

Recreational angling and related conflicts in a disturbed estuarine environment of the Southwest Atlantic

Carlos Gonçalves Belruss¹, Sergio Luis dos Santos Tutui², Acácio Ribeiro Gomes Tomás^{2,*}

¹ Instituto de Pesca - Programa de Graduação em Aquicultura e Pesca - APTA-SAA (Av. Conselheiro Rodrigues Alves, 1252 - Vila Mariana - São Paulo - 04014-900 - SP - Brazil).

² Instituto de Pesca - Centro de Pesquisa do Pescado Marinho - APTA-SAA (Av. Conselheiro Rodrigues Alves, 1252 -Vila Mariana, São Paulo - 04014-900 - SP - Brazil)

* Corresponding author: argtomas@gmail.com

ABSTRACT

We assessed the angling conducted in the Santos estuarine area (southeastern Brazil) between September 2012 and November 2013. The results, based on 189 interviews conducted in 38 different fishing locations, showed that shore-based anglers were predominantly residents (78%) and spent US\$23 per fishing day. However, 61% of the onboard anglers were from the São Paulo metropolitan area and spent around US\$100 per fishing day, generating a potentially important economic impact. Only two of the 15 variables analyzed showed no significant differences between the anglers' categories. According to the anglers' perception the possible pressure on the fishery resources and conflicts regarding resource use and areas in the face of port and industrial activities, urbanization, lack of security, as well as the anglers' time of experience, should be considered in any management measures to be proposed.

Descriptors: Angler's profile, Socio-ecosystems, Anglers' perception, Fisheries management.

INTRODUCTION

Recreational fishing (hereafter referred to as angling) is growing in social, economic and ecological importance in many countries, especially in those that have experienced rapid economic development (FAO, 2012, Arlinghaus et al., 2020). This extensive growth implied the development of methods and techniques destined to understand fish behavior and the best way to capture them, allowing the activity to become a multi-million dollar business (FAO, 2012). Fisheries in the vicinity of urban centers are particularly important because of the facility of access and the environmental and social benefits (Peirson *et al.*, 2001). However, references have already been

made to potential impacts of angling in estuarine environments (Blaber et al., 2000), placing it on the same scale of urgency as commercial fishing for bycatch, fisheries-induced selection, trophic changes, habitat degradation, fishing effort and capture (Cooke and Cowx, 2006). Despite the growing recognition of this importance, existing data is still scarce, hindering the entire planning, development, and management process of this activity, which should also be expanded as a management plan involving other fishing sectors and stakeholders (Freire et al., 2016). The estuarine areas present diverse characteristics that tend to be used for economic development and that, in general, are impacted by different forms of use (Blaber et al., 2000).

The main objective of this study is to describe the recreational fishing carried out in the Santos estuary from a socioeconomic and socio-environmental point of view regarding the

Submitted: 16-September-2021

Approved: 25-February-2022

Associate Editor: Francesc Maynou



© 2022 The authors. This is an open access article distributed under the terms of the Creative Commons license.

stakeholders involved and their relationship with the estuarine environment, considering the lack of information on angling in estuarine environments, and the increasing scientific demand for information on these, particularly in terms of their multiple uses and, consequently, different sources of anthropic pressure.

METHODS

The study area covered the beaches of Santos and São Vicente (23°30'-24°00'S / 46°05'-46°30'W), and the entire estuarine area of the Islands of São Vicente and Santo Amaro, including Santos Bay, the estuarine channels (the Estuary Channel, which separates the islands mentioned above and where the Port of Santos is located, the Piaçaguera Channel to the north, the Bertioga Channel to the east and the Barreiros Channel to the west), and tributary rivers, encompassing six municipalities (Santos, São Vicente, Cubatão, Guarujá, Bertioga, and Praia Grande) for over 35 km and approximately 1,000 km² (Fig.1). Despite this, as can be seen in Figure 1, some of the fishing sites of the onboard anglers were in the coastal environment adjacent to the estuary, mainly between the Bay of Santos and the mouth of the Bertioga Channel. For convenience, all will hereafter be referred to as the Santos estuary.

Santos Estuary is under strong environmental pressure due to being the location of one of the largest industrial plants in Brazil, combined with the largest port in Latin America and inadequate housing along its margins (Buruagem et al., 2013). It also has extensive areas of partially degraded mangroves, with high levels of pollutants, oxygen-demanding substances, phenols, heavy metals (as copper and zinc), and pesticides, several human dwellings in mangrove areas, unplanned urbanization, and the reception of industrial and urban sewage (Martins et al. 2011, Buruagem et al 2013). Nevertheless, there are still well preserved areas in its inner portions, which act as nursery and feeding areas for several species of fish, mollusks, and crustaceans.

Anglers were classified as shore-based and onboard anglers. Samples for onboard anglers were taken in nautical garages in the estuary in the above mentioned cities, and for shore-based, the entire beach border, including decks and fishing piers, the Mariana lagoon (in São Vicente) and the estuarine location known as "Portinho" (in Praia Grande). Semi-structured questionnaires were applied in the form of regional coverage surveys, based on Condi et al. (2007), to obtain information about the dynamics and technology of the angling. The interviewees' participation in

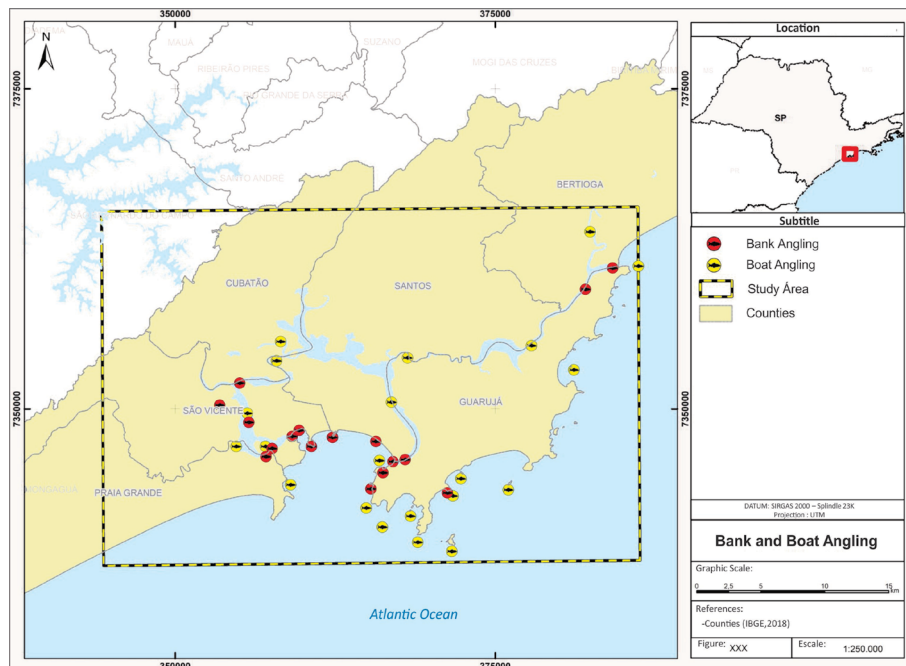


Figure 1. The fishing sites most frequented by onboard and shore anglers interviewed in the Santos Estuary (Bank = shore angling, boat = onboard angling).

the questionnaires was voluntary. A previous pilot questionnaire was applied between September and November 2012 aiming at adaptation and eventual adjustments, and for familiarization with the owners of nautical garages (marinas) and landing points. Subsequently, the sampling period covered December 2012 to November 2013. The used survey instrument was a questionnaire structured from 15 variables related to anglers' socioeconomic (age class, marital status, monthly income, school level, expenses by day of fishing, annual gear maintenance / replacement expenses, bait expenses), behaviors (has a fishing license or not, fishing frequency, place where bait is obtained, and angler home origin), perceptions / anthropogenic (best fishing season, perception of change in fish size over time, perception of quantitative change in catches over time, and anthropic influences), with questions subdivided in alternatives of fixed answers, some of them grouped in class intervals. Income was expressed in six monthly salary class intervals, consider a 5 Brazilian official minimum wage interval (i.e., R\$ 3,390.00, equivalent to US\$ 1,542.45 at the survey period). Interviews were conducted at least monthly at the identified nautical garages, preferably on weekdays, to get information from a larger number of fishers. In addition, at minimum weekly intervals on interspersed days during the evening hours, interviews were conducted with shore-based anglers between December 2012 and July 2013. The daytime visits to Mariana Lagoon were distributed on occasional weekends throughout the period.

After check the questionnaires answers, chi-square tests were used to compare the responses of shore-based and onboard anglers. The data were regrouped for some of the variables to avoid values less than 5 in each class that would make it unfeasible to apply this test.

The QGis 2.4.0 Chugiak software was used for the preparation of the map (Figure 1), with marinas and fishing localities indicated by anglers' category.

RESULTS

Throughout the 189 interviews conducted, two types of angling were observed: shore-based with 95 interviews on beaches and rocky coasts, estuarine lagoon and decks and piers; and onboard, with 94 interviews. We identified 17

fishing locations for shore-based and another 21 for onboard, subsequently recorded on a map (Fig. 1). These locations may vary throughout the year seasonally and even daily due to the presence of cold fronts, air and water temperature, tide cycle and weather.

For statistical purposes of the chi-squared test, eight of the 15 original answers of the variable "anthropic influences" ("safety", "noise", "wind", "urbanization", "illegal fishing", "predatory fishing" and "many turtles") were grouped as "Others". Significant differences were verified at all variables, except "perception of variation in fish size over time" and in "perception in the catches over time" (Table 1).

Angling was of male predominance, 97% onboard and 98% shore-based anglers, the latter younger than the former - 43.9 ± 13.4 (21 to 91) and 52.5 ± 12.2 (19-83) years-old, respectively (Fig. 2a). Most respondents reported being married (75% and 69%, respectively) (Fig. 2b). 80% of shore-based anglers had declared monthly incomes of up to 5 minimum wages (average of 4.4, \cong US\$ 1,408), and 82% of onboard anglers up to 10 (average of 8.6 \cong US\$ 2,580) (Fig. 2c).

Table 1. Results of the chi-squared tests comparing the survey responses applied to the shore-based and onboard anglers at Santos Estuary ($\alpha=0.05$; l.s.: level of significance, ***: 99.9%, **: 99.0%, *: 95.0%, n.s.: not significant).

Variable	p	df	l.s.
age class	<0.001	4	***
marital status	0.002	1	**
income	<0.001	2	***
school level	0.024	2	*
angler origin	<0.001	2	***
fishing license	<0.001	1	***
annual gear maintenance	<0.001	4	***
daily fishing expenses	<0.001	4	***
bait expenses	<0.001	1	***
place to purchase bait	<0.001	4	***
fishing frequency	<0.001	4	***
best fishing season	0.007	2	**
perception of fish size variation over time	0.409	1	n.s.
perception of variation in catches over time	0.150	1	n.s.
anthropogenic influences	0.001	6	**

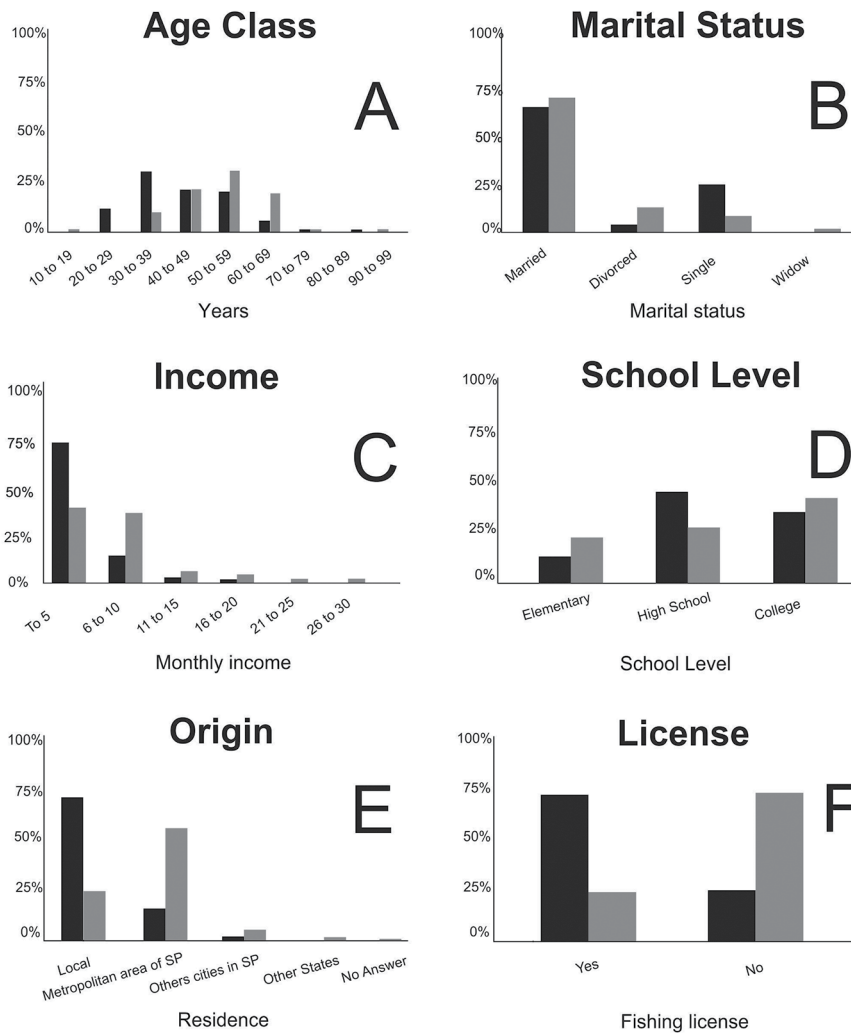


Figure 2. Results of descriptive statistical analyzes of the interviews with boat (grey square) and bank (black square) anglers in the Santos Estuary (a: age class, b: marital status, c: income in US\$, d: education level, e: angler residency, f: fishing license).

Both also differed in relation to formal education, as 45% of onboard had higher education than 37% of shore-based ones, which had the predominant medium level (49%) (Fig. 2d). There was also a marked difference in the origin of the anglers (Fig. 2e), with almost 75% of shore-based anglers from the region and 45% of onboard from the Metropolitan Area of São Paulo). They had also differed in terms of owning a fishing license, with 73% of the shore-based vessels having no license and 75% of the onboard vessels stating that they did (Fig. 2f).

A total of 52% of the shore-based anglers said to spend up to US\$ 140 with purchase and

maintenance of equipment and 40% of onboard anglers between US\$ 205 and US\$ 1,400, and other 17% higher (Fig. 3a). Considering transportation, food, fuel, fishing guide, and other casualties, the cost of one day of fishing to shore-based anglers was up to US\$ 23 for 77% of the interviewees, while for 82% of onboard anglers had mentioned costs of US\$ 23 to US\$ 160 (Fig. 3b). Live bait (shrimps) was the preferred bait by the onboard anglers (64%) (Table 2), who spent US\$ 5 to US\$ 70 (89%) (Fig. 3c). However, (dead) shrimps were purchased in fishmongers (48%) by shore-based anglers, with costs ranging from less than US\$ 5 to US\$ 23 (Fig. 3d).

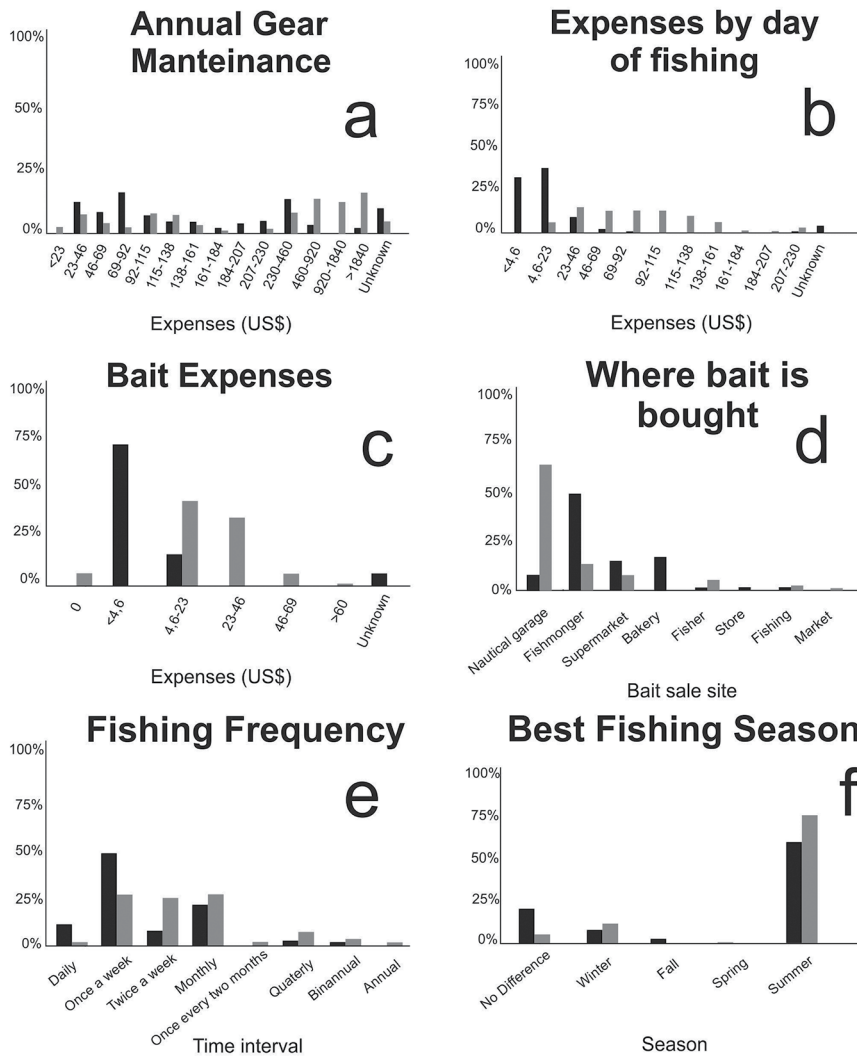


Figure 3. Results of descriptive statistical analyzes of the interviews with boat (grey square) and bank (black square) anglers in the Santos Estuary (a: annual gear maintenance, b: expenses by day of fishing in US\$, c: expenses with the bait in US\$, d: where bait is bought, e: fishing frequency, f: best fishing season).

Table 2. Baits most used in each angling modality in the Santos Estuary.

Bait	Taxon	Shore-based angling (%)	Onboard angling (%)
Live Shrimp	<i>Litopenaeus schmitti</i>	3	64
Seabob shrimp	<i>Xiphopenaeus kroyeri</i>	48	7
Sardine	<i>Sardinella brasiliensis</i>	23	21
Bread	-	19	-
Artificial (jig)	-	-	7
Ghost-shrimp	<i>Callichirus mirim</i>	6	-
Others	-	2	1

Half of the shore-based anglers usually fished weekly with an average of 6.2 hours of fishing. 82% of the onboard anglers, fished weekly, fortnightly, and monthly intervals along an average of 8 fishing hours and had more experienced in the activity (average of 23.3 ± 13.6 yrs, with range 0 to 65) (Fig. 3e). Both categories indicated summer as the most productive season to angling (63% of the shore-based anglers and 79% of the onboard anglers) (Fig. 3f). Onboard anglers had the snooks (*Centropomus parallelus* and *C. undecimalis*) as the target species, but also the weakfishes (*Macrodon atricauda* and *Cynoscion acoupa*).

About the variation of the size and quantity of fish caught, considering their experience, 63% of the shore-based anglers and 68% of the onboard anglers answered that the size of the fish has decreased over time (Fig. 4a) and, 70% and 80%, respectively, that the number of catches has been decreasing over time (Fig. 4b). The main anthropic interferences identified by anglers (Fig. 4c) were the same for both (commercial fishing, pollution, and the intense traffic of vessels). Apart of them, safety was a problem addressed only by onboard anglers (9%).

Most of the shore-based anglers had declared no target species (19.6%), since their goals were a greater number of fish caught (Table 3).

DISCUSSION

This study explored some human dimensions of shore-based and onboard anglers in the Santos

Estuary through a survey that investigated socio-economic aspects, preferences, behaviors, and conflicts concerning local angling.

The social profiles of both angler category, with respect to gender did not present large differences, following the pattern observed elsewhere of being a predominantly male activity, practiced at various ages (Basaglia and Vieira, 2005, Frijlink and Lyle, 2010, Freire et al., 2012, Barcellini et al., 2013, Perez-Bote and Roso, 2014). In most Western countries, angling is described and defined mainly from a middle-aged male perspective because this is the predominant group of participants and, as a result, the angler group that managers and scientists know best (Ditton, 2008). In Australia, male anglers are twice as active than females' (Reid, 2008).

A common socioeconomic pattern, probably justified by the difference in the expenses involved in a day of fishing in each category in coastal distinct areas of Southeastern and Southern Brazil. Similar results were reported by Menezes et al. (2012) and Barcellini et al. (2013) regarding onboard anglers and by Basaglia and Vieira (2005) for shore-based angling. Most of the local shore-based anglers used to fish weekly, like that described by Barcellini et al. (2013) and Schork et al. (2010) in estuaries further south. In general, most onboard anglers live in, or around (metropolitan areas), large cities. Although they have higher expenses (including bait, fishing guide services and/or boat rental or to maintain their own boat in marinas), their fishing frequencies in this

Table 3. Ranking of finfish species of anglers' interest in the Santos Estuary (*: more than an answer).

Shore-based anglers			Onboard anglers		
Target	Taxon	%*	Target	Taxon	%*
None	-	19.6	Snook	<i>Centropomus</i> spp	37.6
Cutlassfish	<i>Trichiurus lepturus</i>	12.7	Weakfish	<i>Macrodon atricauda</i> / <i>Cynoscion</i> spp	12.2
Mullet	<i>Mugil liza</i>	8.5	Cutlassfish	<i>Trichiurus lepturus</i>	11.6
White mullet	<i>Mugil curema</i>	7.9	None	-	3.2
Whitemouth croaker	<i>Micropogonias furnieri</i>	7.9	Whitemouth croaker	<i>Micropogonias furnieri</i>	3.2
Snook	<i>Centropomus</i> spp	4.2	Catfish	Ariidae	2.1
Pompano	<i>Trachinotus</i> spp.	2.1	Atlantic tripletail	<i>Lobotes surinamensis</i>	0.5
Pufferfish	<i>Lagocephalus laevigatus</i>	1.6	Black margate	<i>Anisotremus surinamensis</i>	0.5
Catfish	Ariidae	1.1	-	-	-
Others	-	3.6	-	-	-

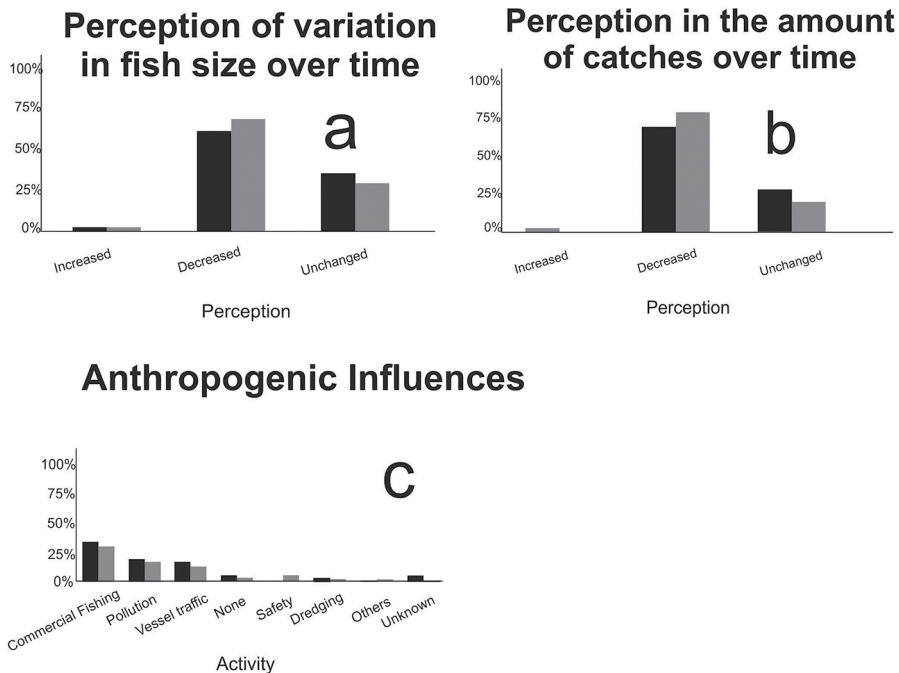


Figure 4. Results of descriptive statistical analyzes of the interviews with boat (grey square) and bank (black square) anglers in the Santos Estuary (a: perception of variation in fish size over time, b: perception in the catches over time, c: anthropogenic influences).

area are lower than shore-based anglers. Even so, they contribute to the local economy, such as boat rental costs, guides, and fuel, as well as baits and food, among others, in a meaningful way.

Shore-based and onboard anglers differ in their fishing habits, socioeconomic characteristics, and in their preferred target species. The responses to some of the questions varied widely, potentially resulting in overlap between the categories.

We acknowledge that this study may present some limitations, as it is not possible to proportionally quantify the sample in the whole recreational angling in the region. Not all questions were answered, especially on those involving costs and expenditure, perhaps due to embarrassment. This tends to occur especially (though not exclusively) in low-income and less educated anglers (proportionally higher among shore-based anglers), where there is greater fear of social exposure, as they consider that it may result in reprisal. Even so, considering the lack of enforcement of fishing licenses, the results obtained may well be accepted as representative of the reality of local recreational fishing activity.

Our findings present the first descriptions of angling activity, which encompasses a broad and diverse contingent of people from various social strata and backgrounds. The growing number of recreational anglers with varying degrees of interest, socioeconomic conditions, and time spent fishing is evident.

Thus, considering that both categories showed appreciation for catch and coexistence with nature in the practice of fishing activity, this disposition may result in future success in the adoption of a voluntary policy of self-recording of catches. In addition, the motivations associated with non-consumption tend to indicate a higher likelihood of fish release by onboard anglers. This, in their perception, makes them more sustainable than shore-based ones. The more experienced anglers tend to recommend the release of certain species, whether endangered or locally recognized as trophy species, and particularly the larger ones, after being photo documented. Thus, the thrill of fishing and the excitement of hitting personal records become more important than the interest in consumption, most remarkable for onboard

anglers. Although not evaluated in this study, the introduction of safe and better handling practices in the release of fish, and in particular larger fish, could potentially be very useful and effective in minimizing post-release mortality, since there is always interest in catching fish of larger size ranges.

It was possible to identify the tourism potential of angling considering the number of marinas dealing almost exclusively with angling, providing direct jobs (through their services), and/or indirectly (fishing guides, boat maintenance, trade, and live bait fishers) (Castilho-Barros et al., 2014). This indicates an active productive chain, even though there are gaps to be seen as challenges for further studies. Most of the interviewees, regardless of the modality, reported that the number of fish caught has been decreasing over time and many of them have an economic interest for commercial fishing. Corroborating to this, Freire (2010) had reported that in some situations catches from angling may exceed commercial catches.

Access to recreational fishing in Brazil occurs through license issuance and fishing quota limits in weight and number (Freire et al., 2016). However, although the annual license was low cost (in the period sampled around \$10) is required for most, the number of fishermen without a license is large (especially among those on shore), since inspection is infrequent.

Moreover, several other anthropogenic activities that interfere with the environment, and consequently into the dynamics of the fishing resources, were recognized by anglers. Important conflicts can occur within the angling community when angler segments with different understandings of fishing, attitudes and behavior come together (Arlinghaus et al., 2020). Otherwise, when compared to commercial fishing, the economic quantification of angling is much more complex in terms of profit and yield (Fenichel et al. 2013).

Understanding that the knowledge of traditional populations should be considered in the formulation of public policies on regional natural resources (Drew, 2005), and considering the experience of the anglers interviewed, and that angling is characterized as an activity commonly transmitted between generations, it is plausible to consider that perceptions of environmental changes that have occurred over the years should also be considered in any management and public

safety measures. The individual perceptions and the personal experience of each angler can define a good or bad fishing day. It involves more factors than just the catches, such as environmental quality, landscaping, ease of access, expenses, comfort, safety, etc. Thus, the management of angling needs to go beyond the quantification of catches and the preservation of the resource, seeking a holistic view of the variables that compose the activity. Finally, understanding the preferences of anglers can be an important tool to support effective management of the recreational fishing economic sector, since policies may gain higher acceptance rates if they align with anglers' interests.

CONCLUSIONS

Our results characterized 189 anglers, among shore-based (94) and onboard (95), and should be viewed as the first description of the Santos estuary related to recreational fishing, providing valuable data that, if collected over time, can bring trends both in social data (anglers' preferences, experiences, motivations, expenditures, conservation attitudes, demographics, etc.) and biological data (composition, abundance and size), at least of the most frequently caught species.

ACKNOWLEDGMENTS

CG Belruss thanks the 'Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil/CAPEs' for a MSc scholarship.

AUTHOR CONTRIBUTIONS

C.G.B.: Data collection, Investigation, Formal Analysis, Writing - original draft,

S.L.S.T.: Conceptualization, Supervision, Methodology, Investigation, Writing - review & editing,

A.R.G.T.: Supervision, Methodology, Project administration, Resources, Validation, Writing - review & editing.

REFERENCES

- ARLINGHAUS, R., AAS, Ø., ALÓS, J., ARISMENDI, I., BOWER, S., CARLE, S., CZARKOWSKI, T., FREIRE, K. M. F., HU, J., HUNT, L. M., LYACH, R., KAPUSTA, A., SALMI, P., SCHWAB, A., TSUBOI, J., TRELLA, M., MCPHEE, D., POTTS, W., WOLOS, A. & YANG, Z. 2020. Global participation in and public attitudes toward recreational fishing: international perspectives and developments. *Reviews in Fisheries Science and Aquaculture*, 29(1), 58-95, DOI: <https://doi.org/10.1080/23308249.2020.1782340>

- BARCELLINI, V. C., MOTTA, F. S., MARTINS, A. M. & MORO, P. S. 2013. Recreational anglers and fishing guides from an estuarine protected area in southeastern Brazil: Socioeconomic characteristics and views on fisheries management. *Ocean & Coastal Management*, 76, 23-29, DOI: <https://doi.org/10.1016/j.ocecoaman.2013.02.012>
- BASAGLIA, T. P. & VIEIRA, J. P. 2005. A pesca amadora de caniço na praia do Cassino. RS: Necessidade de informações ecológicas aliada à espécie alvo. *Brazilian Journal of Aquatic Science and Technology*, 9(1), 25-29.
- BLABER, S. J. M., CYRUS, D. P., ALBARET, J. J., CHING, C. V., DAY, J. W., ELLIOTT, M., FONSECA, M. S., HOSS, D. E., ORENSANZ, J., POTTER, I. C. & SILVERT, W. 2000. Effects of fishing on the structure and functioning of estuarine and near shore ecosystems. *ICES Journal of Marine Science*, 57(3), 590-602, DOI: <https://doi.org/10.1006/jmsc.2000.0723>
- BURUAEM, L. M., CASTRO, I. B., HORTELLANI, M. A., TANIGUCHI, S., FILLMANN, G., SASAKI, S. T., PETTI, M. A. V., SARKIS, J. E. S., BICEGO, M. C., MARANHO, L. A., DAVANSO, M. B., NONATO, E. F., CESAR, A., COSTA-LOTUFO, L. V. & ABESSA, D. M. S. 2013. Integrated quality assessment of sediments from harbour areas in Santos-São Vicente Estuarine System, Southern Brazil. *Estuarine, Coastal and Shelf Science*, 130, 179-189, DOI: <https://doi.org/10.1016/j.ecss.2013.06.006>
- CASTILHO-BARROS, L. C., BARRETO, O. J. S. & HENRIQUES, M. B. 2014. The economic viability for the production of live baits of white shrimp (*Litopenaeus schmitti*) in recirculation culture system. *Aquaculture International*, 22, 1925-1935, DOI: <https://doi.org/10.1007/s10499-014-9792-4>
- CONDINI, M. V., GARCIA, A. M. & VIEIRA, J. P. 2007. Descrição da pesca e perfil sócio-econômico do pescador e descrição da pesca da garoupa (Pisces, Serranidae) no Molhe Oeste da Barra de Rio Grande, RS, Brasil. *Pan-American Journal of Aquatic Sciences*, 2(3), 279-287.
- COOKE, S. J. & COWX, I. G. 2006. Contrasting recreational and commercial fishing: searching for common issues to promote unified conservation of fisheries resources and aquatic environments. *Biological Conservation*, 128(1), 93-108, DOI: <https://doi.org/10.1016/j.biocon.2005.09.019>
- DITTON, R. B. 2008. An international perspective on recreational fishing. In: AAS, O. (ed.). *Global challenges in recreational fisheries*. Oxford: Blackwell Publishing Ltd., pp. 5-12.
- DREW, J. A. 2005. Use of traditional ecological knowledge in marine conservation. *Conservation Biology*, 19(4), 1286-1293, DOI: <https://doi.org/10.1111/j.1523-1739.2005.00158.x>
- FAO (Food and Agriculture Organization). 2012. *Technical guidelines for responsible fisheries: recreational fisheries*. Rome: FAO.
- FENICHEL, E. P., ABBOTTJ, K. & HUANG, B. 2013. Modelling angler behaviour as a part of the management system: synthesizing a multi-disciplinary literature. *Fish and Fisheries*, 14(2), 137-157, DOI: <https://doi.org/10.1111/j.1467-2979.2012.00456.x>
- FREIRE, K. M. F. 2010. Unregulated catches from recreational fisheries off northeastern Brazil. *Atlântica*, 32(1), 87-93.
- FREIRE, K. M. F., MACHADO, M. L. & CREPALDI, D. 2012. Overview of inland recreational fisheries in Brazil. *Fisheries*, 37(11), 484-494, DOI: <https://doi.org/10.1080/03632415.2012.731867>
- FREIRE, K. M. F., TUBINO, R. A., MONTEIRO-NETO, C., ANDRADE-TUBINO, M. F., BELRUSS, C. G., TOMÁS, A. R. G., TUTUI, S. L. S., CASTRO, P. M. G., MARUYAMA, L. S., CATELLA, A. C., CREPALDI, D. V., DANIEL, C. R. A., MACHADO, M. L., MENDONÇA, J. T., MORO, P. S., MOTTA, F. S., RAMIRES, M., SILVA, M. H. C & VIEIRA, J. P. 2016. Brazilian recreational fisheries: current status, challenges and future direction. *Fisheries Management and Ecology*, 23(3-4), 276-290, DOI: <https://doi.org/10.1111/fme.12171>
- FRIJLINK, S. D. & LYLE, J. M. 2010. *An evaluation of motivations, attitudes and awareness of Tasmanian recreational fishers*. Tasmania: Tasmanian Aquaculture and Fisheries Institute, University of Tasmania.
- MARTINS, C. C., BÍCEGO, M. C., MAHIQUES, M. M., FIGUEIRA, R. C., TESSLER, M. G. & MONTONE, R. C. 2011. Polycyclic aromatic hydrocarbons (PAHs) in a large South American industrial coastal area (Santos Estuary, Southeastern Brazil): sources and depositional history. *Marine Pollution Bulletin*, 63(5-12), 452-458, DOI: <https://doi.org/10.1016/j.marpolbul.2011.03.017>
- MENEZES, A. A. S., LIN, C. F., SILVA, C. & SANTOS, R. A. 2012. Aspectos socioeconômicos relacionados à pesca amadora de robalo (*Centropomus undecimalis* e *C. parallelus*) na Baía da Babitonga, Santa Catarina, Brasil. *Revista CEPSUL-Biodiversidade e Conservação Marinha*, 3(1), 22-44.
- PEIRSON, G., TINGLEY, D., SPURGEON, J. & RADFORD, A. 2001. Economic evaluation of inland fisheries in England and Wales. *Fisheries Management and Ecology*, 8(4-5), 415-424.
- PÉREZ-BOTE, J. L. & ROSO, R. 2014. Recreational fisheries in rural regions of the South-Western Iberian Peninsula: a case study. *Turkish Journal of Fisheries and Aquatic Sciences*, 14(1), 135-144.
- REID, D. 2008. Overview of recreational fishing in Australia. In: AAS, O. (ed.). *Global challenges in recreational fisheries*. Oxford: Blackwell Publishing Ltd., pp. 13-17.
- SCHORK, G., MOTTOLA, L. S. M. & HOSTIM-SILVA, M. 2010. Diagnóstico da pesca amadora embarcada na região de São Francisco do Sul (SC). *Revista CEPSUL-Biodiversidade e Conservação Marinha*, 1(1), 8-17.