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The economic displacement of thousands of fishers in the Pantanal, Brazil: A telling story of small-scale fisheries marginalization worldwide.

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Abstract

A new policy in the Pantanal wetland, Brazil, aims to economically displace thousands of artisanal fishers from one-third of the region. The legislation disregards several FAO Voluntary Guidelines for Securing Sustainability in Small-Scale Fisheries' guiding principles (SSF guidelines). Considering that 2024 marks the 10th anniversary of these guidelines, this policy represents a significant setback for fish and fisheries worldwide. In this paper, we show that the legislation is part of long-term agenda against small-scale fishers in the Pantanal, aiming to use narratives around overfishing to justify physical and economic displacements—albeit no empirical evidence showing impact on fish stocks. We also show that, as in many other small-scale fisheries worldwide, overfishing narratives are, in fact, used to open space for industrial activities and large infrastructure projects. The Pantanal is a telling story of that, since the new legislation will likely open space for the construction of over 50 small hydroelectric dams in the Pantanal and surrounding area. We argue that, first, it is urgent to abolish the new

Ghoti papers: Ghoti aims to serve as a forum for stimulating and pertinent ideas. Ghoti publishes succinct commentary and opinion that addresses important areas in fish and fisheries science. Ghoti contributions will be innovative and have a perspective that may lead to fresh and productive insight of concepts, issues and research agendas. All Ghoti contributions will be selected by the editors and peer reviewed. **Etymology of Ghoti:** George Bernard Shaw (1856–1950), polymath, playwright, Nobel Prize winner, and the most prolific letter writer in history, was an advocate of English spelling reform. He was reportedly fond of pointing out its absurdities by proving that 'fish' could be spelt 'ghoti'. That is: 'gh' as in 'rough', 'o' as in 'women' and 'ti' as in palatial.

legislation and promote a pro-fishers agenda in the Pantanal to protect the region. However, since this is not unique for the region, it is critical to implement international programmes that celebrate and support local fisheries worlwide and avoid physical and economic displacements. Stands out turning SSF guidelines into international agreements, implementing citizens science programmes and expanding the fisher's tenure rights through innovative mechanizes of ownership. By better protecting local small-scale fishers in the Pantanal and worldwide we are more likely to guarantee a sustainable future for ecosystems and its peoples.

KEYWORDS
Brazil, small-scale fishery, small-scale fisheries guiding principles (SSF), the pantanal

1 | INTRODUCTION

In March 2024, the government of the Northern Pantanal state approved a new legislation that forbids the transport, storage, and sale of five long-distance migratory fish species for 5 years (law n° 12434/2024, state of Mato Grosso). These species account for 44% of all small-scale commercial catch in the Pantanal wetland, and it will directly impact one-third of the region and affect thousands of fishers who rely on fishing as their main livelihood (ANA, 2020). The legislation was implemented with no fisher's participation, consultation or agreement. By virtually forbidding half of all fishing activities in the Northern Pantanal, the legislation disregards several FAO Voluntary Guidelines for Securing Sustainability in Small-Scale Fisheries' guiding principles, such as consultation and participation, holistic and integrative approaches, and social responsibility, among others (FAO, 2015). Considering that 2024 marks the 10th anniversary of these guidelines, this policy represents a significant setback for fish and fisheries worldwide. In this paper, we aim to highlight the widespread impact of the legislation in the Pantanal, its relation to sustainable fishery practices, and its context within the international small-scale fisheries agenda.

1.1 | Fish of the Pantanal

The Pantanal is a large floodplain situated within the Upper Paraguay River Basin (UPRB), characterized by an altitude variation of up to 200 metres between the floodplain and its surrounding plateau (Figure 1; Junk et al., 2011). Annually, migratory fish species travel hundreds of kilometres to leave the floodplain and occupy the surrounding plateau to spawn (Ziober et al., 2012). After reproduction, adults and juveniles return to the floodplain to grow (de Sousa et al., 2023).

Fish population abundance and distribution are directly related to an annual north–south and east–west direction flood pulse in the region (Junk et al., 2011). The flood takes up to 3 months to cross the entire Pantanal, covering between 10% and 80% of the floodplain depending on the year (Hamilton et al., 1996). The larger the flood pulse, the more fish will be able to survive in the following year (Welcomme, 2001). Furthermore, the moving flood pulse means that recruitment and growth windows change along a spatiotemporal gradient (Resende, 2011).

1.2 | Fishers in the Pantanal

Fishing has been part of Pantanal livelihoods since the first dwellers in the region. Archaeological records show that fishing nets have been used in the Pantanal for at least 5000 years (Peixoto, 2009). Fish bones and fish artifacts are frequently found in indigenous sites throughout the Pantanal, demonstrating the historical intimate relationship between local people and fish (Peixoto & Silva, 2017).

Nowadays, there are artisanal and recreational fishing categories in the region. Artisanal fishing is divided into bait gathering, commercial and subsistence fishing. All the categories are classified as small-scale fishing since fishers are only allowed to use fishing rods; no fishing nets or other simillar fishing instruments are permitted (Chiaravalloti, 2017).

Commercial fishing activities developed in the Pantanal after the 1970s and is a formal labour category in Brazilian legislation, with 90% of riverside community residents registered as fishers (Chiaravalloti, 2019; Chiaravalloti et al., 2022; Mattos et al., 2024). During this period, a combination of large floods, the adoption of new fish storage technologies (ice boxes and freezers), and the establishment of fish processing companies allowed fishers to expand their activities and start commercializing fish (Mateus et al., 2011). People registered as such are entitled to receive a financial benefit (Brazilian minimum wage per month) from the government during the closed fishing season between October/November and January/February (locally known as 'Piracema') (Mattos et al., 2024). Currently, there are around 8000 people registered as commercial fishers in the Pantanal and surrounding areas, capturing over 5000 tons of fish and generating an annual income of over US$12 million (ANA, 2020). 9 of the fish captured are long-distance migratory species (above 100 km) such as spotted sorubim/pintado (*Pseudoplatystoma corruscans*), pacu (*Piaractus mesopotamicus*),

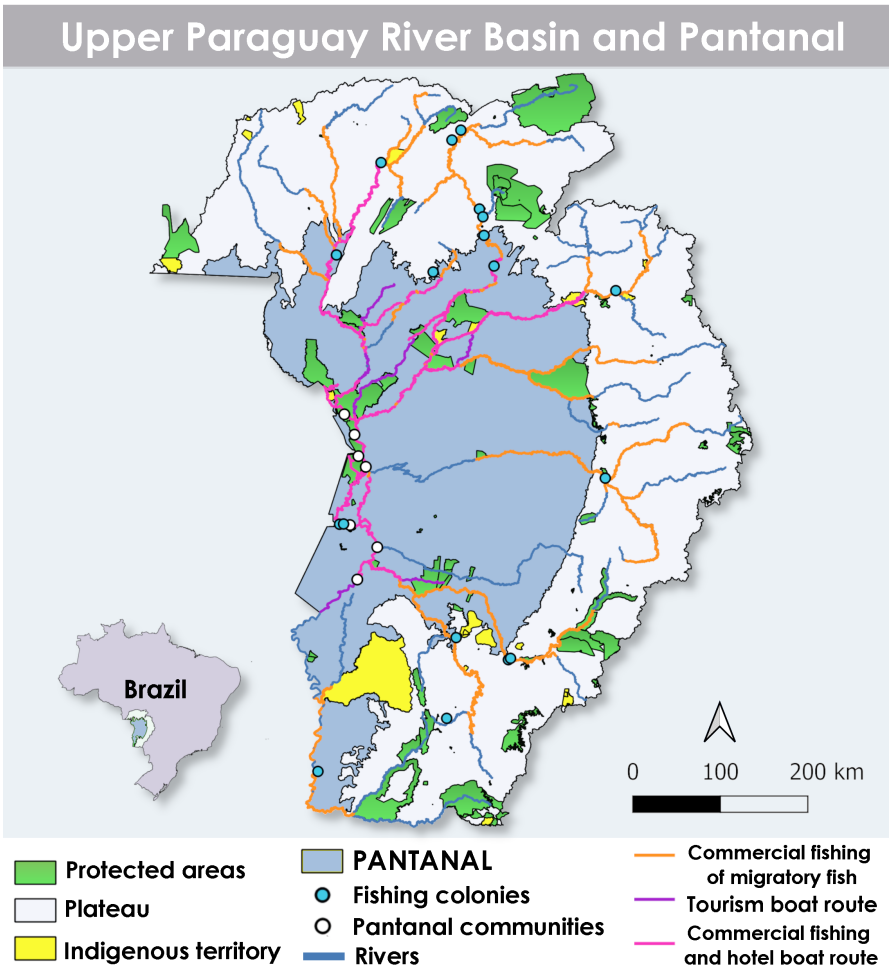

FIGURE 1 Different uses in the Upper Paraguay River Basin and Pantanal by Indigenous Peoples and Local Communities and other activities linked to fishing. Data source for the map: (ANA, 2020).

piavuçu (*Megaleporinus macrocephalus*) and jau catfish (*Zungaro jahu*) (Catella, 2003). Indigenous Peoples and Local Communities (IPLCs) of the Pantanal are mostly classified as commercial fishers, although they shift between commercial, subsistence and bait gathering depending on demand, opportunity and available tools (Chiaravalloti, 2019). Artisanal fishers are usually linked to fishers' associations, locally called 'Colonia de Pescadores', which help them gather the documentation to access the closed fishing season benefits (Figure 1; Nunes et al., 2023).

Recreational fishing also increased in the 1970s as a consequence of large floods and the expansion of transportation networks (i.e., highways and airports). The number of tourists coming to fish in the Pantanal peaked in the 1990s, with over 100,000 tourists visiting each year (Catella, 2003). However, this number has dropped to less than 30,000; possibly due to the opening of new fishing sites in the country and a series of small floods in the Pantanal (Catella et al., 2020). The growth of recreational fishing has led to an increased demand for live bait, prompting many local families to capture small species such as Tuvira (*Gymnotus* spp.) and Pantanal crabs (*Dilocarcinus pagei*) to sell as bait for tourists (Moraes & Espinoza, 2001).

Recent research has identified a 'fuzzy border' that may exist between subsistence and recreational fishing that is typically shore-based or conducted from wooden platforms and is not associated with tourism companies (Massaroli et al., 2021). These are generally cheaper and faster fishing activities, with the catch frequently consumed locally. Yet it plays a critical role in local people's nutrition (ANA, 2020). There are approximately 1.4 million people engaged in this activity in the region, generating over $250 million annually (ANA, 2020).

1.3 | Is there overfishing in the Pantanal?

Scientific assessments of fish stocks in the Pantanal and surrounding regions were mostly conducted during the 1990s and early 2000s. The data suggested possible overfishing for pacu (*P. mesopotamicus*), but no other species showed any signs of stock depletion (Mateus et al., 2011). More recently, an evaluation of the data from the Fisheries Control System of Mato Grosso do Sul State (which includes two-thirds of the Pantanal and analyses the data from artisanal and recreational fishers) from 2004 to 2016, showed stability in the monthly median catch per unit effort (kg per fisherman per day), and on annual landing of migratory species; in other words, no sign of impact (Araujo et al., 2019). More localized studies were also conducted; an evaluation of a centre area of the Pantanal used for

commercial, subsistence and recreational fishing, showed that the region has 'excellent' levels of biological integrity of the fish assemblages (Polaz et al., 2017).

There have also been studies on management measures that may protect fish from overfishing. For instance, fishers from a community in the Southern Pantanal go fishing together and rotate the use of fishing grounds, allowing unexplored areas to re-establish themselves (Chiaravalloti, 2017). In the North Pantanal, in Mato Grosso state (MT), fishers from one community establish clear fishing areas for each family along the river, which protects against possible free riders and overexploitation (Catella et al., 1997).

1.4 | (un)fishing policies in the Pantanal

Despite the lack of evidence of a possible impact on Pantanal fish stock by fishers, there has been a widespread narrative of overfishing (Chiaravalloti et al., 2022). In the 1980s, as recreational fishing started to grow, tourist operators started to pressure policy makers to reduce commercial fishing catch quota and transport (Catella, 2003; Franco et al., 2013). Since then, several legislations were implemented imposing intake and outtake restrictions, especially, for commercial fishers. Between 1983 and 1994, different laws were passed forbidding the use of all fishing nets in the region, and in 2014, the number of fishing rods that professional fishers can use at the same time was reduced to half (Catella, 2003). Minimum and maximum fish sizes and restrictive quotas have increased for all major species (Catella et al., 2020). There have also been accounts of physical and economic displacement of fishers. Strictly Protected Areas were created on the western border of the Pantanal, restricting access to important fishing grounds for hundreds of fishers (Chiaravalloti, 2019). The legislation that forbids half of all commercial fishing in the Northern Pantanal implemented in 2024 is the latest one in this series of policies against commercial fishers.

1.5 | Blaming the wrong one

The evidence pointing to no widespread overfishing in the Pantanal does not mean that fish are not endangered in the region. Rather, there are significant threats to fish that pose major risks to the long-term sustainability of fish stocks (Tomas et al., 2019). However, it is not the Pantanal commercial fishers who should be blamed.

First, infrastructure projects changing hydrological dynamics are already affecting the ichthyofauna of the region. Dozens of small hydroelectric and few large dams have been built in rivers that drain into the Pantanal (Tortato et al., 2022). By 2017, there were 47 dams in operation (Zanatta & Maciel, 2020). A recent study has shown that 30% of dams proposed for the surrounding region of the Pantanal are located on the main migratory routes of fish (Figure 2; Medinas de Campos et al., 2020). At the same time, a new waterway crossing the whole Pantanal is already under construction (Girard et al., 2024). The project aims to expand transportation through the river by deepening and widening the Paraguay River (the most important river in the Pantanal), (Figure 2). The possible impacts of the waterway range from a reduction in the flood extent and changes in hydrological dynamics to the loss of social-ecosystem services (Wantzen et al., 2024).

The presence of invasive species is another significant threat to the Pantanal fishery. At least 10 invasive species of fish, three of which are used in recreational fisheries, such as the peacock bass (*Cichla piquiti*) (Figure 2), the pirarara (*Phractocephalus hemiliopterus*), and the tambaquí (*Colossoma macropomum*), have been found in the Pantanal (Tomas et al., 2019). The presence of these species can represent a serious threat to the native fishes, with impacts on competition for resources, predation and the introduction of parasites or pathogens into the environment (Lymbery et al., 2014).

Climate change is also impacting local fisheries in the Pantanal. The frequency and intensity of extreme climate events in the region have worsened in recent years (Marengo et al., 2016). For instance, in 2019 the Pantanal experienced one of the driest years on record, with forest fires destroying around 30% of the Pantanal (Libonati et al., 2020). Although fish themselves were not directly affected by the fire, the destruction of a large part of the riverside forest has impacted many frugivorous species important for the fisheries in the region (Araujo et al., 2020). Climate predictions point to a reduction of the flood extent and changes in hydrology for the Pantanal (Marengo et al., 2016), with negative impacts on fish and fishers (Peluso et al., 2022, 2023).

Other threats, such as domestic and industrial pollution, pesticides, deforestation, nutrient overload from agriculture (fertilizer and cattle), and silting up of rivers, are also present. Although individually they may not seem to have a large impact, the combination of these factors, in addition to climate change, changes in hydrology, and invasive species, can seriously affect fish stocks and harm fisheries in the Pantanal (Tomas et al., 2019).

1.6 | Why blame fishers for something that is not their fault?

Unfortunately, the Pantanal political agenda against small-scale fishers is part of a broader issue where small-scale fisheries worldwide are marginalized (Béné, 2003; FAO, 2014). These fisheries often face physical and economic displacements under narratives around inefficiency and overfishing (Cohen et al., 2019). Although the FAO Voluntary Guidelines for Securing Sustainability in small-scale fisheries marked an important step towards a more participatory and inclusive towards small-scale fisheries management (FAO, 2015), nearly a decade after their publication, violations of rights and legal issues persist (examples in Nakamura et al. (2024)). The legislation in the Pantanal is a telling example of that.

The legislation that forbids fishing in the Northern Pantanal was proposed shortly after the Brazilian National Agency of Waters and Basic Sanitation blocked the expansion from 47 to over 100 small hydroelectric dams in the surrounding areas of the Pantanal. The

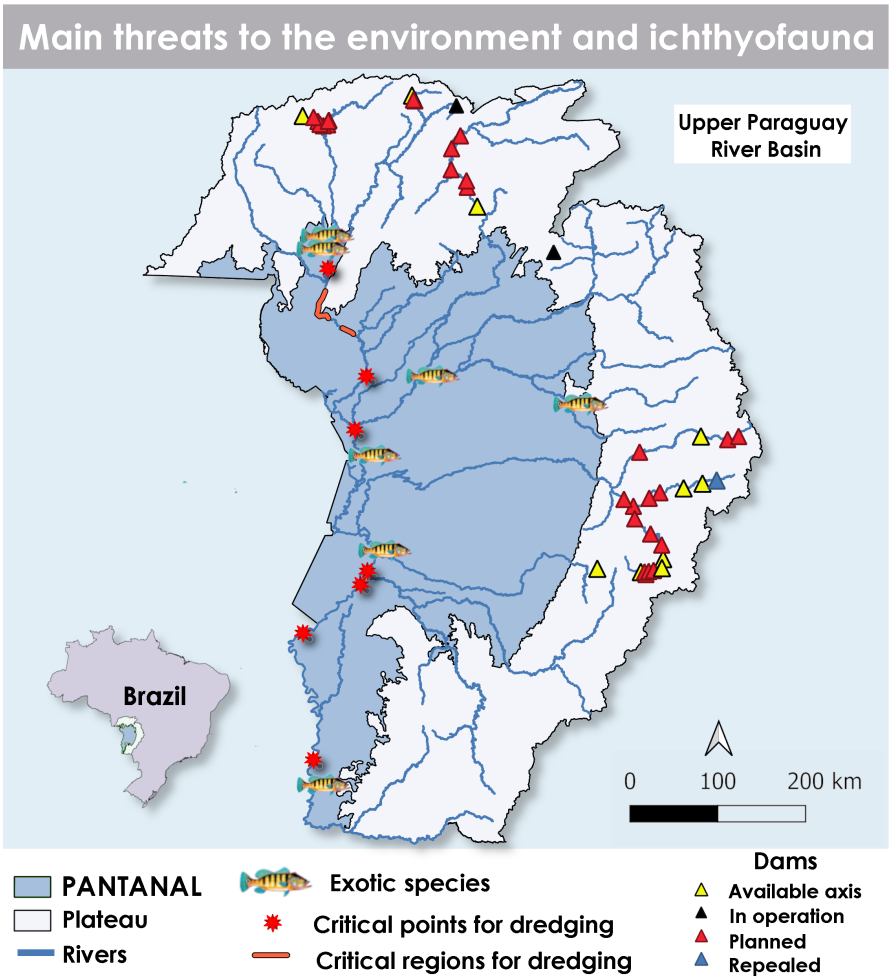

FIGURE 2 Main threats to the environment and ichthyofauna in the Upper Paraguay River Basin and Pantanal. Triangles represent 30% of the dams in conflict-of-use zones located on fish migration routes and regions used by commercial fishing. Critical points and regions that would require frequent dredging and in some cases removal of rocks for the Paraguay-Paraná Waterway. Occurrence points of *Cichla kelberi* and *Cichla piquiti* throughout the Pantanal. Data source for the map: (ANA, 2020; EVTEA, 2015; GBIF, 2023a, 2023b).

agency argued that the dams would impact fish migratory routes and, consequently, local fishers, which goes against the National Water Resources Policy in Brazil (law n° 9433/1997) (ANA, 2020). Thus, by economically displacing fishers, the new legislation could, in principle, create space for the expansion of small hydroelectric dams. In other words, the legislation that forbids half of all commercial fishing in the Northern Pantanal may open space for infrastructure projects that truly endanger the health of the entire Pantanal and its people (Figure 3).

Similar situations have been observed in other small-scale fisheries. In the Rufiji River, a physical displacement of IPLCs in Tanzania has cleared the way for the construction of a large dam aimed at producing hydroelectric power (Hoag & Öhman, 2008). Cases of human rights violations and violence against fishers in the region are widespread (Moreau & Garaway, 2018). In Amazon, the role of many small-scale fisheries in the local economy was partly ignored in the assessment of the possible impact of hydroelectric dams in the region, which minimized the predicted impact of the dams, facilitating government approval and avoiding the required social and economic compensating measures for fishers (Doria et al., 2018). In summary, small-scale fishers are frequently in front of top-down development policies, such as dams and waterways (Allison & Ellis, 2001; Cohen et al., 2019). By creating narratives around overfishing, powerful groups easily justify physical and economic displacements that will open space for industrial activities that frequently impact the entire sustainability of the ecosystem.

2 | CONCLUSION

The new legislation in the Pantanal that forbids fishing of over 40% of species caught by commercial fishers threatens a 5000 year activity in the region (Peixoto & Silva, 2017), that sustains the livelihoods of thousands of people. Sustainability can only be achieved with the participation and respect of all stakeholders in the landscape. It is critical to implement co-management and co-responsibility programmes in the region. Fishers should always be included in discussions and decisions about management objectives, data collection, fishing assessments and management measures to ensure the success of local fisheries (Berkes, 2009). Top-down legislation based on non-empirical evidence will always condemn small-scale fisheries to low yields and collapse (Chuenpagdee et al., 2024).

To better support local small-scale fishers in the Pantanal and globally, we argue that first, the FAO Voluntary Guidelines for Securing Sustainability in Small-Scale Fisheries should become an international convention on how countries should address

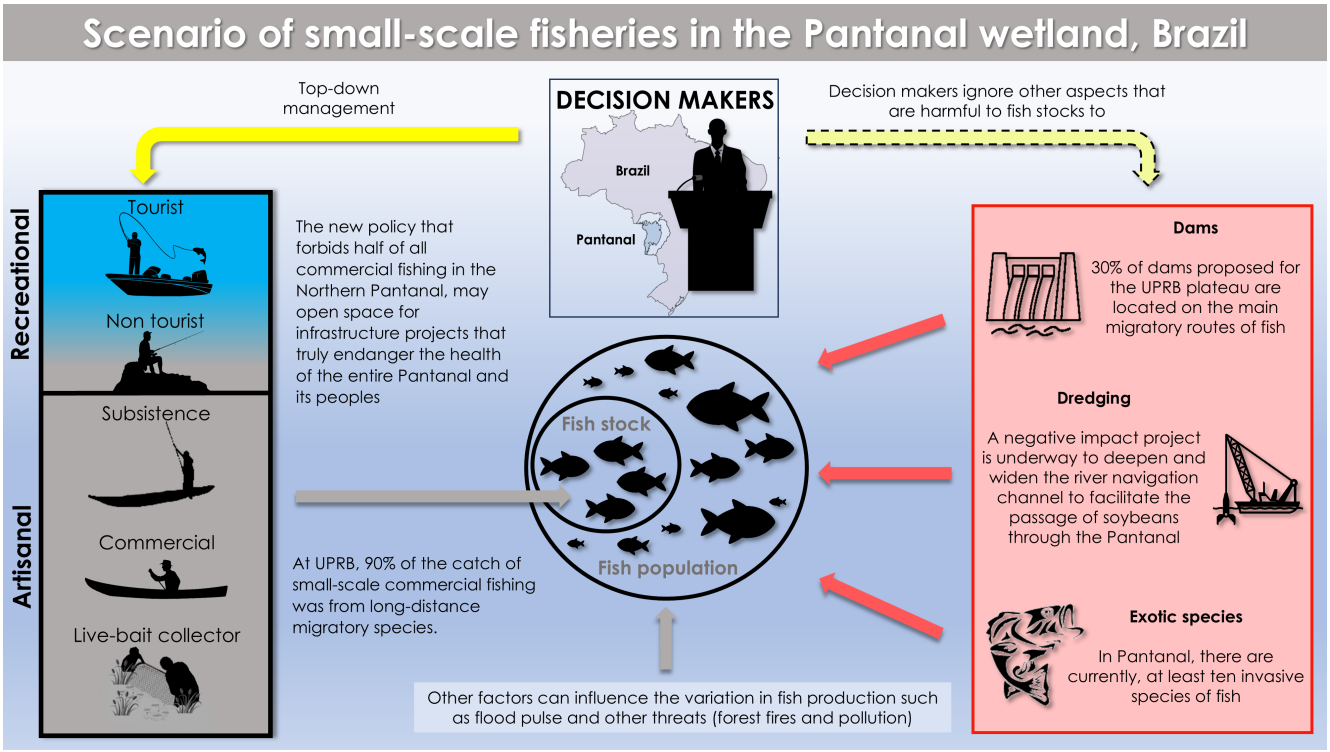

FIGURE 3 'Snapshot' of the current scenario of small-scale fisheries in the Pantanal wetland, Brazil. The figure highlights the importance to consider all factors that can influence the variation in fish production in fisheries management in the Upper Paraguay River Basin (UPRB).

small-scale fisheries. Similar approaches have been adopted for IPLCs through the International Labour Convention 169 and the Convention on Biological Diversity, where countries were invited to adhere to agreed targets on IPLC rights and biodiversity respectively (Convention on Biological Diversity, 2022; ILO, 2017). An international convention would, for instance, provide small-scale fishers with a global platform to advocate for their rights, equity, cultural respect and the rights of women and indigenous people. It would also help in blocking detrimental legislation, such as the new fishing restrictions in the Northern Pantanal.

The second aspect is participation. It is crucial to include fishers' voices in decision-making processes (Reed, 2008). Fishers, who live and understand their environment best, are often overlooked. Implementing programs that allow fishers to participate in knowledge production and decision-making is a critical step towards equity and sustainability. Today, various citizen science tools enable non-scientists to contribute to data collection and knowledge creation (Skarlatidou & Haklay, 2021). Fishers need to represent their needs, perceptions and the ecological dynamics they experience to ensure sustainability. An international citizen science program that allows fishers to collect and store data would give them voice and power in key decisions about fishing practices.

The third aspect is tenure rights. Many cases of physical and economic displacement stem from the lack of secure tenure rights for fishers (Robinson et al., 2018). Their mobility, flexible livelihoods, and often seasonal strategies for resource use and access do not fit neatly into conventional property regimes (Chiaravalloti et al., 2017). Novel tenure arrangements are necessary to allow fishers to secure their rights while adapting to environmental, social, and economic dynamics. For example, seasonal octopus reserves in East Africa have greatly recovered ecosystems while ensuring local nutrition levels (Willer et al., 2023). Such arrangements allow fishers' tenure rights to align with ecological dynamics. Working landscape or Other Effective Area-Based Conservation Measures go in that direction (Bennett et al., 2022).

In summary, fishers in the Pantanal face serious threats. About half of commercial catch have been forbidden in one-third of the Pantanal, while the true causes of fishery and environmental impacts in the region—such as new infrastructure projects, invasive species, and climate change—remain unaddressed, and in some cases, are even promoted as positive developments. Unfortunately, this is just one example of the many policies negatively affecting small-scale fishers worldwide. An urgent change in the agenda focused on international agreements, participatory monitoring and tenure rights is needed to protect local fishers and the ecosystems they depend on.

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CONFLICT OF INTEREST STATEMENT

There are no conflicting interests.

DATA AVAILABILITY STATEMENT

The data used to create the maps are public and are available through the links to their respective citations.

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