

## Socioeconomic aspects of sport fisheries in a neotropical reservoir

Aspectos socioeconômicos de pescadores esportivos em um reservatório neotropical

Aspectos socioeconómicos de los pescadores deportivos en un embalse neotropical

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### Abstract

In economically emerging countries such as Brazil, sport fishing is emerging as an important social and economic contributor. However, despite its importance, some aspects still lack information, which jeopardizes the planning, mapping and proper management of the activity. Thus, the objective of this paper was to describe the socioeconomic profile of the sport fishermen of Itaipu Reservoir, Brazil, in order to provide subsidies for public and private investments in the promotion of regional fishing tourism. For this, semistructured socioeconomic questionnaires were given to sport fishermen (total respondents = 823 fishermen) participating in 19 sport fishing tournaments held at Itaipu Reservoir in 2015 and 2016. The majority of the fishermen that were interviewed were male (84%), married (65%), age 31-40 (31%) and had a high level of education (34%). The professional activities reported by the respondents were 43% entrepreneurs, 15% professionals, 15% public servants, 9% private sector workers and 7% students. The household income ranged from 3 to 6 times the Brazilian minimum wage (minimum wage R\$ 954.00 = US\$ 253.72, US\$ 1 = R\$ 3.76, October 2018) (34%). The expenditure on fishing events averaged US\$ 140.33. The sport fishermen from Itaipu Reservoir demonstrated a high socioeconomic standard in relation to the fishermen from other regions of the country, which foments the local economy.

**Keywords:** Amateur fishing; Catch-and-release; Fishing tourism; Impoundments; Sporting fishers' socioeconomic profile.

### Resumo

Em países emergentes economicamente como o Brasil, a pesca esportiva aparece como importante atividade socioeconômica. Porém, apesar de sua importância, alguns aspectos ainda carecem de informação, os quais podem comprometer o planejamento, ordenamento, mapeamento e a gestão adequada da atividade. Dessa forma, o objetivo deste trabalho foi descrever o perfil socioeconômico dos pescadores esportivos do Reservatório de Itaipu, Brasil, visando fornecer subsídio para investimentos públicos e privados no fomento ao turismo de pesca regional. Para isso, questionários socioeconômicos semiestruturados foram aplicados aos pescadores esportivos (total de entrevistados = 823 pescadores), participantes de 19 torneios de pesca esportiva realizados no reservatório de Itaipu, durante os anos de 2015 e 2016. A maioria dos pescadores entrevistados foi do sexo masculino (84%), casados (65%), com idade entre 31 e 40 anos (31%) e elevado nível de escolaridade (nível superior completo foi mais frequente; 34%). Dos pescadores entrevistados, 43% foram identificados em empresários, 15% profissionais liberais, 15% servidores públicos, 9% trabalhadores do setor privado e 7% de estudantes. A renda familiar variou de 3 a 6 salários mínimos brasileiros (salário mínimo R\$ 954,00 = US\$ 253,72; US\$ 1 = R\$ 3,76, outubro de 2018) (34%). Os gastos nos torneios de pesca foram em média de US\$ 140,33. Os pescadores esportivos do reservatório de Itaipu demonstraram

elevado padrão socioeconômico em relação aos pescadores de outras regiões do país, o que acaba fomentando a economia local.

**Palavras-chave:** Barramentos; Perfil socioeconômico dos pescadores esportivos; Pesca amadora; Pesque e solte; Turismo de pesca.

### Resumen

En países económicamente emergentes como Brasil, la pesca deportiva aparece como una importante actividad socioeconómica. Sin embargo, a pesar de su importancia, aún falta información sobre algunos aspectos, lo que puede comprometer la planificación, ordenamiento, mapeo y adecuada gestión de la actividad. Por lo tanto, el objetivo de este trabajo fue describir el perfil socioeconómico de los pescadores deportivos del Embalse de Itaipu, Brasil, con el fin de proporcionar subsidios para inversiones públicas y privadas en la promoción del turismo pesquero regional. Para ello, se aplicaron cuestionarios socioeconómicos semiestructurados a pescadores deportivos (total de entrevistados = 823 pescadores), participantes de 19 torneos de pesca deportiva realizados en el embalse de Itaipu, durante los años 2015 y 2016. La mayoría de los pescadores entrevistados eran del sexo masculino (84 %), casados (65%), con edad entre 31 y 40 años (31%) y con nivel educativo alto (la educación superior completa fue más frecuente; 34%). De los pescadores entrevistados, el 43% se identificaron como empresarios, el 15% profesionales liberales, el 15% servidores públicos, el 9% trabajadores del sector privado y el 7% estudiantes. La renta familiar osciló entre 3 y 6 salarios mínimos brasileños (salario mínimo R\$ 954,00 = US\$ 253,72; US\$ 1 = R\$ 3,76, octubre de 2018) (34%). El gasto en torneos de pesca promedió US\$140,33. Los pescadores deportivos del embalse de Itaipu mostraron un nivel socioeconómico alto en relación a los pescadores de otras regiones del país, lo que termina por promover la economía local.

**Palabras clave:** Atrapar y liberar; Barramentos; Perfil socioeconómico de los pescadores deportivos; Pesca amateur; Turismo pesquero.

## 1. Introduction

Sport fishing has become important in several countries (e.g., Japan, Australia, New Zealand, Canada and the United States), generating billions of dollars in revenue (Freire et al., 2012). According to the American Sportfishing Association (ASA), in 2014 in the United States, sport fishing had approximately 33 million participants that spent US\$ 48 billion annually on equipment, licenses and fishing travels. In addition, according to these same authors, in 2011 alone, approximately 828,000 jobs were directly and indirectly created through sport fishing activity, generating approximately US\$ 115 billion to the United State economy. On the other hand, in emerging countries in Asia, Africa and South America, sport fishing activity still represents an incipient contribution to the national economy, and there is a lack of information on the effects that the activity has on local fishery resources (Freire et al., 2012). However, recent studies have shown that sport fishing, especially in Brazil, is growing, and that this activity has ceased to be just a leisure option and has become an important segment of the economy, moving millions of Reais per year due to the commercialization of products and services (Barroso & Freitas, 2014).

Driven by the creation of the Programa Nacional de Desenvolvimento da Pesca Amadora-PNDPA in 1997 by the federal government in order to strengthen the activity in the country, sport fishing tourism in Brazil began to expand in the early 1990s, becoming an instrument of economic development (Fabri, 2006; Schork et al., 2010). Sport fishing has been widely practiced in different aquatic environments in both marine and inland waters, such as beaches, shores, high seas, rivers and lakes. The main Brazilian tourist destinations for the practice of this fishing modality have been the Amazonian in the Amazonas State (Tsuruda et al., 2013) and the Pantanal in the Mato Grosso State (Catella, 2016; Barrella et al., 2016), two important Neotropical floodplains known for their high biodiversity of fishes species (Froehlich et al., 2017; Queiroz et al., 2013). In addition, in recent years, due to the formation of reservoirs of hydroelectric power plants near large urban centers, especially in the South, Southeast and Central-west regions of Brazil (Albano & Vasconcelos, 2013), and the introduction of attractive fish species to sport fishing (e.g., *Cichla* sp. and *Salminus* sp.) (Ribeiro et al., 2017), this activity has also expanded in these regions and localities.

Despite the importance of sport fishing socially and economically around the world, some negative aspects have been associated with its practice. Deleterious effects on local fish stocks have been observed, often with similar damage to

commercial fishing (Cooke & Cowx, 2004, 2006; Figueira & Coleman, 2010; Freire, 2010). Another negative effect highlighted by many authors is related to ethical issues associated with animal welfare (Chaves & Freire, 2012; Caminhas, 2015), mainly due to the practice of "catch-and-release", which presents the possibility of causing suffering to fish and can lead to the mortality of the individuals that are subjected to this modality (Cooke & Sneddon, 2007; Thomé-Souza, 2014; Barrocoet et al., 2018). In addition, sport fishing has been determined to be one of the main vectors for introducing non-native species into inland waters, which has been well documented in the literature (Ribeiro et al., 2017; Pelicice & Agostinho, 2009; Vitule et al., 2014; Pelicice et al., 2017; Gubiani et al., 2018), and the effects of non-native species on local biodiversity are also well known (Agostinho et al., 2005; Dudgeon et al., 2006; Ferrareze & Nogueira, 2015).

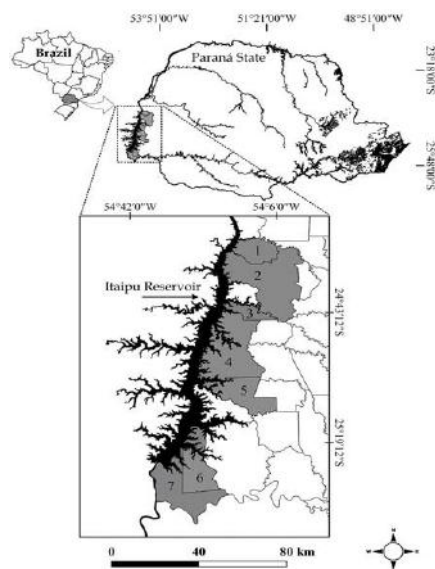
However, despite the extensive development of sport fisheries in the Brazilian scenario, there is a lack of information on the biological, social and economic aspects of the activity. As a consequence, for sustainable tourism, the environmental aspects, the economic characteristics of the communities and companies in the sector and the social aspects of tourism must be incorporated (Swarbrooke, 2002). Hence, the objective of this study was to describe the socioeconomic profile of sport fishermen from the Itaipu Reservoir, a large Neotropical reservoir, in the upper Paraná River, Brazil. Specifically, the profile included the origin of the fishermen, gender, marital status, age, schooling, occupation and family income. In addition, we described aspects of fishing, such as the expenses per event and the fishing equipment used. All this information is important for decision making on public and private investments in the promotion of regional fishing tourism as well as for the planning and management of sport fisheries.

## 2. Methodology

### *Study area*

Itaipu Reservoir is located on the border between Brazil and Paraguay, between latitudes 24°05'S and 25°33'S and longitudes 54°00'W and 54°37'W (Figure 1). It has a surface area of approximately 1,350 km<sup>2</sup> and extends 170 km, covering 16 municipalities on the Brazilian side, with approximately 597,470 inhabitants (IBGE, 2010).

**Figure 1.** Location of Itaipu Reservoir and the respective municipalities in which sport fishing tournaments were held in 2015 and 2016. 1 – Mercedes; 2- Marechal Cândido Rondon; 3 – Entre Rios do Oeste; 4 – Santa Helena; 5 – Missal; 6 – Santa Terezinha de Itaipu; and 7 – Foz do Iguaçu.



Source: Authors.

### Sampling

The study proposal was submitted to the Research Ethics Committee of the Western Paraná State University through “Plataforma Brasil (<https://plataformabrasil.saude.gov.br/login.jsf>) and approved by Decision n° CAAE 07316818.7.0000.0107. Interviews were carried after interviewees consented by signing two copies of the Informed Consent Form, one for the interviewee and one for the researcher.

Sport fishing in Itaipu Reservoir is organized in tournaments promoted by the amateur fishing associations in the seven municipalities bordering the reservoir (Mercedes, Marechal Cândido Rondon, Entre Rios do Oeste, Santa Helena, Missal, Santa Terezinha de Itaipu and Foz do Iguaçu). In 2015 and 2016, 19 tournaments were held (Table 1).

**Table 1.** Sport fishing tournaments held in 2015 and 2016 in Itaipu Reservoir, Paraná State, Brazil.

Period	City	Event name	Total number of sport fishermen per event	Number of sport fishermen interviewed per event
February 07 and 08, 2015	Missal	15º Torneio Aberto Internacional de Pesca a Corvina	852	29
March 07 and 08, 2015	Santa Terezinha de Itaipu	19º Desafio de Pesca a Corvina	591	19
March 21 and 22, 2015	Santa Terezinha de Itaipu	2º Torneio Internacional de Pesca ao Tucunaré	500	56
March 28 and 29, 2015	Marechal Cândido Rondon	Torneio de Pesca a Corvina	262	67
May 3, 2015	Entre Rios do Oeste	Torneio de Pesca para Casais	60	23
May 15 and 16, 2015	Santa Helena	4º Torneio de Pesca Esportiva do Tucunaré e Expo-Pesca	111	35
August 12 and 13, 2015	Marechal Cândido Rondon	9º Torneio de Pesca Marechal ao Tucunaré	190	41
October 10 and 11, 2015	Missal	5º Torneio Aberto Internacional de Pesca ao Tucunaré	490	58
October 18, 2015	Foz do Iguaçu	Torneio Aberto de Pesca ao tucunaré	206	19
November 21 and 22, 2015	Mercedes	11º Torneio de Pesca a Corvina e Tucunaré	294	36
February 13 and 14, 2016	Missal	16º Torneio Aberto Internacional de Pesca a Corvina	816	59
March 05 and 06, 2016	Santa Terezinha de Itaipu	20º Desafio de Pesca a Corvina	267	37
March 19, 2016	Santa Terezinha de Itaipu	3º Torneio Internacional de Pesca ao Tucunaré	564	83
April 02 and 03, 2016	Marechal Cândido Rondon	19º Torneio de Pesca a Corvina	774	37
May 13 and 14, 2016	Santa Helena	5º Torneio de Pesca Esportiva do Tucunaré e Expo-Pesca	288	58
September 17 and 18, 2016	Marechal Cândido Rondon	10º Torneio de Pesca Tucunaré	140	34
October 08 and 09, 2016	Missal	6º Torneio Aberto Internacional de Pesca ao Tucunaré	500	63
October 23, 2016	Foz do Iguaçu	Torneio Aberto de Pesca ao Tucunaré	120	21
November 19 and 20, 2016	Mercedes	12º Torneio de Pesca a Corvina e Tucunaré	460	48

Source: Authors.

Semi-structured interviews were conducted with the application of questionnaires to the sport fishermen participating in the events. The interviewees were randomly selected among participants. To improve the representativeness of the sampling, we sought to interview approximately 10% of the total number of sport fishermen participating in the tournaments.

During the interviews, information was collected regarding socioeconomic aspects of the sport fishermen namely city of the origin, gender, marital status, age, schooling, occupation, family income, expenses amount by event and fishing equipment.

#### *Data analysis*

The data were tabulated in electronic spreadsheets and later analyzed using descriptive statistics based on the frequency of responses. To characterize the socioeconomic aspects of the sport fishermen, the results were expressed in graphs and tables.

### **3. Results**

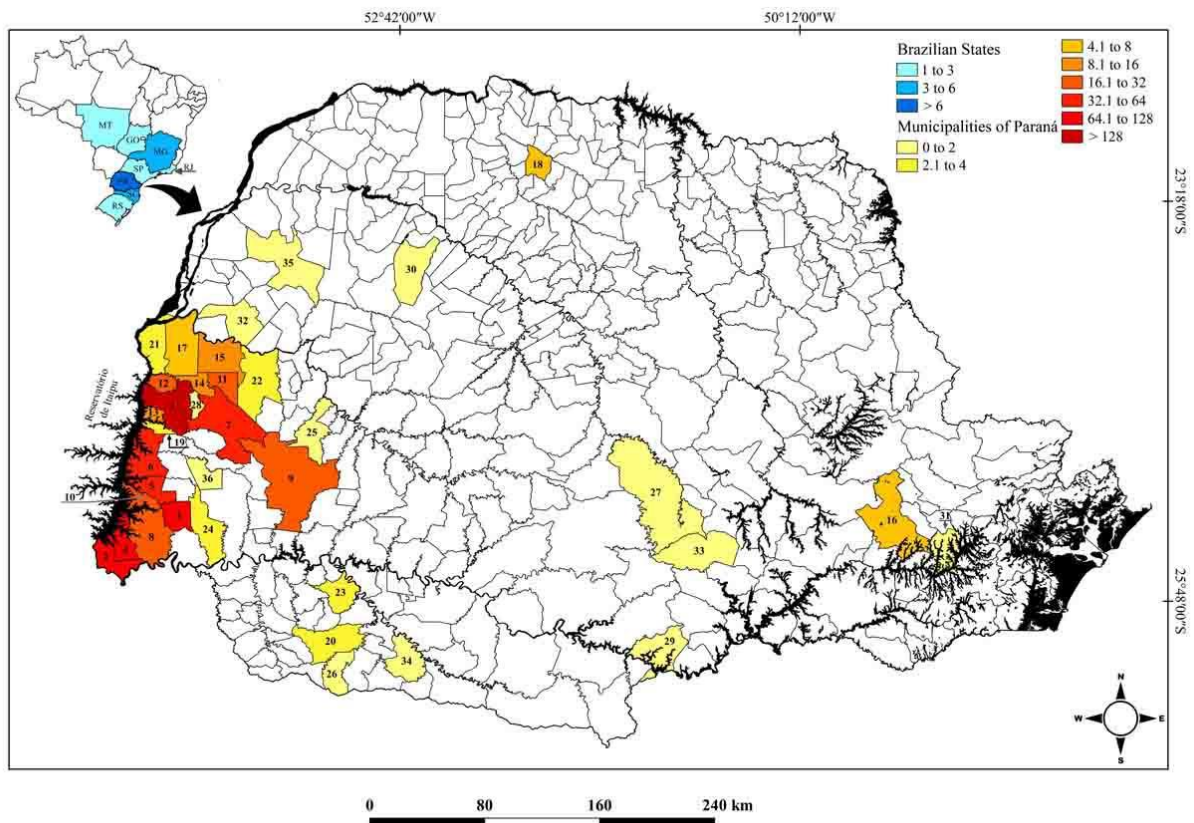
#### *Socioeconomic profile of the sport fishermen*

During the study period, 823 fishermen were interviewed in fishing tournaments at Itaipu Reservoir (Table 1), representing 11% of the total fishermen participating in the events (total of participating fishermen = 7485 fishermen).

The majority of the participants in the tournaments were Brazilian (96.2%). However, fishermen from other countries were also registered (Paraguay 3.6% and Argentina 0.2%). Of the Brazilian fishermen, the highest participation came from the state of Paraná (94.7%, Figure 2). However, there were participants from seven other states (Figure 2). In total, regarding the origin of the fishermen, 36 Paraná municipalities were cited (Figure 2). The highest representation was from the municipalities bordering the reservoir (79% of respondents), especially from the municipalities that hosted an event. The municipalities of Marechal Cândido Rondon (20%) and Foz do Iguaçu (13%) were the most cited cities of origin of the fishermen.



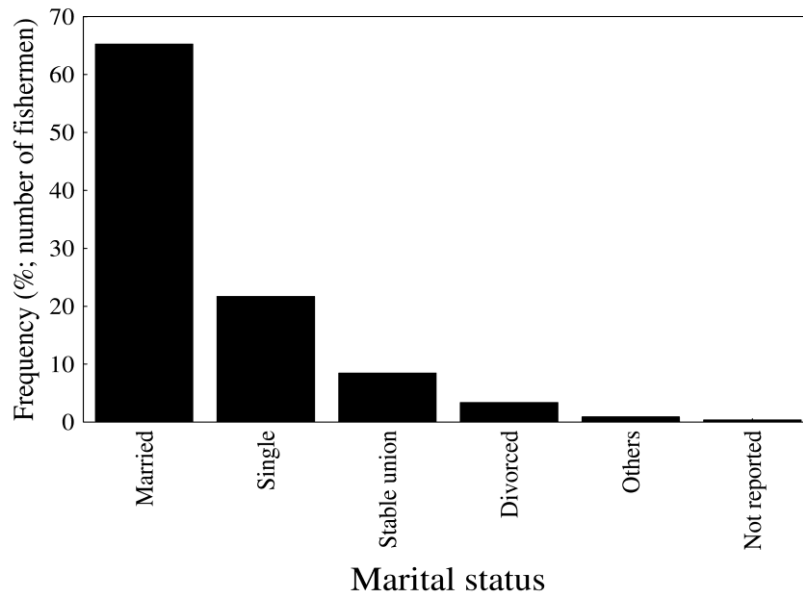
**Figure 2.** Indication of the region of origin of the Brazilian sport fishermen during the tournaments evaluated in 2015 and 2016 at Itaipu Reservoir. SC – Santa Catarina; MG – Minas Gerais; GO – Goiás; MT – Mato Grosso; RJ – Rio de Janeiro; RS – Rio Grande do Sul; and SP – São Paulo. 1 – Marechal Cândido Rondon; 2 – Foz do Iguaçu; 3 – Medianeira; 4 – Santa Terezinha de Itaipu; 5 – Missal; 6 – Santa Helena; 7 – Toledo; 8 – São Miguel do Iguaçu; 9 – Cascavel; 10 – Itaipulândia; 11– Maripá; 12 – Mercedes; 13 – Pato Bragado; 14 – Nova Santa Rosa; 15 – Palotina; 16 – Campo Largo; 17 – Terra Roxa; 18 – Santa Fé; 19 – Entre Rios do Oeste; 20 – Francisco Beltrão; 21 – Guaíra; 22 – Assis Chateaubriand; 23 – Dois Vizinhos; 24 – Matelândia; 25 – Corbélia; 26 – Marmeleiro; 27 – Prudentópolis; 28 – Quatro Pontes; 29 – União da Vitória; 30 – Cianorte; 31 – Curitiba; 32 – Iporã; 33 – Irati; 34 – Pato Branco; 35 – Umuarama; and 36 – Vera Cruz do Oeste.



Source: Authors.

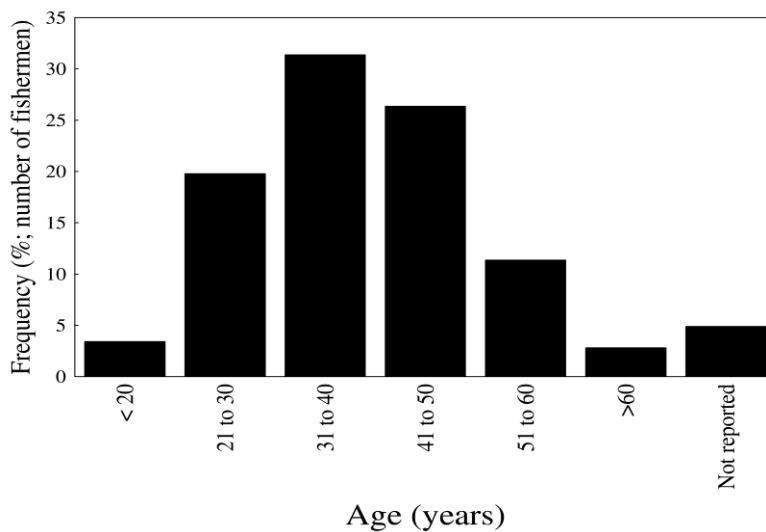
Most of the fishermen were male (90%). Most of the interviewees were married (65%), 22% of the fishermen were single, 9% were in a stable union and 4% were divorced (Figure 3). The age of the fishermen ranged from 15 to 75 years. Most were concentrated in the age group of 31 to 40 years (31%, Figure 4).

**Figure 3.** Marital status of the sport fishermen participating in the sport fishing tournaments held in Itaipu Reservoir, Paraná State, in 2015 and 2016.



Source: Authors.

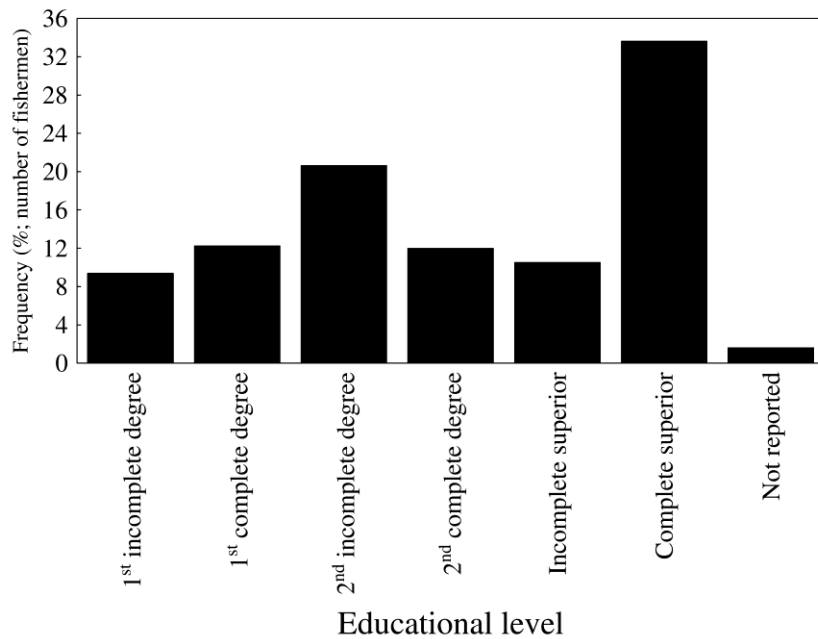
**Figure 4.** Age group of the sport fishermen participating in the sport fishing tournaments held in Itaipu Reservoir, Paraná State, in 2015 and 2016.



Source: Authors.

Most of the participants had complete superior (34%) or 2nd incomplete degrees (21%) (Figure 5). In addition, no illiterate fishermen were registered.

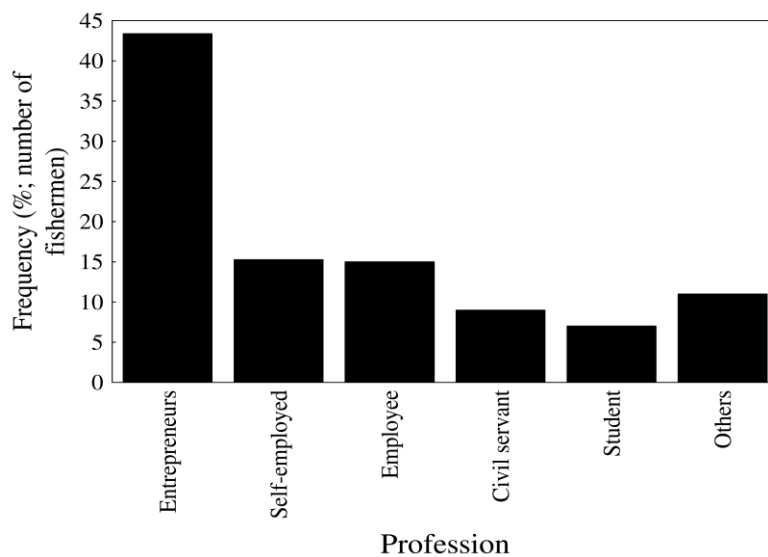
**Figure 5.** Educational level of the sport fishermen participating in the fishing tournaments held in Itaipu Reservoir, Paraná State, in 2015 and 2016.



Source: Authors.

The sport fishermen reported different professions (Figure 6). However, the majority were entrepreneurs (43%, Figure 6). In addition, it is interesting to note that 7% of the interviewees were students.

**Figure 6.** Professions of the sport fishermen participating in sport fishing tournaments at Itaipu Reservoir, Paraná State, in 2015 and 2016.



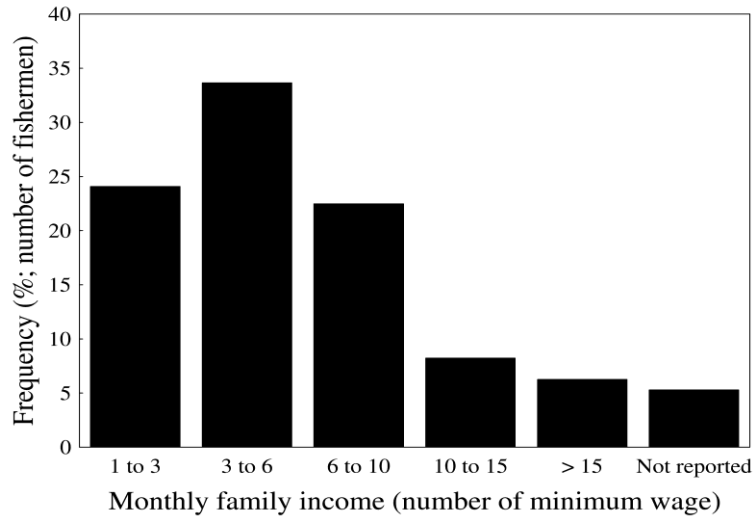
Source: Authors.

The average household income varied from one to more than 15 times the Brazilian minimum wage per household (minimum wage in the period was R\$ 954.00 = US\$ 253.72, US\$ 1 = R\$ 3.76, October 2018), with the majority receiving



between 3 and 6 times the minimum wage (34%). On the other hand, only 6% of the respondents reported receiving more than 15 times the minimum monthly salary (Figure 7).

**Figure 7.** Monthly household income of the sport fishermen participating in the sport fishing tournaments at Itaipu Reservoir, Paraná State, in 2015 and 2016.

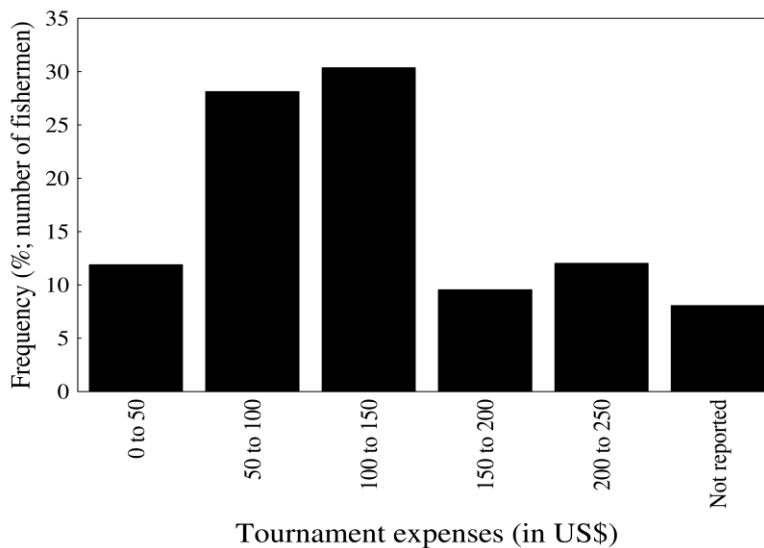


Source: Authors.

### *Characteristics of sport fishing*

The tournament expenses ranged from US\$ 50 to 250 (US\$ 149.69 average) (US\$ 1 = R\$ 3.76 in October 2018) per tournament. Most participants spent between US\$ 100 and 150 (30%) (Figure 8). Declared expenses included gear, bait, lodging, fuel, displacement, feed, and tournament registration.

**Figure 8.** Tournament expenses for sport fishermen participating in sport fishing tournaments at Itaipu Reservoir, Paraná State, in 2015 and 2016.



Source: Authors.

During the events, the fishing equipment most commonly used by the fishermen was reels (85%). In addition, fishing rods was used by eight percent of the fishermen, and no fly fishing equipment was used.

#### 4. Discussion

The sport fishing at Itaipu Reservoir has regional importance. The origin of the participants was almost exclusively local, with fishermen being predominantly from the seven municipalities bordering the reservoir. In addition, our results showed that most of the participants lived in the city where the event was held. In this way, tourist attraction strategies may be developed to attract participants from other cities as well as from other states and countries to foment the local economy in different sectors, such as commercial, tourism, and food, among others.

The predominance of male fishermen, as observed in our results, in sport fishing events has been a recurrent pattern in this type of fishery around the world (e.g., Argentina (Llompart et al., 2012); France (Herfaut et al., 2013); Canada (Brownscombe et al., 2014); India (Gupta et al., 2016); and USA (ASA, 2016)). In Brazil, other studies have revealed the same pattern: a greater prevalence of male fishermen in sport fisheries, such as in the North (Santos & Oliveira Junior, 1999; Salazar Filho et al., 2005; Silva & Lima, 2015; Souza & Cañete, 2016; Souza et al., 2017), Midwest (Abreu et al., 2015), Southeast (Tsuruda et al., 2013; Peixer & Petrere Júnior, 2009; Tarcitani & Barrella, 2009; Silva et al., 2016) and South (Schork, et al., 2010; Basaglia & Vieira, 2005; Harayashiki et al., 2011; Menezes et al., 2012) regions.

Our results revealed that the sport fishermen of Itaipu Reservoir are younger than the standard Brazilian sport fishermen. According to Freire et al. (2012), in their review of Brazilian sport fisheries, the age group of national sport fishermen was between 40 and 55 years old. That younger participant's fish at Itaipu Reservoir is not a surprising result since the sport fishing there is supported almost exclusively by tucunaré (*Cichla spp.*) fishing (see Table 1 for the number of tucunaré fishing events). Fishing for this species is attractive to the sport fishing public given the high sportiness of the species and the many techniques used for its capture (Barroco & Freitas, 2014; Freitas & Rivas, 2006).

Sports fishing in Brazil can be characterized as an elite sport. Several studies have showed that Brazilian sport fishermen have a high level of education and a monthly family income much higher than the average Brazilian population. For example, Menezes et al. (2012), evaluating bass fishing (*Centropomus undecimalis* and *C. parallelus*) in Babitonga Bay, observed that most fishermen had a high level of schooling and family income. This pattern has been recurrent in other places, such as São Francisco do Sul, Santa Catarina (Schork et al., 2010) and at the Billings Dam, São Paulo (Alves da Silva et al., 2018).

Our results show the same pattern for Itaipu Reservoir. We observed that the average monthly household income (approximately US\$ 1,257.45 = R\$ 4,728.00; US\$ 1 = R\$ 3.76, October 2018) was greater than that of the population of Paraná State (approximately US\$ 384.31 = R\$ 1,445.00 in 2018, (IBGE, 2019), US\$ 1 = R\$ 3.76, October 2018). This result may be associated with the occupation of most of the sports fishermen from Itaipu Reservoir, of which the majority considered themselves entrepreneurs (see Figure 5). Similarly, Barrella et al. (2016), evaluating sport fishing in the "Deck do Pescador" in Santos, São Paulo, observed that when entrepreneurs were a minority, the average monthly income of the fishermen decreased (ca. US\$ 801.54 = R\$ 3,133.79; US\$ 1 = R\$ 3.76, October 2018).

In addition to the average monthly family income, the fishermen's expenses per event also corroborate the elitism of national sports fisheries. Our results showed that the expenses per event were on average US\$ 149.69 (R\$ 562.83; US\$ 1 = R\$ 3.76, October 2018). Despite this, the sport fisheries at Itaipu Reservoir were less expensive when compared to other places in Brazil. For example, the cost of a fishing trip to the Pantanal in the Mato Grosso State, where fishing tourism is considered one of the main economic activities of the municipalities of the region, such as the Cáceres municipality (Netto & Mateus, 2009), can fluctuate between US\$ 470.00 to 970.00 per person with an average of US\$ 163.00 per day of fishing (Moraes & Seidl,

2000). It is important to note that both sport fishing modalities (at Itaipu Reservoir and in the Pantanal) fit the patterns described by Albano and Vasconcelos (2013), which indicated that in Brazil, there are two distinct sport fishing modalities: one urban (e.g., sport fishing at Itaipu Reservoir) and another located at a distance from the major centers (the Pantanal and Amazonian regions). According to these same authors, this form of tourist fishing requires greater expenses and, consequently, attracts fishermen with higher purchasing power when compared to the sport fishing near large urban centers.

One of the problems reported in studies on sport fisheries is the identification of target species (Peixer & Petrere Júnior, 2009). Our results showed that for Itaipu Reservoir, the sport fisheries target two non-native species, the tucunará and the corvina. Apparently, a recurrent pattern has been observed for urban sport fisheries, which are almost entirely based on non-native species (Ribeiro et al., 2017). In addition, in a review paper, Gubiani et al. (2018) reported that sport fishing is one of the main vectors for the introduction of species in the Neotropical region.

## 5. Conclusion

Based on the above, we can conclude that the socioeconomic profile of the sport fishermen of Itaipu Reservoir can be characterized as middle-aged, entrepreneurial people with high family income and educational levels, which makes this fishing modality elitist based on the national patterns of the socioeconomic profiles of the population. In addition, sport fishing at Itaipu Reservoir plays an important economic role locally, since most fishermen originate in the municipality that organizes the events or those municipalities that are very close. Thus, investments in outreach to promote greater media coverage of the events may attract fishermen from other cities, states and countries. Additionally, promoting tourism in sport fishing may be another alternative for the development of this activity regionally.

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