



Using social media to describe catches of recreational fishing in an amazonian hotspot

Usando as redes sociais para descrever as capturas da pesca recreativa em um hotspot amazônico

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Abstract: Aim: We used social media posts to describe recreational fishing catches in Cachoeira Porteira, Trombetas River basin, Amazon. **Methods:** We analyzed images and videos publicly shared on Instagram between 2019 and 2024, identifying captured fish species, number of individuals, conservation status, and estimated body size. **Results:** We recorded 245 individuals belonging to 10 families and 18 species, with trophic groups carnivorous (55%) and piscivorous (34%) dominating the catch composition. The most frequently recorded species were *Cichla thyrurus* (37.2%) and *Hoplias aimara* (15.8%). Only 6% of individuals were caught below the first gonadal maturation size (L_{50}), composed of three species of large migratory catfishes (*Brachyplatystoma filamentosum*, *Zungaro zungaro*, and *Phractocephalus hemiliopterus*). However, *P. hemiliopterus* showed a high proportion of catches below its first gonadal maturation size L_{50} (42%). **Conclusions:** Recreational fishing in Cachoeira Porteira targets mainly large predatory fishes, generally at or above maturation size, but with a considerable proportion of immature large catfishes. Social media provides insights into catch composition and size structure, offering an alternative approach to investigate data-poor Amazonian fisheries.

Keywords: culturomics; digital fisheries data; Brazilian Amazon; freshwater sport fishing; catch and release.

Resumo: Objetivo: Usamos postagens em redes sociais para descrever as capturas da pesca recreativa em Cachoeira Porteira, bacia do rio Trombetas, Amazônia. **Métodos:** Analisamos imagens e vídeos compartilhados publicamente no Instagram entre 2019 e 2024, identificando as espécies capturadas, o número de indivíduos, o status de conservação e o tamanho corporal estimado. **Resultados:** Registramos 245 indivíduos pertencentes a 10 famílias e 18 espécies, com os grupos tróficos carnívoros (55%) e piscívoros (34%) dominando a composição das capturas. As espécies registradas com maior frequência foram *Cichla thyrurus* (37,2%) e *Hoplias aimara* (15,8%). Apenas 6% dos indivíduos foram capturados abaixo do tamanho de primeira maturação gonadal (L_{50}), compostos por três espécies de grandes bagres migradores (*Brachyplatystoma filamentosum*, *Zungaro zungaro* e *Phractocephalus hemiliopterus*). No entanto, *P. hemiliopterus* apresentou uma parcela considerável



de capturas abaixo de seu tamanho de primeira maturação gonadal L_{50} (42%). **Conclusões:** A pesca recreativa em Cachoeira Porteira tem como alvo principalmente grandes peixes predadores, geralmente em ou acima do tamanho de maturação, mas com uma proporção considerável de grandes bagres imaturos. As redes sociais podem fornecer informações sobre a composição das capturas e a estrutura de tamanhos como uma abordagem alternativa para investigações sobre pescarias amazônicas com baixa disponibilidade de dados.

Palavras-chave: *culturomics*; dados digitais da pesca; Amazônia brasileira; pesca esportiva em água doce; pesque e solte.

1. Introduction

Fishing is one of humanity's oldest extractive activities, with archaeological evidence indicating that early humans consumed fish and shellfish as early as 140,000 years ago (Marzano, 2020). Fishery resources are an important source of protein and macronutrients globally, providing food security and income (Lynch et al., 2016; Boyd et al., 2022; Eggertsen et al., 2024). In 2022, global fishing activities employed ~33.3 million people and generated USD 159 billion in revenues, producing 223.2 million tons of aquatic animals (FAO, 2024).

Despite their importance, inland fisheries are often underestimated due to spatial and temporal heterogeneity, as well as logistical challenges associated with data collection (FAO, 2024). The limited recognition of inland fisheries within the United Nations Sustainable Development Goals (SDGs) reinforces their marginalization in key policy frameworks (Funge-Smith & Bennett, 2019). Assessing fisheries production in inland waters remains a complex challenge (Giovos et al., 2018), as these systems exhibit high diversity of habitats, species, and environmental conditions, limiting the applicability of standard assessment approaches typically designed for marine fisheries (Lorenzen et al., 2016). In low- and lower-middle-income countries, monitoring of inland fisheries is often limited or absent from official statistics, primarily due to resource constraints and political neglect. This leads to underreporting, particularly in small-scale sectors such as subsistence and recreational fisheries (Freire et al., 2020; FAO, 2024).

Recreational fishing is a non-commercial activity often practiced with cultural significance (Santos & Scherer, 2023), providing leisure and recreational benefits to ~300 million people globally (Arlinghaus et al., 2019). In Brazil, recreational fishing generates ~2 billion USD annually and supports around 200,000 jobs (Brasil, 2023). Nevertheless, Brazil has not provided fishing data to FAO since 2015 (Zamboni, 2020; Valbo-Jørgensen & Machado, 2023). Estimating catches from inland fishing is even more challenging due to the absence

of integrated data across the country's river basins. A review found that only 10% of Brazilian recreational fishing studies focused on the Amazon, the large freshwater ecosystem in Brazil (Lubich et al., 2023), highlighting critical knowledge gaps.

In the digital age, marked by technological innovations such as virtual environments, digital services, and intelligent applications, science holds considerable potential to support nature conservation and management through connected digital tools (Arts et al., 2015). The vast amount of information produced by the digital revolution presents new opportunities for understanding human-nature interactions (Di Minin et al., 2015; Saliba et al., 2023). This growing body of data has fostered the development of *culturomics* (Ladle et al., 2016; Correia et al., 2021). *Culturomics* research is shaped by emerging scientific paradigms that emphasize the intensive use of digital media data to formulate meaningful questions and hypotheses (Correia et al., 2021). Social media platforms like YouTube, Facebook, and Instagram are increasingly being recognized as valuable tools for mining and compiling data. These platforms offer promising avenues for studying and monitoring both the social and ecological dimensions of fishing (Jarić et al., 2020).

Over the last decade, an increasing number of studies have used images posted on social media to investigate patterns and dynamics of recreational fishing (e.g., Giovos et al., 2018; Roos & Longo, 2021; Martinazzo et al., 2022). Such studies emphasize the growing use of social media as an alternative approach for compiling catch records and generating data on recreational fishing (Sbragaglia et al., 2023). For instance, a study conducted in the Mediterranean analyzed YouTube videos of blue hake, *Pomatomus saltatrix*, (Linnaeus, 1766) recreational fishing (Sbragaglia et al., 2020). The results showed that handline fishers caught larger fish than divers, highlighting the spatial and temporal dynamics of blue hake fishing. Similarly, in Brazil, Giglio et al. (2020) analyzed Facebook images to assess recreational spearfishing in the Abrolhos reefs, recording 25 species in which

43% belonged to those listed as threatened in the Brazilian Red List.

Here, we investigated recreational fishing catch patterns in Cachoeira Porteira, a hotspot of freshwater recreational fishing in the Brazilian Amazon. Given the region's absence of systematic monitoring, we used social media as an alternative approach to compile catch records and provide basic data on recreational fisheries dynamics in Amazonian freshwater ecosystems. Finally, we provide insights into the potential of culturomics to support fisheries management in data-poor contexts.

2. Material and Methods

2.1. Study area

Cachoeira Porteira is situated in the municipality of Oriximiná, state of Pará, in the Brazilian Amazon (Figure 1). It lies along the Trombetas River and is among the communities most remote from Oriximiná. The settlement is home to Indigenous people and riverside residents who rely on subsistence farming, fishing, hunting, and the extraction of forest products (Bentes et al., 2021; Reale & Cavalcante, 2022). In Cachoeira Porteira, one of the most popular activities is recreational fishing, primarily practiced in the rivers Trombetas

and Mapuera by visitors from more developed regions of Brazil and from abroad. Cachoeira Porteira is considered one of the most attractive freshwater recreational fishing sites in the world due to the high abundance of valuable species and the well-preserved environment (Mendel Junior, 2022). Since 2012, the local community has been operating two lodges dedicated to recreational fishing. The difficulty of accessing the region, due to its distance from airports and urban centers and its low population density, contributes to low fishing effort and the maintenance of fish stocks.

2.2. Data collection and analysis

Exploratory searches for images on recreational fisheries in Cachoeira Porteira were conducted on social media YouTube, Facebook, and Instagram. Searches were conducted using the hashtag search tool with the following keywords: #pescabaixoamazonas, #pescaesportivaamazonia, #pescarecreativaamazonia, #sportfishing, #mapuerafishing, #mapuerasportfishing, #riomapuera, and #cachoeiraporteira. We explored all three platforms and found that records predominated on Instagram, accounting for more than 90% of the images, so we decided to focus our compilation on Instagram. This

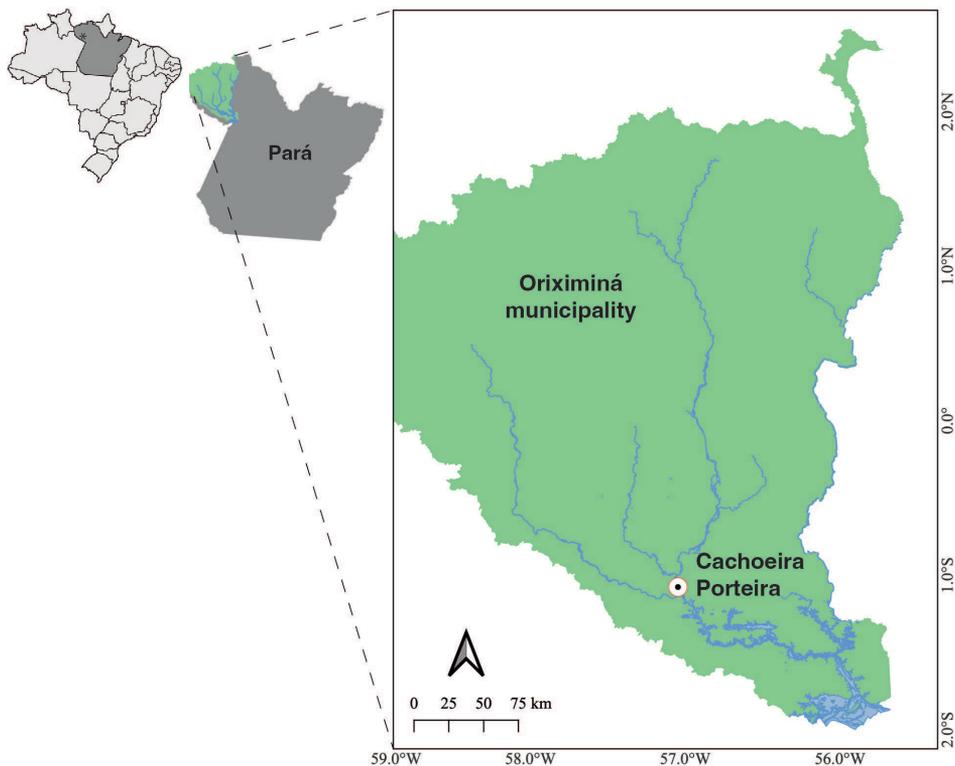


Figure 1. Study area in the Trombetas River basin, Brazilian Amazon.

social media is widely used in the region to share recreational fishing catches. In addition to hashtag searches, we used geolocation to identify posts from Cachoeira Porteira related to recreational fishing catches.

To complement these searches, we also examined the commercial profiles of companies in the region involved in the recreational fishing sector. No direct contact was made with any of these companies. All collected data were anonymized and complied with established ethical guidelines for the use of social media in fisheries research (Monkman et al., 2018). Records of recreational fishing catches were compiled for the period between September 2019 and December 2024.

For each image compiled, we collected the following data: i) date of posting; ii) species caught; iii) number of individuals caught; and iv) estimated fish body size of each individual. Body size was estimated using ImageJ software (Abràmoff et al., 2004), with scale calibration based on reference objects of known size visible in the images, such as parts of the fisher's body or fishing objects. Only media posts that displayed captured fish with sufficient clarity for species identification were included in the analysis. Species identification was carried out based on the researchers' knowledge, with the support of identification guides Santos et al. (2009) and Ohara et al. (2017). The size at first gonadal maturity (L_{50}) was determined using the FishBase database (Froese & Pauly, 2024) and double-checked in their references. If a species had no L_{50} size described, we used data of another species from the same genus. The species were classified by trophic group using information from the FishBase database as carnivorous, piscivorous, omnivorous, and detritivorous. Conservation status at the national level was based on the Brazilian Red List of Threatened Species (Brasil, 2022).

Images lacking a visible scale or with insufficient resolution to allow reliable species identification were discarded. Descriptive statistics were used to summarize the data, including species composition, trophic group distribution, and conservation status profiles. For each species, we calculated the mean body size of captured individuals and the frequency of individuals below the first gonadal maturation size. We calculated the frequency of trophic groups and conservation status categories both across all individuals and separately for each species.

3. Results

A total of 245 fish were recorded across 220 images, representing 5 orders (Characiformes, Clupeiformes, Osteoglossiformes, Perciformes, and Siluriformes), 10 families, and 18 species (Table 1). The most frequently recorded species were the Trombetas peacock bass, *Cichla thyrurus* ($n = 92$), representing 37.2% of the total individuals caught, and the giant wolf fish, *Hoplias aimara* ($n = 35$, 15.8%). The least captured species were the silver arowana, *Osteoglossum bicirrhosum*, and the rip-saw catfish, *Oxydoras niger*, with 1 individual for each ($n = 1$, 0.4%).

The species with the largest average body size was the gilded catfish, *Zungaro zungaro* (114.5 cm \pm 30.4) (average \pm standard deviation), followed by the piraíba, *Brachyplatystoma filamentosum* (100.6 cm \pm 32.3), while the smallest were the jacundá species *Lugubria marmorata* (21.3 cm \pm 2.2) and *Lugubria tigrina* (19.1 cm \pm 1.2). Overall, 6% of individuals caught were below the L_{50} size (Table 1, Figure 2). The higher frequency of individuals below the L_{50} was observed for the redbtail catfish, *Phractocephalus hemiliopterus* (42.1%; Figure 2e), *B. filamentosum* (25%; Figure 2c) and *Z. zungaro* (25%). Catches of these three species represented 19% of the total fish individuals recorded.

Regarding trophic groups, catches were composed by carnivorous ($n = 135$; 55.1%), followed by piscivorous ($n = 84$; 34.3%), omnivorous ($n = 25$; 10.2%), and detritivorous ($n = 1$; 0.4%) (Figure 3). In terms of conservation status at the National Level, no species was listed in the Brazilian Red List of Threatened species.

4. Discussion

By assessing images posted on social media, we provided the first information on recreational fisheries in Cachoeira Porteira, a hotspot of recreational fishing in the Amazon. Our results documented the capture of 18 fish species, being carnivorous and piscivorous the main trophic groups, totaling 89.4% of individuals captured. Catches were composed mainly of fish from higher trophic levels, such as the carnivorous Trombetas peacock bass, *C. thyrurus*, and speckled pavon, *C. temensis*, and the piscivorous giant wolf fish, *H. aimara*, and piraíba, *B. filamentosum*. Recreational fishers prefer these species due to their strong resistance when hooking and large body sizes (Ladislau et al., 2024). The dominance of carnivorous and piscivorous species within the catch composition aligns with recreational fishers'

Table 1. Fish catches posted on social media by recreational fishers in Cachoeira Porteira.

Family	Scientific name	Common name	No. of individuals	Maturity size (L ₅₀)	Mean body size (cm) ±s.d.	% of ind. below the first maturity size	Trophic group	Conservation status (Brazil)
Cichlidae	<i>Cichla thyrurus</i> Kullander & Ferreira, 2006	Trombetas peacock bass	92	25.0	46.5 ±12.70	0.0	carn	-
Erythrinidae	<i>Hoplias aimara</i> Valenciennes, 1847	Giant wolf fish	39	16.7	62.26 ±12.96	0.0	pisc	-
Pimelodidae	<i>Brachyplatystoma filamentosum</i> Lichtenstein, 1819	Piraiba	20	85.0	100.6 ±32.3	25.0	pisc	-
Cichlidae	<i>Cichla temensis</i> Humboldt, 1821	Speckled pavon	20	33.5	57.7 ±14.3	5.0	carn	-
Pimelodidae	<i>Phractocephalus hemiliopterus</i> Bloch & Schneider, 1801	Redtail catfish	19	85.0	84.7 ±18.3	42.1	omn	-
Ctenoluciidae	<i>Boulengerella cuvieri</i> (Spix & Agassiz, 1829)	Pike characin	10	21.58	45.9 ±16.3	0.0	carn	-
Pimelodidae	<i>Zungaro zungaro</i> Humboldt, 1821	Gilded catfish	8	90.0	114.5 ±30.4	25.0	pisc	-
Cynodontidae	<i>Hydrolycus scomberoides</i> Cuvier, 1816	Payara	7	40.0	58.0 ±14.3	0.0	pisc	-
Pristigasteridae	<i>Pellona castelnaeana</i> Valenciennes, 1847	Amazon pellona	5	20.0	27.4 ±15.3	0.0	pisc	-
Sciaenidae	<i>Plagioscion squamosissimus</i> Heckel, 1840	South American silver croaker	5	20.7	40.5 ±9.1	0.0	pisc	-
Pimelodidae	<i>Leiarius marmoratus</i> Gill, 1870	Sailfin pim / Achara catfish	4	35.0	71.8 ±2.2	0.0	omn	-
Pimelodidae	<i>Pseudoplatystoma fasciatum</i> Linnaeus, 1766	Barred sorubim	4	45.5	60.6 ±15.0	0.0	carn	-
Pimelodidae	<i>Platynemataichthys notatus</i> Jardine & Schomburgk, 1841	Pati	4	25.0	49.8 ±10.8	0.0	carn	-
Cichlidae	<i>Lugubria marmorata</i> (Pellegrin, 1904)	Jacundá	3	12.0	21.3 ±2.2	0.0	carn	-
Cichlidae	<i>Lugubria tigrina</i> (Ploeg, Jégu & Ferreira, 1991)	Jacundá	2	12.0	19.1 ±1.2	0.0	carn	-
Bryconidae	<i>Brycon amazonicus</i> Spix & Agassiz, 1829	Slender brycon	1	45.5	33.0 ±0.0	0.0	omn	-
Osteoglossidae	<i>Osteoglossum bicirrhosum</i> Cuvier, 1829	Arawana	1	30.0	80.0 ±0.0	0.0	omn	-
Doradidae	<i>Oxydoras niger</i> Valenciennes, 1821	Ripsaw catfish	1	62.5	76.0 ±0.0	0.0	detr	-

Trophic group: carn = carnivore; pisc = piscivore; omn = omnivore; detr = detritivore.

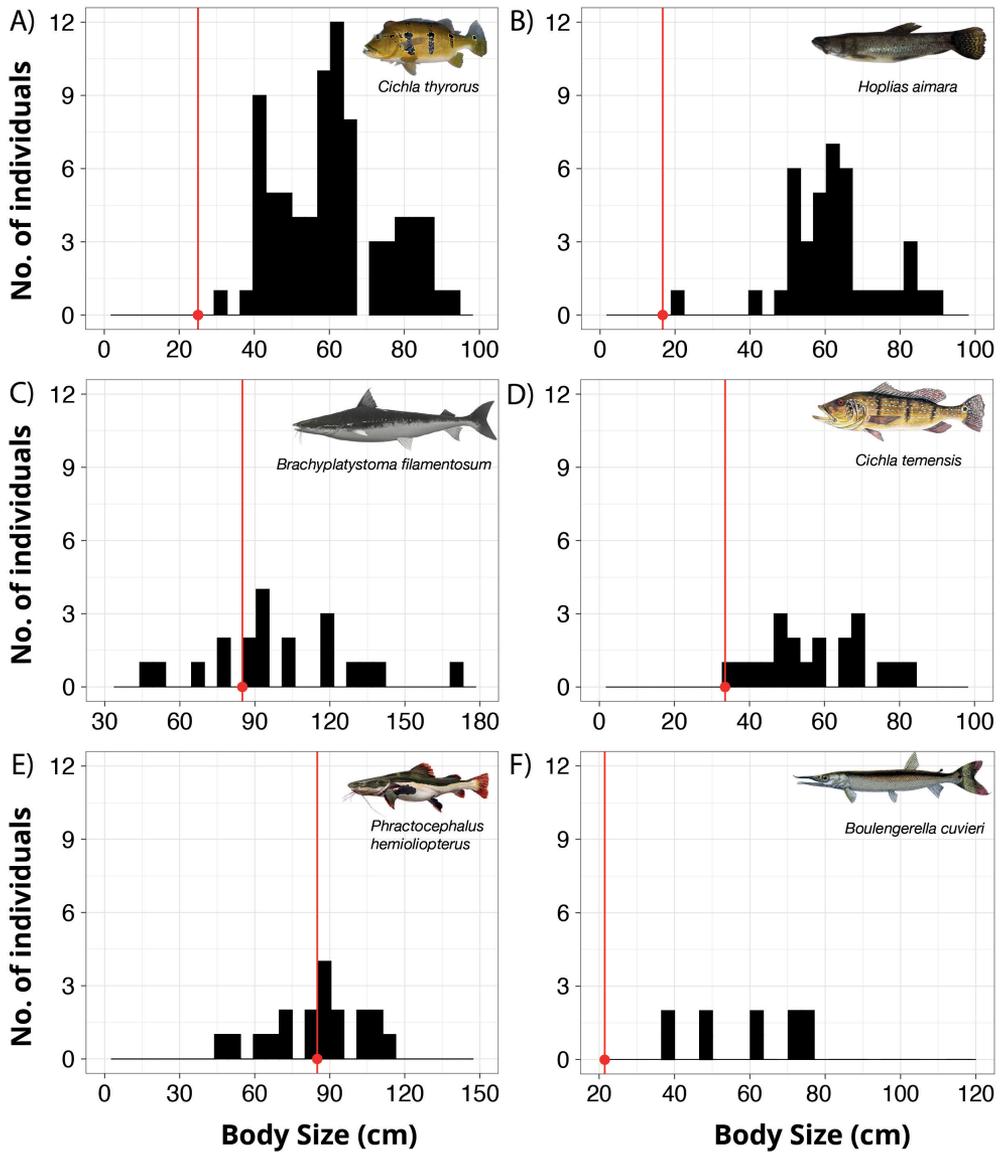


Figure 2. Body size (total length) of the six fish species most caught by recreational fishers in Cachoeira Porteira: (A) *Cichla thyrurus*; (B) *Hoplias aimara*; (C) *Brachyplatystoma filamentosum*; (D) *Cichla temensis*; (E) *Phractocephalus hemiliopterus*; (F) *Boulengerella cuvieri*. The vertical red line indicates the size of the first gonadal maturation (L₅₀ value) for each species.

general preference for larger, predatory fish, which are often perceived as more challenging and prestigious targets (Barbosa et al., 2021; Flink et al., 2024). For instance, the migratory catfish *B. filamentosum*, the third-most-captured species in our study, can reach lengths of more than 1.2 meters and weights of 200 kg (Lundberg 2003). *Cichla temensis* can reach body sizes of up to 1 m (IGFA, 2001). Fishing for large individuals has previously been reported in Amazonian fisheries, where increasing fishing effort in multispecies tropical fish communities is expected to reduce the average body size of captured

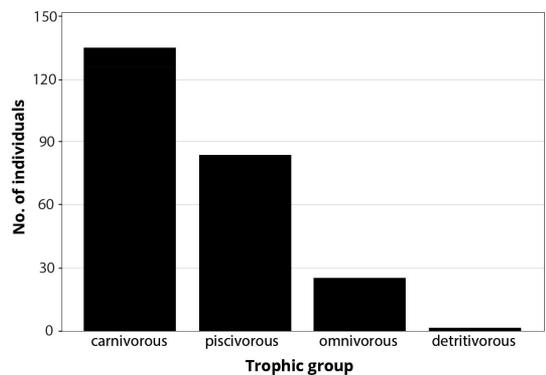


Figure 3. Number of fish caught according to trophic group.

species through the gradual replacement of depleted large-bodied species by smaller ones (Castello et al., 2015). This will have negative consequences for the ecosystem, as it will reduce (or eliminate) certain trophic functions performed by these large-bodied species.

Most individuals (94%) were caught at sizes above the length at first gonadal maturation (L_{50}), with only four species having individuals captured below this threshold. Such species are mainly large migratory catfishes belonging to the family Pimelodidae, which comprises more than 100 valid species of freshwater fish (Van Der Laan et al., 2014; Freitas & Montag, 2019). A concern is the high proportion (42%) of *P. hemioliopterus* caught at sizes below the L_{50} . Large carnivorous fish can play crucial ecological roles, even when present at low population densities (Carbone & Gittleman, 2002). However, an evaluation of the vulnerability of fish stocks to overfishing in the Amazon basin revealed a potential overfishing risk for *P. hemioliopterus* (Pereira et al., 2023). *Brachyplatystoma filamentosum*, which has 25% of individuals caught below the L_{50} , has been experiencing high fishing pressure for decades. The species has been declining since the 1970s, with a sharper decline since 1994 (Petrere Junior et al., 2004). The removal of small individuals (those that have not yet reached reproductive maturity) is concerning and contradicts one of the three key indicators for proper fisheries management: the one related to allowing fish to spawn (see Froese, 2004). Ideally, 100% of fish should be allowed to spawn at least once before being caught, thereby ensuring population replenishment and maintaining healthy stocks. Removing individuals before they reach reproductive maturity can impact the recruitment and sustainability of these populations (Duponchelle et al., 2021).

Large catfish play a crucial role as top predators and nutrient transporters in Amazonian river systems (Barthem & Goulding, 1997). Therefore, our findings raise concerns about potential cumulative impacts on fish stocks. Considering that social media images are typically biased toward larger individuals, often posted as trophy fish (Giovos et al., 2018), the actual number of large catfish being caught is likely even higher. It is essential to study the cascading effects on the ecosystems by the selective removal of such species. Catch and release is practiced in the region with low mortality rates for Trombetas peacock bass (Thomé-Souza et al., 2014). However, the

frequency and effectiveness with large catfishes are unknown.

The absence of species listed in the Brazilian Red List of Threatened Species suggests there is no fishing pressure on species of conservation concern. We also checked the species' status at the global level in the IUCN Red List; none are classified as worse than Least Concern. However, knowledge gaps remain regarding the biology and population trends of several fish species. These uncertainties highlight the need to expand ecological research efforts to better understand species' life histories and population dynamics in the Amazon.

In the lower Amazon region, unfortunately, there is no systematic fisheries monitoring, which makes fisheries management a challenge. Our findings reinforce that alternative approaches, such as social media, can serve as valuable complementary tool for monitoring recreational fishing activities in data-poor regions. By compiling publicly available Instagram images, we provided insights into catch composition, body-size structures, and the conservation status of fish species targeted in a major recreational fishing destination in the Brazilian Amazon. However, certain limitations must be acknowledged. Catches posted on social media may not reflect the true composition of recreational fishing harvests due to inherent biases, such as the tendency to post images of larger rather than smaller individuals (Roos & Longo, 2021) and of targeted rather than non-targeted species. Another potential limitation concerns the reliability of species identification, given the poor quality of some images. Future research may incorporate recent methods developed to address this issue using artificial intelligence and deep learning (Villon et al., 2020; Lennox et al., 2022; Adhikary et al., 2025). Nevertheless, the scalability, cost-effectiveness, and replicability of this approach make it an attractive alternative tool for obtaining basic fisheries data in data-poor regions, especially when combined with traditional scientific surveys and monitoring initiatives.

5. Conclusions

By compiling publicly available images in social media, we provide the first quantitative assessment of recreational fishing catches in Cachoeira Porteira, a major freshwater recreational fishing destination in the Brazilian Amazon. The fishery primarily targets large predatory fish, with carnivorous and piscivorous species dominating the catch. A small fraction of individuals were caught below the first

gonadal maturation size, indicating that most of the target species are being caught at sizes compatible with at least one reproductive event. However, our results also reveal a high proportion of immature individuals for two large migratory catfishes, *Phractocephalus hemioliopterus* and *Brachyplatystoma filamentosum*, which are already considered vulnerable to overfishing in parts of the Amazon basin. Social media data proved to be a valuable alternative for characterizing freshwater recreational fishing patterns in remote areas such as Cachoeira Porteira. However, further studies are essential to more accurately assess fishing effort, total catch, and potential impacts on local fish assemblages.

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Data availability

The data set analyzed/produced in this study can be requested from the corresponding author due to ethical concerns in sharing personal data collected on social media.

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