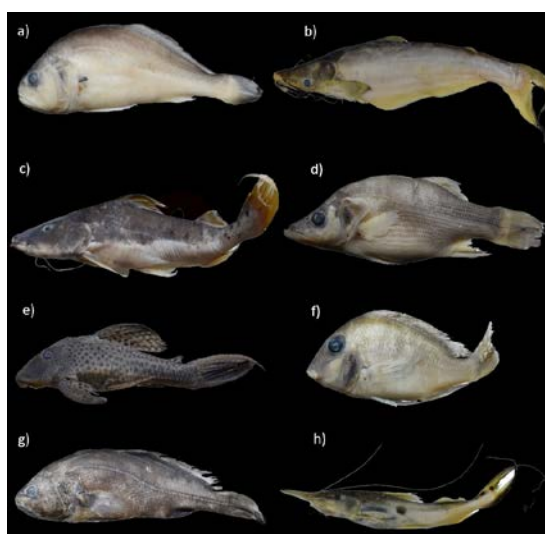


Fig 4: Some fish species representative from Ceará and Tauá rivers, Santa Bárbara from Pará at Marajó Bay, Brazil. a) *Plagioscion squamosissimus*, b) *Hypophthalmus marginatus*, c) *Brachyplatystoma filamentosum*, d) *Centropomus undecimalis*, e) *Hypostomus plecostomus*, f) *Geophagus proximus*, g) *Plagioscion auratus*, and h) *Hemisorubim platyrhynchus*.

Table 1: Taxonomic list, trophic guild (TG), estuarine use (EU), number of individuals (N), standard length (SL), total length (TL), and weight (W) of the samples from Ceará and Tauá rivers, Santa Bárbara from Pará at Marajó Bay, Brazil.

Orders/Family/Species	Common Name	TG	EU	N	SL (cm)	TL (cm)	W (g)	Voucher
Characiformes								
Curimatidae								
<i>Psectrogaster amazonica</i> (Eigenmann & Eigenmann, 1889)	Branquinha	D	FS	12	12.5-18.5	16-22.5	50-120	GEA 7333
Triportheidae								
<i>Triporthus angulatus</i> (Spix & Agassiz, 1829)	Sardinha-papuda	ZB	FS	5	17.5-23	21-28	65-145	GEA 7336
Clupeiformes								
Engraulidae								
<i>Lycengraulis grossidens</i> (Spix & Agassiz, 1829)	Sardinha	ZB	ES	5	8.5-11	10-13	10-20	GEA 7338
Pristigasteridae								
<i>Pellona flavipinnis</i> (Valenciennes, 1837)	Sarda	PV	FM	1	26	32	265	GEA 7339
<i>Pterengraulis atherinoides</i> (Linnaeus, 1766)	Sardinha	PV/ZB	ES	2	12-12.5	14.5-15.5	20-20	GEA 7349
Cyprinodontiformes								
Anablepidae								
<i>Anableps anableps</i> (Linnaeus, 1758)	Tralhoto	HV	ES	1	13	16	40	GEA 7343
Perciformes								
Centropomidae								
<i>Centropomus undecimalis</i> (Bloch, 1792)	Robalo	PV/ZB	ES	1	26	30	425	GEA 7341
Cichlidae								
<i>Geophagus proximus</i> (Castelnau, 1855)	Acará	OP	FS	6	10.5-13	12.5-16	40-75	GEA 7335
Scianidae								
<i>Plagioscion auratus</i> (Castelnau, 1855)	Pescada-preta	ZB	FS	1	18	23.5	130	GEA 7342
<i>Plagioscion squamosissimus</i> (Heckel, 1840)	Pescadinha ou Pescada-branca	PV	FM	30	15.5-25	19.5-28.5	65-210	GEA 7334
Siluriformes								
Aspredinidae								
<i>Aspredinichthys tibicen</i> (Temminck, 1840)	Rebeca	ZB	ES	12	16.5-25.5	20-26.5	20-40	GEA 7332
Ariidae								
<i>Bagre bagre</i> (Linnaeus, 1766)	Bagre	PV/ZB	MM	1	25.5	30.5	300	GEA 7344
Pimelodidae								
<i>Brachyplatystoma filamentosum</i> (Lichtenstein, 1819)	Filhote	PV	FM	1	27	35.5	305	GEA 7340
<i>Hypophthalmus marginatus</i> (Valenciennes, 1840)	Mapará	ZP	FM	1	28	35	115	GEA 7348
<i>Hemisorubim platyrhynchos</i> (Valenciennes, 1840)	Sorubim	ZB	MS	1	24	38	125	GEA 7346
Loricariidae								
<i>Hypostomus</i> sp.	Acari	ZB	FS	1	14	18	105	GEA 7350
<i>Hypostomus plecostomus</i> (Linnaeus, 1758)	Acari	ZB	FS	1	16	22	110	GEA 7345
Doradidae								
<i>Lithodoras dorsalis</i> (Valenciennes, 1840)	Bacu	HV	FS	3	12-14	14-17	40-40	GEA 7337
Auchenipteridae								
<i>Trachelyopterus galeatus</i> (Linnaeus, 1766)	Cachorro de padre	PV/ZB	FS	5	14-17	15.5-18.6	70-160	GEA 7347

Discussion

The stretches of river sampled had the predominance of the order Perciformes, followed by Siluriformes, Characiformes, Clupeiformes and Cyprinodontiformes. Since the abundance and richness of species can change according to the methodology used at the time of collection, in the effort of capture and period of the day and year [19, 11]. In this study, the fishing gear used (i.e., gillnets) was just that owned by the local fishermen. They use it due to their caught efficiency. However, this made it possible to observe which species are commonly caught due to higher selectivity of the fishing gear, because fishermen do not use a wide variety of meshes and also do not use more gears, such as longline, gillnets, among others.

Among the 14 families captured, the most representative

species in terms of abundance was *P. squamosissimus* known as "South American silver croaker" belonging to the family Sciaenidae. The abundance of this species was monitored throughout the study. The reproduction of the species occurs throughout the year, characterizing spawning with two annual peaks, between April and June in wet season, and between August and September in dry season [25, 38]. In the Amazonian region, this species has high commercial value in both freshwater and estuarine fisheries [39].

According to the fishermen's reports and based on the observed analysis of the samples, it was noticed that each type of mesh captures a specific type of fish, the 25 mm meshes capture small species, which in most cases do not if it has a commercial value. It was also observed the capture of many juvenile fish, such as *B. filamentosum* captured during this

study, which has high commercial value as an adult.

Estuarine habitats are used as breeding and nursery areas for many species of migratory fish^[27, 40]. This fact is corroborated by the presence in juvenile catches of *B. filamentosum* and *C. undecimalis*. These species are commonly found entering the estuaries, when salt variations are favorable, usually during periods of low rainfall^[39, 41], seed dispersal species are more common during the rainy season, for example the species *Lithodoras dorsalis* which was collected in this study^[42].

It was possible to observe during this study that the high presence of mangrove trees (e.g., *A. germinans*) and typical lowland percussion vegetation (e.g., *Machaerium lunatum*), showed high divergence in relation to habitats with less vegetation. In these areas, the capture of juvenile and adult fish of commercial value was highlighted by fishermen as essential areas for the community's subsistence.

In general, our study presents pioneering information for stretches of tributaries of the Marajó Bay, characterizing the main target species for the community's own consumption and trade, as well as basic information regarding the use of fluvial-estuarine areas by these species. Such observations are important for the development of conservation and management plans for these fish species. In addition, future studies should take into account a holistic approach to the analysis of iconic communities in different habitats in these fluvial-estuarine zones, still considering spatial and temporal variables, habitat connectivity, and recruitment of larvae.

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