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Research

Perceptions of governance and access in artisanal marine fisheries in northern Brazil

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ABSTRACT. Artisanal fisheries form the basis of the livelihoods of millions of people in the Brazilian Amazon. Few empirical studies have characterized, however, how the governance of marine small-scale artisanal fisheries (SSF) in the Amazon, under the decentralized governance system in place, is perceived by those most affected. Drawing on Ribot and Peluso's (2003) Theory of Access eight net-map interviews were conducted with key informants (small-scale and large-scale artisanal fishers, representative of civil society organization and public authority) to investigate how the local fisheries governance system is perceived to affect SSF access to fish and fisheries in Bragança (E of Pará, northern Brazil) between November 2022 and March 2023. Interactions are predominantly seen to occur between SSF as part of daily access negotiation processes. These processes take shape through interactions relating to knowledge of the biogeophysical environment and fishing, and conflict situations when customary fishing rules are not respected. Public authorities were seen to primarily control fishers' legal access through inspections. Civil society organizations were perceived to be ineffective in facilitating access to benefits from public policies. Public authorities and civil society organizations were seen to leave a governance gap in terms of access for fishers. Vessel owners and post-harvest actors were seen by fishers as key regulators of SSF access to capital and markets. They control credits, set ex-vessel prices, and provide material resourcing that sustain power asymmetry. This study highlights key stakeholders' perceptions of the range of relationships through which access to fish and fisheries is negotiated and contested. Our findings suggest that coastal fisheries governance in the Brazilian Amazon needs to address a number of factors influencing SSF, and more broadly, artisanal fishers' access. This should occur alongside resolving immediate conflicts, with a consistent focus on equity and justice as systemic preconditions for sustainable human-nature relations in fisheries.

Key Words: *Brazilian Amazon; fisheries governance; participatory network mapping; theory of access*

INTRODUCTION

Coastal and marine fisheries play a significant role in the livelihoods of Amazonian riverine and coastal communities. Fish and fishing are locally important for a protein-rich diet (da Silva and Begossi 2009, Isaac and de Almeida 2011), culture (Cordeiro 2010), and social dynamics (Mertens et al. 2015), and are often the sole source of income for local populations in coastal communities (Krause and Glaser 2003). In 2019, total marine catches along the Brazilian Amazon coast were estimated at 272,155.422 tonnes representing approximately 37% of the estimated national production (Page et al. 2020). Brazil has not collected national-level fishing statistics since 2011. Page et al. (2020) reconstructed fisheries landings using unpublished data from Freire et al. and data from the Food and Agriculture Organization of the United Nations (FAO) up to 2017. See Santos et al. (2023) for further discussion on the causes and implications of the lack of systematic national fisheries data collection.

Marine fisheries in the Brazilian Amazon also contribute to national and international markets, with red snapper (*Lutjanus purpureus*) as an emblematic, although unsustainable, industrial, and large-scale artisanal export-oriented fishery (Isaac et al. 2009, Mescouto et al. 2024). Pará is the Brazilian state with the second highest number of fishers, of which around half are women (MPA 2023).

Brazilian marine fisheries have undergone significant transformations in recent decades. In Pará, for instance, the once-prominent industrial fishing fleet has declined, and a large-scale, capitalized artisanal fleet has emerged (Isaac-Nahum 2006). This shift has altered local fishing relations by facilitating the entry of new actors, accelerating processes of elite capture, and deepening inequities in access to fish and fisheries (Maneschy 1990, McGrath et al. 2015). The 1988 Brazilian Constitution aimed to decentralize fisheries governance in Brazil with the ultimate goal of improving aspects of governance such as civil society participation, greater consideration of local realities, and local accessibility of public authorities (Wever et al. 2012). However, the governance of marine fisheries in the Amazon continues to be described as partially centralized (Oviedo and Bursztyn 2017), ineffective and weak due to institutional fragmentation, rule breaking and weak enforcement (Isaac and Ferrari 2017, Alencar et al. 2022), although with little empirical evidence so far. There are also assumptions, yet to be substantiated, that fisheries conflicts are relatively low in small-scale fisheries (SSF) because informal rules would help prevent them (Isaac et al. 2009). However, conflicts in the region have been found to arise from negative perceptions of protected area management (Prado and Seixas 2018, Borges et al. 2021), coercive behavior of fisheries surveillance agents, overlapping fishing grounds (Jimenez et al. 2019), and land distribution issues (Santos et al. 2020), among others. A common denominator of these conflicts is unequal access to fish and fisheries as a fundamental driver (Ribot and Peluso 2003, Saunders et al. 2024).

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In this study, we understand small-scale fisheries (SSF) as involving fishers fishing "autonomously or in a family economy, with their own means of production or through a partnership contract, ashore, or with the use of small boats" (translation of the definition of artisanal fishing in article 9, of the Brazilian National Policy for the Sustainable Development of Aquaculture and Fisheries Law No. 11.959, of June 29, 2009). Small-scale fisheries can have subsistence and/or commercial purposes. In large-scale artisanal fisheries, fishing trips last longer than 10 days, vessels are longer than 12 meters, and the hull is mostly made of wood (but can also be made of iron; Isaac et al. 2009). Importantly, we acknowledge that the legal definition of artisanal fishing varies across Brazil's regulatory frameworks. For example, Law No. 11.959/2009 increased the vessel size limit from 10.2 to 20.3 metric tonnes. However, some regulations, notably those concerning social security, continue to use the previous 10.2 metric tonnes threshold, which leads to inconsistent classifications that affect fishers' access to public policy benefits.

Understanding how access is negotiated, achieved, or lost, is essential for socioeconomic outcomes and for the anticipation and more nuanced assessment of fisheries-related conflicts. In addition, a more precise understanding of the role of different groups and institutions in the structure and dynamics of fisheries governance, from the perspective of those whose lives are intimately affected by it, is essential for the formulation of strategies aimed at more equitable governance and governance outcomes.

The present research investigates local and regional stakeholder perceptions of the governance structures and processes for coastal and marine fisheries in the Brazilian Amazon. The main objective is to understand how governance structures are perceived to influence SSF access to fish and fisheries in the coastal state of Pará, North Brazil. Specifically, the aim is to understand (1) who the main actors are in the perceived interaction networks; (2) what are the interactions that connect them; and, (3) how is access to fish resources and fisheries negotiated.

Our analysis unfolds in two steps. First, we examined the composition of perceived networks in terms of actors and links. We then built on a thematic analysis of the conducted interviews to understand how different interactions relate to issues of access in SSF. We discussed the main implications for fishers' access to fish and fisheries considering the Theory of Access (Ribot and Peluso 2003, Peluso and Ribot 2020). We looked at the Amazonian coast of Brazil as a case in point, in which the artisanal fishing sector has historically developed in the absence of supportive public policies and with unregulated market for fish (McGrath et al. 2015, Doria et al. 2021).

Concepts and theoretical framework

Governance and network mapping approaches

We adopted Mark Bevir's (2012:3) definition of governance as "all processes of social organization and social coordination." Bevir (2012) pointed out that the rise of this concept is indicative of a certain discrediting of traditional political institutions. Framing these social organizational processes through the lens of governance shifts the focus away from traditional hierarchies and state structures, emphasizing instead the influence of markets and diverse network structures. In fact, "markets and networks might provide governance in the absence of any significant government" (Bevir 2012:3, but see also Young 1992), beyond the reading of governance as equivalent to government. This paradigmatic shift is also illustrated by the sharp increase in studies on environmental governance using social network analysis (Schwenke and Holzkämper 2020).

Various approaches within the social sciences have highlighted the dynamics of networked governance. The social capital literature emphasizes how diverse actors are connected through a set of relationships, or ties, such as the exchange of lease quotas in the Tasmanian lobster fishery (van Putten et al. 2011), cooperation and information sharing among small-scale fishers in Lobitos, Peru (Maya-Jariego et al. 2017) in which varying network structures are acknowledged to influence actors' access to different types of resources. This resonates with Ostrom's theory of the commons (Ostrom 2010) and related work on collective action, which highlight how resource users, such as small-scale fishing communities, develop local governance arrangements to manage shared resources, sometimes in coordination with, or in the absence of, effective state involvement. Relational approaches (Emirbayer 1997) have recently gained traction; these adopt a process-relational understanding of sustainability-oriented themes. This implies transcending rigidly separate categorizations of human and non-human actors or actants all of which are perceived as having strong influence on how environmental governance unfolds (West et al. 2020).

A number of studies have employed participatory network mapping or related approaches in the context of marine and coastal governance in Brazil. Glaser et al. (2018) adapted the Net-Map method (Schiffer and Hauck 2010) in a comparative analysis of fisher and tourism operator perceptions of environmental governance of a coral reef system in Northeast Brazil. Findings indicate that rules are more readily implemented if perceived as equitable and legitimate by those expected to comply. Gerhardinger et al. (2022) showed how the same methodological approach conducted with high-level institutional innovators of the Brazilian government can help to develop pathways for more transformative ocean governance.

Access

One objective of the study of environmental governance is to understand how access to natural resources and derived benefits are negotiated, contested, and distributed. Access is defined as "all possible means by which a person is able to benefit from things" (Ribot and Peluso 2003:156). In this study, we define "things" as fish and fisheries, where fisheries refer to the range of activities that can lead to the capture of specific fish resources and that can be defined by a variety of social, technological, economic, environmental, and governance conditions (Johnson 2006, Damasio et al. 2016, Smith and Basurto 2019). Similar to Silver and Stoll (2019), our analytical focus underscores that the benefits of fishing extend beyond mere production and income, highlighting its tangible contributions to sustainable livelihoods.

Analyzing access relationships, i.e., who is seeking access, who is maintaining access, and who is controlling others' access, provides a relational perspective on patterns of distribution and drivers of resource conflict. The Theory of Access (Ribot and Peluso 2003, Peluso and Ribot 2020) posits that beyond property rights, de facto gaining, maintaining, or controlling access to resources is

Table 1. Description of the different mechanisms of access after Ribot and Peluso (2003).

Access mechanism	Explanation
Structural and relational mechanisms	
Technology	Refers to the need for fishing gear (including vessels) and other equipment that may favor access to particular fish species and fisheries.
Capital	In terms of wealth, access to capital allows, for example, the acquisition of fishing gear and other technological equipment, as well as the mobilization of labor.
Markets	Access to markets refers to the ability to benefit commercially from fish and fisheries. Markets can be defined at local, national, and/or international levels, and the struggle for access to certain markets (e.g., setting prices) can be linked to exclusionary practices.
Labor and labor opportunities	Labor and labor opportunities are key elements of access to different fish and fisheries. They also define the distribution of benefits because those who control labor opportunities can define the conditions of work relations (including in terms of contract formalization and remuneration scheme).
Knowledge	Knowledge affects who has access and how. For example, access to a particular fishery requires knowledge of the biogeophysical environment as well as the technology required. Knowledge systems also include beliefs and discursive practices that shape meaning making. The ability to access and control information and what knowledge counts in decision making is often linked to issues of power.
Authority	Authority is generally associated with a concentration of power over and control of access. For example, formal and informal organizations need authority to develop and enforce legitimate access rules. Less authoritative groups may be more subject to coercion and thus restrictive control over their activities.
Social identity	Social identity influences access on several levels and is relevant to all other dimensions of access. At the local level, it may influence the sharing of knowledge, aspects such as authority or prejudice and exclusion, as well as allocation of benefits from public policies.
Negotiation of other social relations	Although all other dimensions of access are also forms of social relations, this particular type of mechanism refers to the array of relationships such as trust, friendship, conflict, and dependency as means of negotiating access. Structural, political, and economic changes can alter context-specific social networks of access.
Rights-based mechanisms	
Legal-based	Legal access is mediated by formal and informal laws, regulations, and conventions. In fisheries, fishers often need a fishing licence from the relevant government agency to be formally allowed to fish and to benefit from government programs that support fishing-dependent livelihoods.
Illegal-based	Illegal access occurs when formal and informal access rules are violated. Typically, in fisheries, this occurs when prohibited fishing practices and gear are used to catch fish. It also includes corruption and theft combined with the use of coercive force.

regulated by a range of interacting mechanisms that fall under the following categories: technology, capital, markets, labor and labor opportunities, knowledge, authority, social identity, negotiation of other social relations, and legal- and illegal-based mechanisms. A short description of each mechanism is provided in Table 1. All operate through social relations in a dynamic way, and their workings are contingent on the power relations prevailing among involved entities.

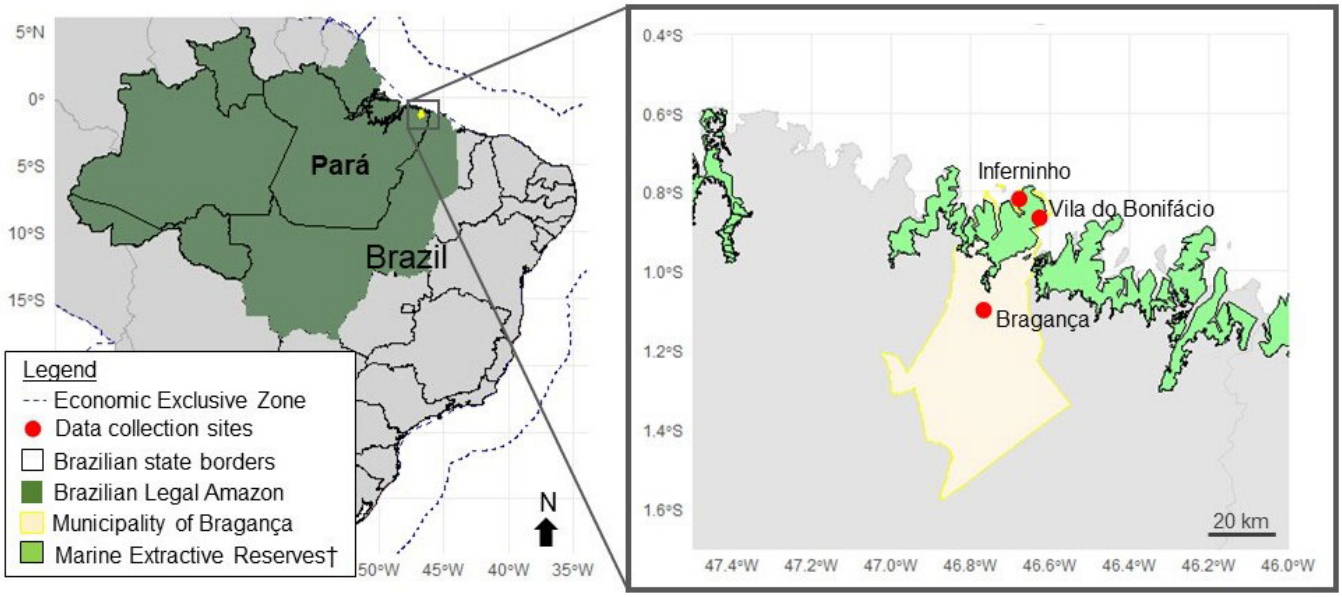
Peluso and Ribot (2020:300) argued that "[...] all efforts to gain, maintain, or control access are, at base, struggles in the domain of social relations [...]", thus suggesting that negotiations of access are central to fishery-related conflicts. A growing number of studies point at lack of equity as a key underlying driver of marine conflicts (Glaser et al. 2018, Saunders et al. 2024). By illuminating the ways in which different groups of people do or do not benefit from a particular natural resource, and by detailing the benefits derived or pursued, the Theory of Access offers a framework to analyze the origin of environmental conflicts. Although mostly applied to terrestrial cases (Myers and Hansen 2019), this theory has also been useful to analyze issues of marine governance (Hicks and Cinner 2014, Calderön-Contreras and White 2019, Andriamahefazafy and Kull 2019). We suggest that these studies may not fully capture the relational component central to the Theory of Access. We propose and use a participatory network mapping methodological approach to assess how access is produced, negotiated, and contested through social interactions (Peluso and Ribot 2020).

METHODS

Study area

This fisheries study focuses on the municipality of Bragança (Fig. 1), located on the coast of the state of Pará, in northern Brazil. Pará is Brazil's second largest state and belongs to what is called the Legal Amazon. The Legal Amazon was initially established by Law No. 1.806 of 6 January 1953, which created the Amazon Economic Valorization Plan and designated the area as a region under the jurisdiction of the Superintendence of Amazon Development (SUDAM). Currently, the Legal Amazon encompasses approximately 58.9% of the Brazilian territory (https://www.ibge.gov.br/geociencias/informacoes-ambientais/geologia/15819-amazonia-legal.html?=&t=o-que-e). Both Pará and the municipality of Bragança have a medium-level human development index (HDI), which translates to poor levels of education, health, and revenue (https://cidades.ibge.gov.br/brasil/pa/braganca/panorama). Of the 393,512 fishers formally registered in Pará (MPA 2023), 194,184 are women and only 236 of them are classified as industrial fishers. In 2022, 49.8% of the 123,082 inhabitants in Bragança earned less than half the legal minimum monthly salary (https://cidades.ibge.gov.br/brasil/pa/braganca/panorama). The city and region lack adequate sanitation and drinking water systems, public recreational areas, health centers, and other infrastructure (Gomes et al. 2009, Gorayeb et al. 2009). This setting of poverty for the majority contrasts with the abundance of nature as local people often acknowledge (Isaac et al. 2010). In fact, this perception of natural abundance influenced the migration of people who fled the semi-arid climate of Northeast Brazil, especially the state of Ceará to come to this region since the late 1890s and early 1900s (Lacerda 2006). Among them, two early families founded what is now known as Vila dos Pescadores and Vila do Bonifácio. In 2010, the total population of Vila do Bonifácio (Fig. 1) was estimated at 1050 people (IBGE 2010, as cited in dos Santos Cavalcante et al. 2022), with 81% of families engaged in commercial artisanal fishing. In these and other fishing communities, kinship plays a crucial role in shaping access (Alencar et al. 2014).

Fig. 1. Map of the study area. † Two marine extractive reserves (RESEX) lie within the municipality of Bragança: the Tracuateua marine RESEX to the west and the Caeté-Taperaçú marine RESEX to the east. The latter is central to this study because it is where data were collected. The boundaries corresponding to the RESEX of Cuinarana and Filhos do Mangue are not included in the map. The corresponding data were last updated in 2022, before both RESEX were officially decreed in March 2024.



The study area embraces two Brazilian Ramsar sites, namely the Amazon Estuary and its mangroves and the Cabo Orange National Park. Highly diverse marine life sustains a range of fishing operations, from small- and large-scale artisanal to industrial fisheries (Isaac et al. 2009).

Ethical considerations

Our research follows the Resolution nº 466, of 12 December 2012 by the Brazilian National Health Council Plenary, which provides guidelines and norms regulating research involving human beings, and the European Commission's directives on ethics in Social Science and Humanities (European Commission 2021).

Fisheries landings in Bragança and challenges to governance

As per the most recent available official national statistics on marine capture fisheries in Brazil, the state of Pará ranks second in the country in terms of fisheries production with 153,332.3 tonnes landed in 2011 (MPA 2011). Marine fisheries in North Brazil are highly diverse, multispecies and multi-gear. Isaac et al. (2009) identified 20 fishery production systems within 3 fishery types: small-scale artisanal fisheries, large-scale artisanal or semi-industrial, and industrial fisheries. Small-scale fisheries use small wooden boats of less than 12 meters in length and have a relatively low environmental impact (in terms of, e.g., exploitation status of targeted stock, level of discards) while mostly contributing to local diets and livelihoods. Large-scale fisheries operate wooden vessels between 12 and 15 meters, while industrial fisheries use steel boats and have a higher environmental impact (Isaac et al. 2009).

Figure 2 shows some of the main organizations in charge of developing and implementing fisheries regulations at different governance levels in our study region, the coastal municipality of Bragança, Pará. Fisheries governance in Brazil is de jure decentralized, i.e., regional and local institutions are delegated power and management by the central governments (Glaser and Gorris 2023). Key legal frameworks have been developed since re-democratization in Brazil (for a federal-level analysis of key legal frameworks for fisheries governance see Nakamura and Hazin 2020; for the Pará state-level, see Alencar et al. 2022). The National Policy for the Sustainable Development of Traditional Peoples and Communities (Decree no. 6040/2007) recognizes the social and political rights of traditional populations, including access to terrestrial and aquatic territories. The National Policy for the Sustainable Development of Aquaculture and Fisheries (Law no. 11,959/2009) replaced the Fisheries Code (Decree-Law no. 221/1967) and shifted the focus from industrialization to environmental, economic, and social sustainability. These policies highlight the significance of inclusive participation, capacity building, and sustainable livelihoods in fisheries, establishing themselves as essential legal tools that influence access to fish and fisheries in Brazil.

In the context of participation in formal governance processes, extractive reserves (RESEX; *reservas extrativistas*) are key institutional arrangements (Seixas and Kalikoski 2009). Extractive reserves are protected areas that aim to both secure local livelihoods and the traditional use of natural resources while integrating local populations into national development (Glaser and Da Silva Oliveira 2004). Extractive reserves are managed by a deliberative council, a multi-stakeholder body chaired by the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio). Our study area includes the Caeté-Taperaçú marine RESEX (Fig. 1), established in 2005. As per the last available statistics, the Caeté-Taperaçú marine RESEX supports

Fig. 2. Selected relevant organizations involved in fisheries governance in Bragança, Pará, Brazil, as identified during the research process (non-exhaustive).

	Organization	Mission	Legal establishment	Reference
Federal level	Ministry of Fisheries and Aquaculture	Formulate and implement a national fisheries and aquaculture policy making it a sustainable source of work, income, and wealth	Law 11.958/2009	https://www.abc.gov.br/zopacas/informacoes/instituicaompa.aspx
	Ministry of Environment and Climate Change	Formulate and implement national environmental public policies for the protection of the natural environment	Law 8.490/1992	https://www.abc.gov.br/zopacas/informacoes/InstituicaoMMA.aspx
	Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA)	Environmental licensing, environmental quality control, authorization for the use of natural resources and environmental supervision, monitoring, and control	Law 7.73/1989	https://www.gov.br/ibama/pt-br/acesso-a-informacao/institucional/sobre-o-ibama#missao-visao-valores
	Chico Mendes Institute for Biodiversity Conservation (ICMBio)	Manage, protect, monitor, and supervise federal conservation units	Law 11.516/2007	https://www.gov.br/icmbio/pt-br/acesso-a-informacao/institucional/o-instituto
	Brazilian Navy	Defense of the homeland, the guarantee of constitutional powers and, at the initiative of any of them, of law and order	Created in 1822	https://www.marinha.mil.br/historia
	National Fisher's Movement (MONAPE)	Ensuring political and economic autonomy of fishers' working class in the struggle for better living and working conditions	1988	Ramalho 1999 in de Fox & Callou (2013)
	Fisher's Pastoral Council (CPP)	Stimulate artisanal fishers' organization toward a more just society, and advocate for nature conservation	Around 1969	http://www.cppnacional.org.br/node/3
	National Commission to Strengthen Extractive Reserves and Traditional Coastal and Marine Extractive Peoples (CONFREM)	Develop, articulate, and implement strategies aimed at recognizing and guaranteeing traditional coastal and marine extractive territories with a view to protect livelihoods and promote sustainable production	2014	https://confrem.wordpress.com/pagina-principal/quem-somos/
State level	State Secretariat for Agricultural and Fisheries Development (SEDAP)	Formulate, plan, and coordinate policies and guidelines for the sustainable development of fishing activities, promote coordination with municipalities	Law 8.096/2015	https://www.sedap.pa.gov.br/a-sedap
	State Secretariat for the Environment and Sustainability (SEMAS)	Promote integrated, shared, and efficient environmental management, compatible with sustainable development, ensuring the preservation and conservation of the environment, and improving the quality of life	Law nº 5457/1988	https://www.semas.pa.gov.br/institucional/o-que-e-a-sema/
	State Council for the Sustainable Development of Fisheries and Aquaculture (COEPAq)	Deliberate on fisheries and aquaculture regulations, propose and approve activity plans, advise on policy and compliance issues, mediate conflicts, enhance actors' dialogue, and suggest budget allocations and strategic actions to SEDAP	Law 7.019/2007	Decree no. 497 of August 22, 2012
	Federal University of Pará (UFPA)	Produce, disseminate, and transform knowledge in the Amazon region to promote a more inclusive and sustainable society	Law 3.191/1957	https://ufpa.br/missao-visao-e-principios/
	Federal Institute of Pará (IFPA)	Offer all levels and modalities of professional and technological education to train and qualify citizens	Law 11.892/2018	https://ifpa.edu.br/component/content/article?id=1516
	Fisher's Movement of the State of Pará (MOPEPA)	Act in favor of the interests of artisanal fishers in the Legislative Power of Pará	1989	Bezerra (2000)
	Union of Fishing Industries of the States of Pará and Amapá (SINPESCA)	Represent the general interests of fishing vessel owners and operators in the states of Pará and Amapá before the administrative and judicial authorities	1985	http://sinpesca.org.br/pagina.php?cat=1&noticia=11
Regional level	Mixed Fishing and Aquaculture Cooperative of the Salgado region (COOMPESCAR)	Support activities for saltwater fishing	2014	https://cnpj.biz/19586294000103
Municipal and local level	Municipal Secretariat for Aquaculture and Fisheries (SEMAP)	Promote integrated sustainable development by strengthening fishing activities in Bragança	Law 4.647/2018	https://www.portalcr2.com.br/detalhes-estrutura/braganca-secretaria-municipal-de-aquicultura-e-pesca
	Municipal Secretariat for the Environment	Elaborate and put into practice policies aimed at environmental management at the municipal level	Law 4.035/2009	https://www.portalcr2.com.br/detalhes-estrutura/braganca-secretaria-municipal-de-meio-ambiente
	Municipal Council for the Development of Fisheries and Aquaculture (COMDEPA)	Oversee the implementation of the municipal fisheries policy and encourage dialogue among interested parties on fisheries issues	2021	https://web.archive.org/web/20240613013500/https://braganca.pa.gov.br/posse-do-conselho-municipal-de-desenvolvimento-da-pesca-e-aquicultura-comdepa/
	Municipal Environment Council (COMDEMA)	Oversee the implementation of the municipal environmental policy and encourage dialogue among interested parties on environmental issues	Law. 4.035/2009	De Sousa (2011)
	Deliberative Council of the Caeté-Taperaçú Extractive Reserve	Multi-stakeholders body for the negotiation and effective implementation of the Resex Caeté-Taperaçú Management Plan	Ordinance 17/2007	Ordinance 17/2007
	Assuremacata	Association representing Caeté-Taperaçú marine extractive users, which holds the Real Right of Use Concession (CDRU) for RESEX	2005	https://www.ibama.gov.br/sophia/cnia/plano_manejo/caeteaperacucartilhafinal.pdf
	Fisher's guild Z-17	Represent artisanal fishers and promote and defend their social rights	1922	Lima et al. 2020
	Bragança's artisanal fishers' union	Represent artisanal fishers and promote and defend their social rights	2004	Personal Communication

Civil society

approximately 8000 families who rely on its natural resources for sustenance (ICMBio 2011, https://www.gov.br/icmbio/pt-br/assuntos/noticias/ultimas-noticias/resex-marinha-de-caete-taperacu-fortalece-as-instancias-participativas) with crab (*Ucides cordatus*) fisheries representing the most significant economic sector (Partelow et al. 2018). Its deliberative council includes ICMBio in the lead and, among others, representatives of the users' association *Associação dos Usuários da Reserva Extrativista Marinha Caeté-Taperaçú* (ASSUREMACATA, hereafter users' association), the Z-17 Fishers' Guild (*Colônia de Pescadores de Bragança Z-17*, hereafter the fishers' guild), and the Artisanal Fishers' Union of Bragança (*Sindicato dos Pescadores Artesanais de Bragança*, hereafter the fishers' union; federal ordinance no. 17, of 24 September 2007). Although the RESEX are designed to enhance participatory governance, limited engagement with its political processes has been noted (Partelow et al. 2018). This is often linked to perceptions of procedural burdens, the marginalization of local voices, including those of younger generations in decision making, and ongoing internal power disputes (Partelow et al. 2018).

Further institutional arrangements that promote participation at the state and local levels are the fishing agreements and the standing management committees (*Comitês Permanentes de Gestão*). Fishing agreements are established by local communities that formulate rules for fishing in a particular body of water, such as gear restrictions or seasonal fishing schedules. Relevant to the study area is the Caeté River Fisheries Agreement (but focused on freshwater fisheries; established through State-level SEMAS Ordinance n°1.358 of 07/2023). Standing management committees, such as the Standing Committee on Fisheries Management and the Sustainable Use of Demersal Fisheries Resources in the northern and northeast regions (established through Interministerial Ordinance n°8 of 09/2015) are consultative advisory multi-stakeholder bodies that inform decisions taken by the relevant federal authorities on given fisheries, including large-scale, artisanal, and industrial fisheries.

Despite these arrangements, fisheries regulations still often originate at the federal level, limiting the autonomy of regional and local institutions. Power imbalances at multiple levels hinder equitable actor participation and the integration of different types of knowledge. Lack of financial and human resources, as well as data, result in less accountable local organizations (Moura et al. 2009, Wever et al. 2012, Oviedo and Bursztyn 2017). In Bragança, sustainable fisheries with a balanced and effective participation in decision making are not yet a reality (Isaac et al. 2009, Partelow et al. 2018, Borges et al. 2021). Lack of communication among stakeholders, power imbalances, and political misrepresentation are among the factors that hinder participatory engagement in fisheries management (Isaac et al. 2010, Seixas et al. 2019).

Data collection

This research aligns with the premises of qualitative research (Maxwell 2008). We build on a social constructivist and critical approach to acknowledge that realities are socially constructed and mediated by subjective experiences shaped by the broader context and environment; and to acknowledge the mediation of the researcher's own subjectivity(ies) in building an understanding of the problem being explored (Schwandt 1994). More specifically, this study builds on an analysis of perceptions as socially and historically situated interpretations, understandings, and evaluations of environmental change and governance (Bennett 2016). As forms of situated knowledge, perceptions are shaped by political and economic structures, institutional contexts, prevailing power relations, and everyday lived experiences.

Data were collected using a participatory network mapping method called Net-Map pioneered by and adapted from Schiffer and Hauck (2010). Net-Map allows the study and understanding of perceptions of complex governance problems (e.g., fisheries governance-related issues). A total of eight net-map interviews (Table 2) were carried out with key-informants between November 2022–March 2023 in the state of Pará, North Brazil. Net-maps #1-4 were conducted in the fishing communities of Vila do Bonifácio and Inferninho. The remaining net-maps were conducted in Bragança. Interviewees were: artisanal fishers, individuals (n = 3) or in groups (n = 2 groups of 3 fishers), and representatives of local municipal-level institutions linked to artisanal fisheries' interests and management, namely two civil society organizations: the users' association (n = 1) and the artisanal fishers' union (n = 1); and one public authority, ICMBio (n = 1). Participants were selected through purposive sampling (Patton 2002) to capture a range of perspectives relating to fisheries that formally classify as artisanal, in the region of Bragança. This net-mapping approach reflects our goal of undertaking a deep qualitative exploration of the interviewees' subjective experiences, with particular attention to their varied backgrounds and involvement in fisheries management. This allowed us to capture the complex nuances of relational power dynamics influencing access within this sector. Research fatigue observed in the region was also considered. Subsequently snowball sampling (Braun and Clarke 2013) was also used in the absence of a gatekeeper and as the lead author built a local network. In meaningfully selecting our interviewees, we aimed to explore if and how diverse targeted fish species, gear type, and thus engagement in different temporal and spatial relations within their fishing activities, influenced fishers' perceptions. Selection criteria additionally included fishing experience for fishers' interviewees (net-maps #1–5) and considerations of leadership within the community or relevant institutions for other participants (net-map 1; net-maps #6–8). The Z-17 fisher's guild in Bragança is another key institution, however, requests for a net-map interview were unsuccessful. We acknowledge this limitation and recognize its impact on the scope and depth of our analysis of governance and local power dynamics.

A first set of net-maps was conducted with individual participants (net-maps #1–3). For net-maps #4–5, a focus group approach was adopted to gather perspectives from otherwise geographically dispersed participants to encourage dynamism and reduce potential research fatigue from a time-consuming activity, and to provide insights into the ways in which accounts of governance processes are negotiated among participants (Braun and Clarke 2013). When fishers shared similarities in terms of fishery operation and community affiliation, as in net-map #4, participation was balanced. The participants in net-map #5 were involved in the municipal education system for fishers in the town of Bragança. However, they worked in different fisheries and did not share community membership. In this case, one of the participants with closer ties to formal fisheries management

Table 2. Overview of Net-Map interviews between November 2022 and March 2023 in Bragança, State of Pará, Brazil.

net-map #ID	Groups of fishers and formal institutions interviewed, and fishing ground/place of work	Of what sector	Single-participant or focus group	Age group	Basic participant fishing-related information	Interview duration (in minutes)
1	Diverse fishes (net, river, and estuary)	SSF	Key informant	40–49	Participant only worked in small-scale artisanal fisheries, owns his own boat and gear, and goes fishing with another person, usually a relative; is familiar with the Municipal Secretariat for Fishing through a relative working there.	155
2	Cynoscion acoupa fishery (net and longline, estuary, and coastal)	SSF	Key informant	20–29	Participant only worked in small-scale fisheries, owns his own boat and gear, and goes fishing with another person, usually a relative. Descends from the founders of the fishing village Vila do Bonifácio in 1913.	81
3	Acoupa weakfish fishery (net and longline, estuary, and coastal)	SSF	Key informant	50–59	Participant owns his own boat and gear and goes fishing with another person, usually a relative. Has already worked in large-scale artisanal fisheries close to the international border with French Guiana. Descends from the founders of the fishing village Vila do Bonifácio in 1913.	120
4	Diverse fishes (fixed trap (*curral*), estuary)	SSF	Focus group (3 participants)	50–69	Participants live in the community of Inferninho and have close personal ties. They have always operated mainly in *curral* fisheries; they own their own *curral*, go fishing with another person, usually a relative; are leading members of the *Curral* Fishing Association, which is supported by the Municipal Secretariat for Fishing and are recognized as local fishing community leaders.	99
5	Mixed fisheries (coastal shrimp, Gillbacker sea catfish, Acoupa weakfish; net and longline, coastal, and Northwards up to the international border with French Guiana)	SSF and LSF	Focus group (4 participants)	40–59	Participants worked in both small-scale and large-scale artisanal fisheries; they may or may not own a boat and gear; go fishing with relatives and with crew in larger fishing boats; one participant working as volunteer with ICMBio.	120[†]
6	ICMBio, Bragança region	Public authority	Key informant	40–49	At the time of the interview, the participant had been in charge of social-environmental management at ICMBio for two years and was not a fisher.	79
7	Artisanal fishers' union, Bragança region	Civil society organization representing artisanal fishers	Key informant	50–59	Participant originally came from a fishing community and is a small-scale artisanal fisherwoman. She holds a leading position in the artisanal fisher's union in Bragança and in her community, and was exclusively dedicated to this position at the time of the interview.	124
8	Assuremacata (Caeté-Taperaçú marine RESEX users' association), Bragança region	Civil society organization representing mostly small-scale fishers	Key informant	50–59	Participant is a small-scale artisanal fisher and has a political and activist career in favor of small-scale artisanal fishing in the region. At the moment of the interview, he was exclusively dedicated to his position at the RESEX users' association.	195

SSF =Small-scale artisanal fisheries.
[†] The recording of the interview for net-map #5 was unsuccessful and thus was not included in the qualitative data analysis of this research.

organizations had a more prominent voice, and care was taken to avoid over-representation. Our subsequent analysis was also informed by observations of these group power dynamics (Farnsworth and Boon 2010). The overall number of interviews is consistent with our aim of exploring a range of stakeholder-specific perceptions in depth, in accordance with the principles of qualitative research. Other studies using the Net-Map method have conducted similar numbers of interviews (e.g., N = 6 in Glaser et al. 2018).

Before the network mapping exercises, all participants were informed of ethical considerations of the study and gave consent for the recording of their interviews. The net-map activity consisted of three steps (adapted from Schiffer and Hauck 2010):

1. To kick-off the activity, participants were asked "Who affects and who is affected by what happens with fisheries landing in Bragança?" (based on Glaser et al. 2018). Participants mentioned different groups of people or institutions. The interviewee wrote the names on color-coded post-it notes (Table 3). Fisheries sectors were attributed different colors, depending on how participants distinguished or named them. The post-it notes were placed on a large piece of white paper. We acknowledge the epistemological and ethical implications of framing this question in a way that polarizes groups of actors into those with power and those without. Drawing on theories of power dynamics and in particular Ribot and Peluso (2003) and Peluso and Ribot (2020), we understand power as a relational force mediated by structures in which fluid hierarchies as well as everyday acts of resistance challenge static notions of power.
2. When it was agreed that all relevant actors had been identified, participants were asked how the entities interact with each other, i.e., what types of links connect different entities. Five types of links were previously established based on Schiffer and Hauck (2010) and Glaser et al. (2018): (1) communication, (2) support/capacity building, (3) money flow, (4) control, and (5) complaint (Table 4). These links were to be represented by drawing uni- or bi-directional arrows of different colors for each type of link.
3. As the activity proceeded, the interviewer summarized what they were seeing in terms of net-map actors and links to ensure a correct understanding of the overall picture and to prompt further explanations when needed by participants.

Presidential elections were held in Brazil in October 2022, and a new government took office in January 2023. All net-maps produced before March 2023 are representative of the governance

Table 3. Net-Map actors' classification and their corresponding post-it note color.

Classification of actors	Corresponding color
Small-scale artisanal fisheries (SSF)	Yellow
Large-scale artisanal fisheries (LSF)	Green
Industrial fisheries (IF)	Blue
Vessel owners and post-harvest (VOPH)	Orange
Other onshore and offshore businesses (BUS)	Purple
Public authorities (PA)	Pink
Research and education organizations (REO)	Gray
Civil society and civil society organizations (CSO)	White

situation under the previous government because the configuration of ministries and secretariats under the new administration was uncertain during that time.

Data analysis

For this research, we used an inductive methodological approach. The net-map interviews yielded two types of outputs: (1) a visual representation of the perceived network; and (2) the interview recording. We first analyzed the net-maps produced in terms of their composition of actors and links. We then undertook a qualitative analysis of the interviews to understand how the interactions between different actors relate to access for fishing.

Analysis of perceived networks

Visual and basic quantitative analysis of the net-maps provided information on the network composition, i.e., on which actors were perceived by respondents, through which interactions they were related, and the respective frequencies of occurrence (based on Gerhardinger et al. 2022).

First, the perceived networks were visually represented using the open-source software Gephi (product version 0.10.1) for network visualization. Labels were established for each actor group mentioned by the interviewee that best reflected the names originally assigned. The parameters by which participants grouped certain fisheries were discussed to assign a fishery category. The names of target fish species mentioned in common Portuguese language during the interviews were associated with scientific names based on Isaac et al. (2008) for artisanal fisheries and Frédou et al. (2008) for industrial fisheries.

The numbers of actors and links were counted for each net-map to align with the previously established typologies. A Sankey diagram was plotted using the open-source data visualization platform RAWGraphs (Mauri et al. 2017) to represent the interactions between actors as senders and receivers, respectively, for all eight net-maps combined. To understand stakeholder specific differences of perceptions, the networks were also compared in terms of network composition.

Qualitative analysis of interviews

A qualitative analysis of the net-map interviews was carried out to elucidate the perceived interactions related to access to fish and fisheries. The transcripts of the interviews were initially generated using the online transcription software Sonix Inc. and were subsequently manually corrected and edited. We then conducted a thematic analysis (TA) using a deductive-inductive codebook approach based on Miles and Huberman (1994). Coding was done in the original language of the interviews, Brazilian Portuguese, using the software MaxQDA Plus version 2020. The coding process is detailed in Appendix 1. Different access issues were identified for each category of actors concerned (based on Ribot and Peluso 2003). The coding process was performed by the lead author (LD) and subsequently discussed and checked with co-authors MG and RS. The influence of the author's subjectivity in the coding process is acknowledged.

The results of the qualitative analysis are presented in the form of tables, which include the three most cited mechanisms of access to fish resources and fisheries for the most cited SSF, public authorities, vessel owners and post-harvest, and civil society organizations, along with the corresponding themes. The frequencies are shown per aggregate of fishers' net-maps (net-maps #1–4), civil society organizations' net-map #6 and net-map #7, and public authorities' net-map #8 to better capture differences in participant groups' perceptions.

RESULTS

Network map analysis: general overview

The eight net-maps are pictured in Appendix 2. A total of 174 actors and 402 links were mentioned by participants. Small-scale fisheries (SSF) actors were the most cited actor group (n = 42), followed by public authorities (n = 36), and civil society organizations and large-scale fisheries, which were each cited 24 times (Table 5). The group of vessel owners and post-harvest actors included intermediaries, vessel owners, and the fishing and processing industries, as well as the national and international export markets.

In fishers' net-maps #1–5, the most frequently mentioned link type through which access is negotiated was "money flow" (n = 59), followed by "complaints" (n = 48), and "support" (n = 48; Table 5). However, in the summary net-map, SSF access through "communication" was mainly within SSF's own group (Fig. 3). "Complaint" was the next largest link through which access to fish and fisheries was negotiated mainly among SSF. Few links were perceived coming from groups of fishers to government agencies, civil society organizations, and vessel owners and post-harvest actors. For net-map #5, whose participants work in what they classified as industrial fisheries, access was negotiated through complaint links that come from all industrial fisheries explicitly to vessel owners.

Civil society organizations were perceived to influence SSF access mostly through support links, as in net-map #2 (Table 5). In the other fishers' net-maps, the fishers' guild and the artisanal fishers' union were either absent (e.g., net-map #4) or connected through money flow to fishing actors (as a mandatory contribution for membership) as in net-map #3. The fishers' guild and the artisanal fishers' union were poorly connected to each other and to SSF from the fishers' perspective. In both civil society organizations' net-maps (net-map #7–8), the RESEX users' association facilitated access of fishing actors through "control," "communication," and "support." The artisanal fishers' union, on the other hand, appeared only in its own net-map, with no link to fishing actors, and appeared to play a minor role in facilitating fishers' access. Contrary to fishers' perceptions, civil society organizations' respondents saw SSF actors with limited links to each other.

Table 4. Definition of the types of interactions used in the net-maps and the corresponding arrow color used for the graphical representation. All definitions of types of interactions were sourced and adapted from the Cambridge dictionary online.

Types of links	Definition	Access implications	Corresponding link color
Communication	Process by which a message or information is sent from one place or person to another, or the message itself	Communication links are conceptualized as knowledge exchange. The exchange of information about fisheries between fishers on land or at sea improves access to fish and fisheries (e.g., Crona 2006), as does the existence of conflict resolution mechanisms when access is obstructed or contested.	Blue
Support/ cooperation	To encourage someone or something because you want them, or it, to succeed; the act of working together with someone	Support links are conceptualized as asset sharing, capacity building, funding, and sharing of other forms of material resourcing (e.g., Partelow et al. 2018). Support is positively related to improved access.	Green
Money flow	The process by which money is moved from one place or by one person to another	Money flow is conceptualized as the existence of formal or informal labor contracts, selling contracts, credits, or loans. An increased access to markets, financial capital, and labor for fishers is associated with greater fish catches and access to fishing gears (Poissant et al. 2023).	Yellow
Control	To order, limit, or rule something or someone's actions or behavior	Control links are conceptualized as indicative of enforcement of (formal or customary) fishing regulations. Although these may be designed to sustain fisheries in the long term, in the short term, they are likely to restrict fishers' access to fish and fisheries. If fishers perceive that control is unevenly enforced (i.e., one group benefits from greater access) or that regulations are not legitimate (e.g., unfair restriction of access), this may result in complaints to the controlling body (see Fabinyi et al. 2015).	Brown
Complaint	A statement that something is wrong or not satisfactory	Complaint links are conceptualized as contestations of perceived unequitable access to fish and fisheries (Glaser et al, 2018, Saunders et al. 2024). Complaints may reflect a spectrum of conflict situations, ranging from latent to more evident.	Red

In contrast to the low mentions of interactions emanating from SSF to public authorities, SSF received around half (n = 38) of the total links coming from public authorities (n = 74), which translated a strong overall perception of influence of the latter over SSF. Public authorities mostly regulated access of SSF through control (net-map #3–6, Table 5). The government representative interviewed was the only respondent to depict a systematic bi-directional communication network between the government agency represented (ICMBio) and all fisheries actors. No direct connection between ICMBio and the RESEX users' association was mentioned by the public authority respondent. No complaints were perceived among or between formal organizations, but all fisheries were mentioned to have complaints among themselves. Despite receiving very few links coming from other actors, vessel owners and post-harvest actors largely controlled SSF and large-scale artisanal fisheries' access through money flow.

Qualitative analysis of interviews

Knowledge, technology, and legal-based mechanisms were particularly relevant for SSF access. Figure 4 shows the average number of mentions per interview aggregate (net-maps #1–4; net-map #6; and net-maps #7–8) relating to different mechanisms of access. Small-scale fisheries' access to fish was mostly linked to knowledge of the biogeophysical environment and in particular to the characteristics of the target species, as illustrated by the following quote:

> *This is the time for net fishing when the moon is full. That's the time to net the pescada-amarela* [Cynoscion acoupa]*, which is the best.* (net-map#2)

The second most cited dimension of access was technology. Small-scale fisheries' reliance on technology to adapt to changes in fish behavior and environmental conditions becomes particularly evident when access to this technology is restricted:

> [...] *if we had another type of material net, then we'd go somewhere else, right? Antônio* [...] *has 400 meters of fishing nets. Then his fishing won't stop, because he's already got the pescada* [Cynoscion acoupa]*, he's got the corvina* [Cynoscion virescens]*, he's got the uritinga* [Sciades proops]*, he can fish and keep his pattern up all the time, right?* (net-map #4)

Technology was also a topic in many of the complaint links among SSF that related to gear conflicts and aspects of everyday negotiations for access to fish and fisheries. Legal-based mechanisms represented challenges to SSF access. Small-scale fisheries struggle to obtain official documentation confirming their formal status as fishers, which impedes their ability to advocate for their rights and engage in disputes with industrial fishers.

Technology and markets were important for both large-scale artisanal- and industrial fisheries. Public authorities were perceived to control SSF access through legal mechanisms, knowledge, and illegal mechanisms. In terms of access through legal mechanisms, public authorities were mostly perceived to fail to facilitate fishers' access (access obstruction) or to exercise unfairly differentiated legally based authority over SSF:

> *Why don't they go to the industrial boats, which damage a lot more? They don't control them. Because they want to control us, because it's easy to control the small ones, it's very easy.* (net-map #2)

Civil society organizations were importantly related to the exercise of control through legal mechanisms, social identity, and knowledge. Civil society organizations were perceived as often obstructing access through legal-based mechanisms, as highlighted by this interviewee:

> *We paid the colony* [fishers' guild] *with all our heart. I'm fishing. I can't work* [because of health issues] *for two,*

Table 5. Number of mentions of actor and link types for each Net-Map, following the classification approach by Schiffer and Hauck (2010) and Glaser et al. (2018). A higher number of mentions indicates that the actors or connections are perceived as the most prominent across the maps.

net-map #ID	Number of actors mentioned									Total actors	Number of link types mentioned					Total links
	SSF	LSF	IF	VOPH	PA	CSO	REO	BUS	MSB		comm	supp	mon	cont	compl	
1	1	2	2	4	5	1	1	0	0	16	8	2	8	0	8	26
2	5	9	3	2	4	2	0	1	0	25	12	30	17	2	18	79
3	4	4	3	2	3	2	0	0	0	18	12	3	18	10	9	52
4	5	2	2	2	5	2	0	0	0	18	2	9	3	5	8	27
5	7	0	4	4	6	4	2	0	0	27	8	4	13	5	6	36
6	5	2	2	1	6	2	1	0	1	20	38	7	4	14	17	80
7	10	4	2	4	3	6	1	0	0	30	21	3	13	3	9	49
8	5	1	1	3	4	3	2	1	0	20	19	9	11	4	10	53
Total	42	24	19	22	36	22	7	2	1	174	120	67	87	43	85	402

SSF = small-scale artisanal fisheries; LSF = large-scale artisanal fisheries; IF = industrial fisheries; VOPH = vessel owners and post-harvest; PA = public authorities; CSO = civil society organizations; REO = research and education organizations; BUS = other businesses; MSB = multi-stakeholder bodies; comm = communication; supp = cooperation/support; mon = money flow; cont = control; compl = complaint.

> *five months, a year. It should pay an aid to the person, you know? And it never did that.* (net-map #1)

Obstructed access often translated into complaint links in the net-maps. Vessel owners and post-harvest actors were frequently considered as mediating access to markets and capital. Appendix 3 provides quotes to illustrate further access mechanisms that are at the root of the more frequently occurring codes for SSF, public authorities, vessel owners and post-harvest actors, and civil society organizations.

DISCUSSION

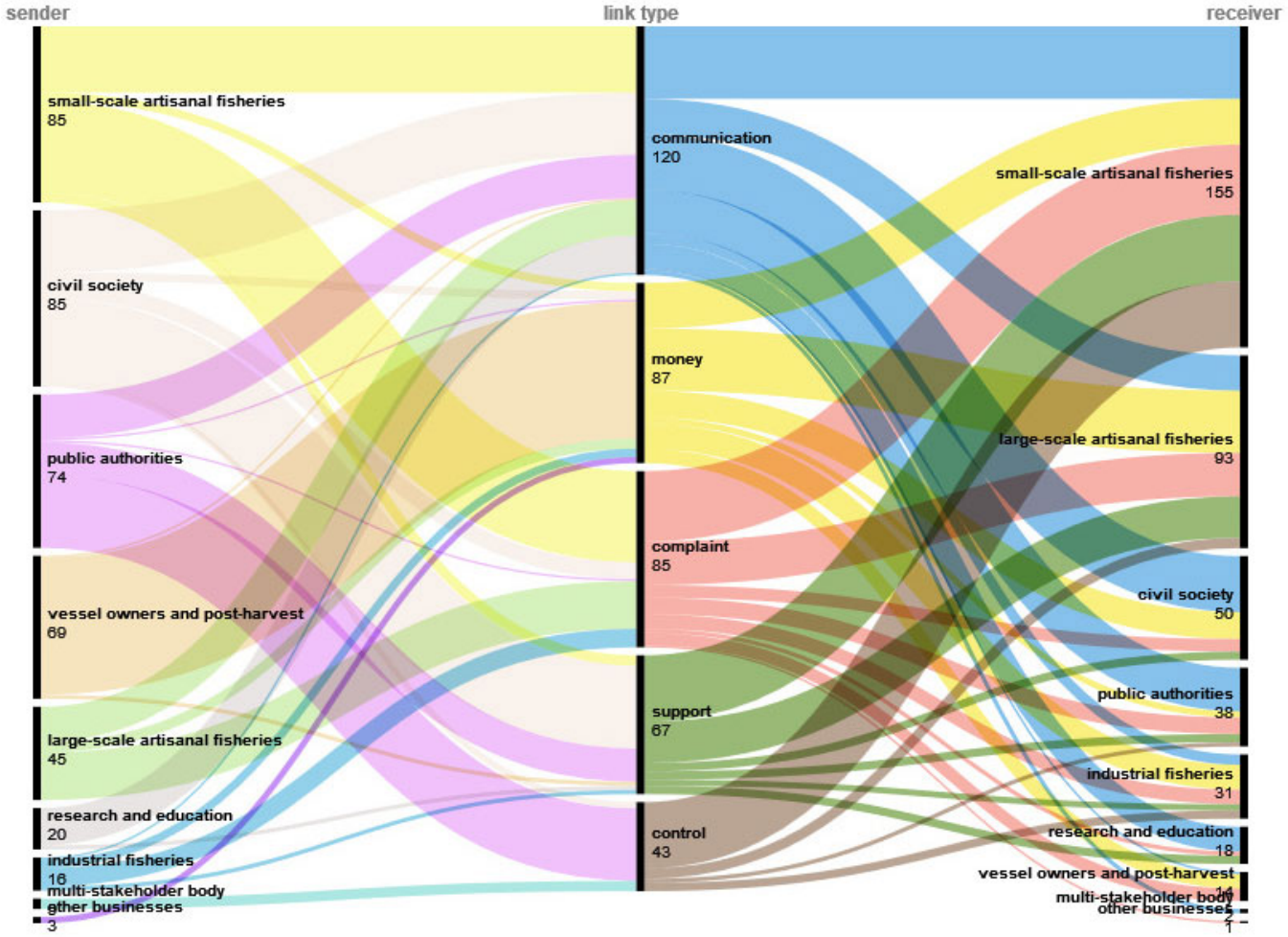
Navigating access: social organization among fishers

Communication links between SSF mostly convey information about everyday fishing praxis and knowledge. Knowledge was the most frequently mentioned access mechanism for SSF, in line with Andriamahefazafy and Kull's (2019) findings. Local fishing knowledge (LFK) refers to the understanding, meanings, and constructs associated with the environment and human-nature feedback, importantly allowing for the adaptation of fishing strategies and improved access to fishing resources. Our coding reveals that LFK contains elaborate details on the dynamics of fish migration, feeding and reproduction habits, and on how these habits are influenced by environmental factors. Our findings are in line with Barboza and Pezzutti (2011) who highlighted the richness of LFK and terminologies used by fishers from one of our study sites, Vila do Bonifácio. The terminologies and beliefs relating to the workings of nature (e.g., as the work of God and/or as a twist of fate) revealed by our interviews testify to the continuous (re)construction of imaginaries of coastal entanglement and thus influence how access is permanently (re)negotiated at the individual subjective and collective levels. Despite the absence of formal institutions to support and regulate artisanal fisheries perceived by our interviewees and reported in other Amazonian fishery contexts (Maneschy 1990, Doria et al. 2021, Alencar et al. 2022), the abundance of ties among SSF is thus evidence of informal social networks in artisanal fisheries and merits investigation into the implications for social organization in fisheries. The fact that conflicts internal to SSF were frequently cited by non-fisher interviewees may be due to an apparent propensity to mention conflicts elsewhere but not those respondents themselves were involved in. For instance, civil society organizations' representatives and public authorities involved in fisheries management may tend to highlight the existence of fisheries conflicts to legitimize their authority to control access (Peluso and Ribot 2020). Government agencies at multiple levels play a pivotal role in the management of fisheries conflicts and have the capacity to promote positive social transformation (SSF guidelines, FAO 2015, Dahlet et al. 2021). However, in contexts such as Bragança, where government infrastructure for artisanal fisheries is weak, local communities may be compelled to foster their own institutions for conflict resolution, as observed in other parts of Brazil (Prado et al. 2021) and in tropical fisheries more broadly (Dahlet et al. 2021).

Public authorities: controlling, unreachable, or missing

The relatively few links that come from SSF and go to public authorities (n = 6) suggest limited power or influence of the former over the latter, and a shared perception that public authorities are not accessible. In essence, control links are understood as activities of inspection (*fiscalização*), which is perceived as the pinnacle of government authority. This control enforces formal regulations for particular fisheries, restricting short-term access to fish with the promise of protecting fish stocks, ultimately securing long-term access for fishers. This generated livelihood and equity issues. We concur with Fabinyi et al. (2015) that, beyond concerns over the ecological health of fish stocks, equity impacts of control activities are central for SSF. In the Bragança region, the lack of inspection activities was on the one hand seen to illustrate the government's absence and neglect of artisanal fisheries. On the other hand, the regulatory authorities responsible for inspection (e.g., IBAMA) were criticized for conducting excessive inspections of small-scale fishers, who are more deprived of capital and material resources, while failing to monitor the most powerful groups of fishers, such as industrial trawlers, despite their involvement in the most destructive fishing practices. A similar "command-and-control" approach adopted by ICMBio and IBAMA is perceived by coastal users in the Tamandaré region in Northeast Brazil (Glaser et al. 2018). Our results reveal that inspection is seen to have an ambivalent role. Subject to inspection by state authorities, the "inspected" become a political subject. But when inspection is disproportionately focused on the most

Fig. 3. Absolute frequency and directionality of links and link types by actor group (N = 402 links). The height of each rectangle reflects how often a given link type was identified. The colors of the flows on the left represent different actor groups (sources of the links), and the colors on the right represent different interaction types (link types).



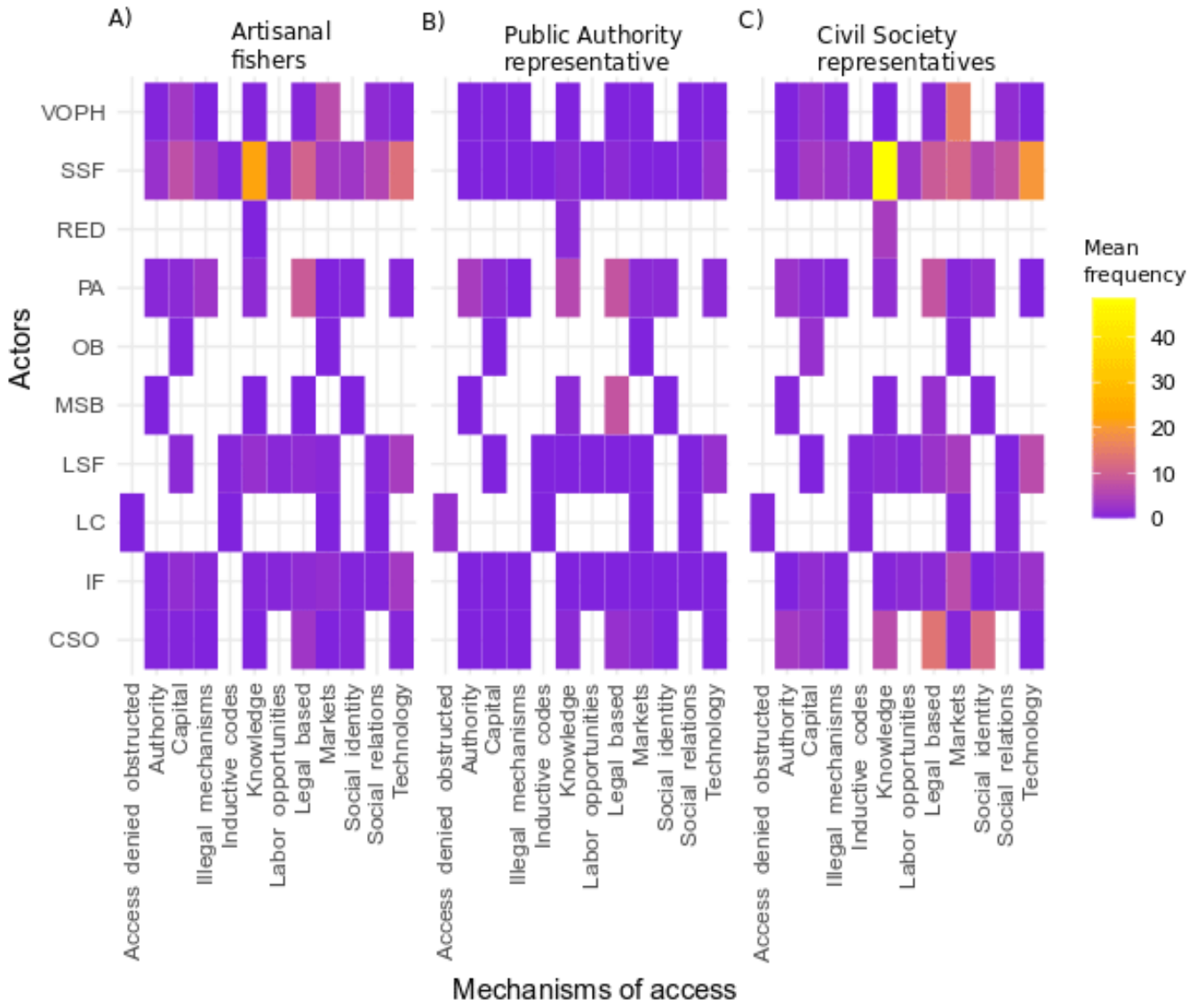
vulnerable groups, it becomes a matter of discrimination underpinned by important power imbalances. The Brazilian Navy seems to have greater legitimacy among SSF because it provides capacity-building activities that are mandatory for the acquisition of a fishing license. Although not formally responsible for fisheries management, the Brazilian Navy appears to play a gatekeeping role in the bureaucratic process of fisher formalization. This process directly affects SSF access to licenses, and by extension, to fishing rights.

Our findings also indicate perceptions of further forms of marginalization under the code of "access denied/obstructed," echoing Hall et. al.'s (2011) notion of powers of exclusion, cited in Myers and Hansen (2019). For instance, unlike industrial fishers, who typically have better administrative support and formalized documentation, artisanal fishers often struggle to obtain the General Register of Fishing Activity (*Registro Geral da Atividade Pesqueira*, RGP), the official document issued by the Ministry of Fisheries and Aquaculture that certifies their profession. The RGP is essential not only for legal recognition but also for accessing social protection and other public policies in support of artisanal fisheries. Getting the official documents is challenging for several reasons, including difficult access to public authorities and corruption or inaction by civil society organizations. Efforts to remedy this situation at the federal level include the creation of the National Secretariat for Registration, Monitoring and Research within the Ministry of Fisheries and Aquaculture, and at the Bragança level within the Municipal Secretariat for Fisheries and Aquaculture. In this context, our findings suggest that civil society organizations such as the fishers' guild and the artisanal fishers' union are held responsible for supporting and providing their members with access to legal mechanisms.

Civil society organizations and challenges to fishers' representation

The fishers' guild and artisanal fishers' union are perceived to be institutions for safeguarding fishers' rights, including access to social security benefits like pensions and benefits in times of unemployment and ill-health. Fishing is a highly risky and physically demanding activity (Sales et al. 2022) and access to health benefits is essential. The lack of trust and perceived

Fig. 4. Heatmaps showing the mean frequency of text units coded relating to different mechanisms of access (x-axis) and groups of actors (y-axis) by net-maps aggregates: (A) artisanal fishers' net-maps taken together (n = 4); (B) the public authority representatives (n = 1); and (C) civil society representatives' net-maps taken together (n = 2). SSF = small-scale fisheries; LSF = large-scale fisheries; IF = industrial fisheries; VOPH = vessel owners and post-harvest; PA = public authorities; CSO = civil society organizations; REO = research and education organizations; BUS = other businesses; MSB = multi-stakeholder bodies.



inefficacy of artisanal fishers toward these organizations, and in particular the fishers' guild, may explain the low membership rate of 48% of registered fishers in Pará (Lourenço et al. 2006). Fishers' guilds in Brazil were first established by the Brazilian Navy in the 1920s, undermining the autonomy of fishing communities (Ramalho 2014). In other parts of the world where fishers' guilds have emerged in a bottom-up fashion, they are now actively involved in local environmental management (e.g., in Spain, see Herrera-Racionero et al. 2022). In this sense, future research appears needed to examine and situate the role of fishers' guilds and unions as pivotal actors within the Brazilian decentralized governance system, as well as their potential and actual influence on context-specific collective action.

In contrast, the RESEX Caeté-Taperaçú emerged from grassroots efforts supported by public authorities, social movements, and academia (do Nascimento 2021). The users' association's representative speaks of the organization as belonging to the people and claims to represent SSF against abuses by banks, intermediaries, and the fishing industry, among others. This is reflected in the number of mentions that related civil society organizations to social identity in the qualitative analysis of net-map #8. Because the RESEX Caeté-Taperaçú is not mentioned at all in three of the five fishers' maps, perceptions of its influence on fisheries governance are diverse. Social identity is key for improved SSF access (e.g., Bennett et al. 2021). In Bragança and

other locations where large-scale fisheries and/or tourism are absorbing the labor of small-scale fishers, ecosystems are becoming increasingly degraded, and fishing livelihoods and related social identities are undermined. This, in turn, may affect the capacities for collective action by fishers and increase their dependence on government intervention (Ramalho 2014, Pinkerton 2019).

Partelow et al. (2018) found that the RESEX Caeté-Taperaçú has been increasingly seen as a government social aid program facilitating access to housing and material goods rather than an institution actively embodying the collective management of natural resources. Our interviews confirmed this. The users' association is linked to the National Program for Agrarian Reform and gives access to its members to programs and public policies such as the *Bolsa Verde* (green allowance) or agrarian reform credits, which are key among the few forms of public support available to the poor, remote communities within the RESEX (Prado and Seixas 2018).

Improving the formalization of SSF is a key FAO recommendation to nation states as a means of securing access to those working within these fisheries (FAO 2022). This could be achieved through the development of a legal framework for community-based resource management (Mertens et al. 2015, Blythe et al. 2017), in which artisanal fishers have formalized rights to manage their fisheries, and this extends beyond Caeté-Taperaçú marine RESEX boundaries (Borges et al. 2021). Articulating such a framework with the institutions linked to the RESEX may be challenging. Environmental NGOs active in the region have played an important role in supporting community organization and co-management efforts (Rare Brasil 2021). Social movements emerge as relevant enablers for scaling up SSF struggles to other levels of governance and improving local leadership capacity and conservation outcomes (Potiguar Júnior 2007, Pinkerton 2017). That no such NGOs and movements were mentioned by fisher respondents indicates a need for local outreach and mobilization.

Vessel owners and post-harvest actors filling the governance gap through capital and market

The predominance of money flow links from vessel owners and post-harvest actors to SSFs suggests a one-way influence in which the former control artisanal fishers' access to markets and capital. On the Pará coast, artisanal fisheries typically rely on the *marreteiro* (middleman) to handle smaller quantities of fish and local markets and villages, while the *intermediário* (intermediary) handles larger production volumes and may resell to the national and international market. Both types of traders may also act as vessel owner, fishing gear financier, and/or moneylender including when catches are low, when illness prevents fishing, or when fishers suffer financial distress. Most of these transactions take place informally. Small-scale fisheries reliance on the *marreteiro* and *intermediário* will thus likely increase as public authorities and civil society organizations, such as the fishers' guild, fail to provide effective legal support. Research by Poissant et al. (2023) in the rural Peruvian Amazon suggested that geographic isolation increases dependency of SSF on powerful intermediary actors. Similarly, Basurto et al. (2013) linked isolation to less cooperative behaviors and greater reliance on intermediaries. In our study area, the road construction in the 1970s cutting through the mangroves swamp provided a faster access route linking the coastal communities of Vila do Bonifácio and Vila dos Pescadores to the urban center of Bragança. This provoked a surge in *intermediários* (Oliveira and Henrique 2018). Coupled with limited traditions of collective action, the prevalence of informality in the SSF value chain, also appears to intensify the dependency of SSF on *intermediários*, which may potentially lead to increased exploitation of fishers, increased fishing pressure and a reduction in fish availability (Miñarro et al. 2016, Poissant et al. 2023).

Access to technology and capital remains a major barrier to SSF access in Bragança, a challenge also identified in other regions of Brazil (Haque et al. 2015). In an effort to improve access to credit, the Brazilian government introduced the *Plano Safra da Agricultura Familiar* in June 2023, which provides loans for SSF. Access to these loans is prevented, however, by difficult bureaucracy, poor repayment terms and rates, and fear of losing assets (Haque et al. 2015). As a result, fishers in Bragança often turn to their informal social networks, which include their intermediaries, for support. Another layer of complexity is added when the *marreteiro* or *intermediário* is the respective fisher's relative such as in the case of the interviewee in net-map #2 whose uncle is the vessel owner and whose cousin is the *marreteiro*. Kinship networks play a central role in controlling and maintaining access to resources in Amazonia (Alencar et al. 2014), including in the context of erosion and resource depletion, as seen in Inferninho and Vila do Bonifácio. Characteristics of patron-client relationships were mentioned by our interviewees, but few complaint links came from SSF to intermediaries. This may indicate the ambiguity inherent in such relationships. Only net-map #5 discloses systematic complaint links flowing from all industrial fisheries to boat owners who are also fish traders indicating that the importance of informal and kinship links is a special feature of SSF in our research region.

CONCLUSION

This study explores how coastal and marine fisheries governance networks are seen to affect artisanal fishers' access in Bragança, on the northeast Amazonian coast of Brazil, from the perspectives of a number of different relevant actors.

Fishers in both small-scale artisanal and large-scale artisanal fisheries are perceived to negotiate access to fish and fisheries among themselves, mostly on a daily basis, through communication and complaint links. These interactions are related to knowledge (e.g., communicating knowledge of the biogeophysical environment) and technology (e.g., gear conflicts). Public authorities and civil society organizations are seen to control fishers' access through legally based mechanisms. However, these actors are portrayed as absent (e.g., obstructing access), unreachable, or lacking in reliability and fairness. When connected to SSF, public authorities are mostly reported to exert restrictive control of SSF through diverse means. Artisanal fishers lack a robust representation. Respondents perceived respective institutions, i.e., the fishers' guild and the artisanal fishers' union as failing to fulfil their main function: facilitating access to vital benefits of public policies (e.g., access through legally based mechanisms). Similarly, and despite a contrasting early history (Glaser et al. 2010), the influence of the association of the Caeté-Taperaçú extractive reserve appears to be limited now. In the

absence of support from public authorities and civil society organizations, actors linked to vessel owners and the post-harvest sector are asserting their influence by controlling fishers' access to markets and capital. In these relationships, SSF frequently find themselves depending on intermediaries for loans, or even narcotics, which must then be repaid with lower prices received for their catches.

Fisheries governance in Bragança is based more on market mechanisms and unequal forms of dependency (Johnson 2010) than on supportive laws drawn up by the public authorities. The results of our research draw attention to the need to: (1) enhance accessibility to public policies and government programs to strengthen the formalization of artisanal fisheries, taking into account its local characteristics and particularities, including the social organization already in place among artisanal fishers; (2) mobilize financial and human resources for local public authorities geared to improving access and equitable participation of artisanal fishers in decision-making forums; (3) facilitate access to the market and capital for artisanal fishers, for example, by incentivizing the establishment of a cooperative or other forms of innovation; (4) promote and encourage artisanal fishers' organization and representation, for instance, by facilitating funding for capacity development in local leadership. These measures can only be fully effective if the need for basic education and health service structures is also addressed. The work presented here shows that promoting more equitable access for, and encouraging dialogue with, artisanal fishers are essential and missing prerequisites for sustainable development in the Amazon.

The integration of net mapping and access analysis provides valuable insights for the development of more inclusive marine conservation policies. Future research could examine how perceived governance networks evolve in response to significant institutional and environmental shifts, such as the proposed designation of a protected area vis-à-vis competing plans for oil exploitation in the Brazilian Amazon Shelf (Araujo et al. 2021). Longitudinal and multi-scalar analyses could shed light on how climate change compounds access challenges for artisanal fishers and how governance dynamics vary across levels. Additionally, further attention to the influence of non-state actors and the role of gender and intersecting power relations in shaping network influence remains crucial.

This becomes even more critical as aquaculture and oil exploration interests grow in the Amazon estuary, and in view of the upcoming 30th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC COP 30) to be held in Belém in November 2025.

Author Contributions:

Lol Dahlet: conceptualization, methodology, investigation, formal analysis, data curation, validation, writing – original draft, writing – review & editing, visualization, funding acquisition. Roberta S. L. Barboza: supervision, conceptualization, validation, writing – review & editing. Ingrid van Putten: validation, writing - review & editing. Aniekan Akpan: data curation. Rapti S. de-Zoysa: writing - review & editing. Marion Glaser: supervision, conceptualization, methodology, investigation, validation, funding acquisition, writing – review & editing.

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Data Availability:

The data and code that support the findings of this study are available on request from the corresponding author, LD, and subject to privacy/ethical restrictions. None of the data and code are publicly available because they contain information that could compromise the privacy of research participants. Ethical approval for this research was granted by the Brazilian National Research Ethics Committee (CONEP) (Plataforma Brasil, CAAE: 65040122.3.0000.0018) and through the ICMBio SISBIO authorization to conduct research within Federal Conservation Units (SISBIO license no. 82744-1).

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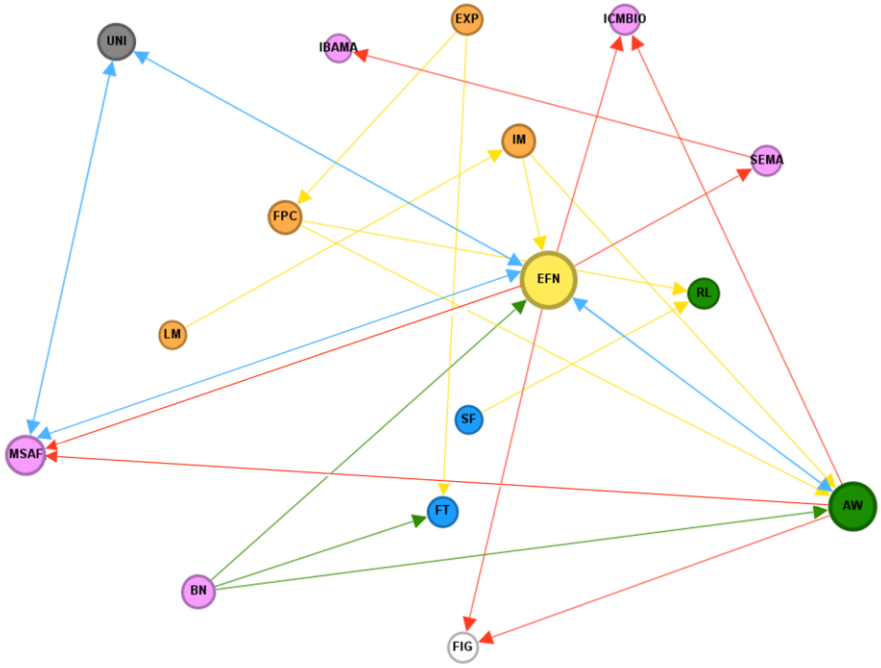
Appendix 1. Description of the coding process undertaken as part of the thematic analysis using a deductive-inductive codebook approach based on Miles and Huberman (1994).

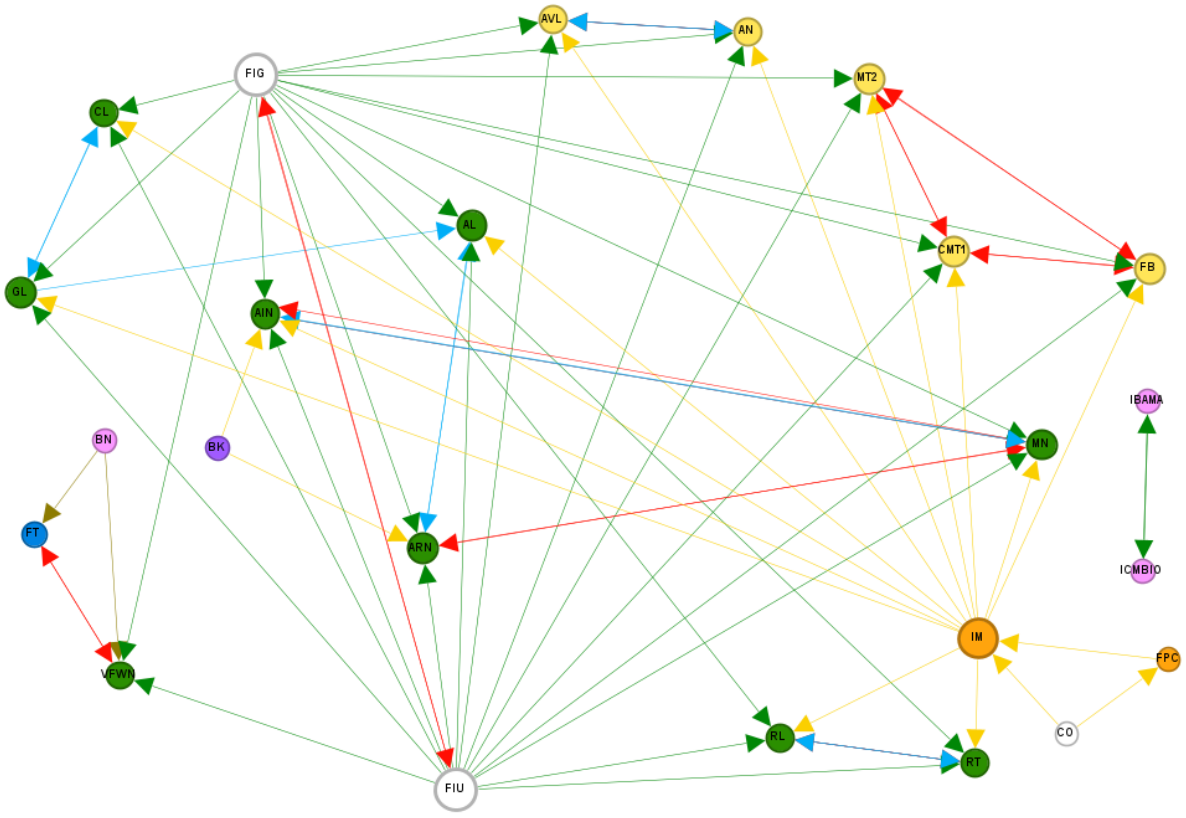
The coding process involved four steps. The first-level codes consisted of the list of actors according to the previously established typology (see Table 3). For each actor category, second-level codes were nested that corresponded to the mechanisms of access proposed by Ribot and Peluso (2003) (c.f. section on *Access* of the Introduction). We then assigned inductively generated descriptive codes under these second-level codes. Descriptive codes were linked to units of text from the net-map interview transcripts related to particular access mechanisms. A coding text unit could range from a sentence to a whole paragraph. Themes and sub-themes were then created to summarize and group together data-driven codes. The coding process was performed by the lead author (LD) and subsequently discussed and checked with co-authors MG and RS.

Appendix 2. Perceived governance networks.

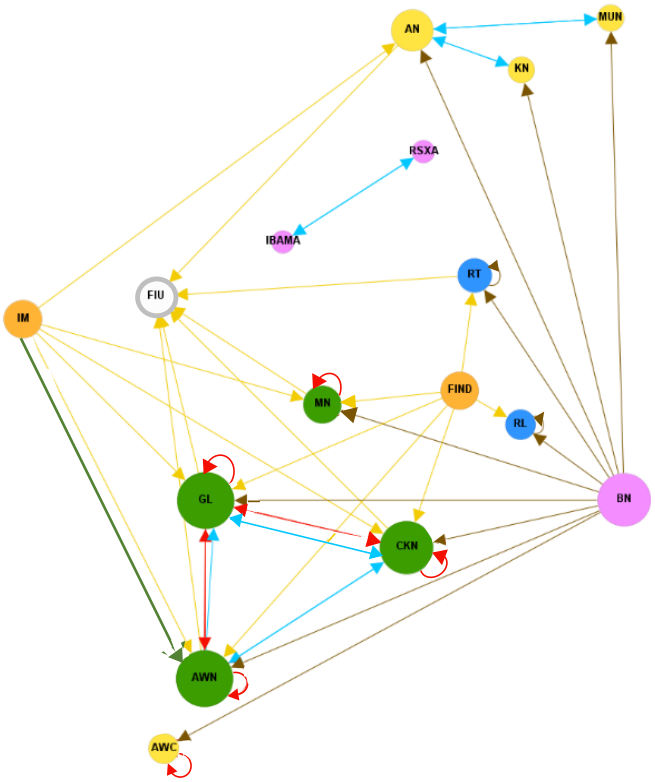
net-map#1



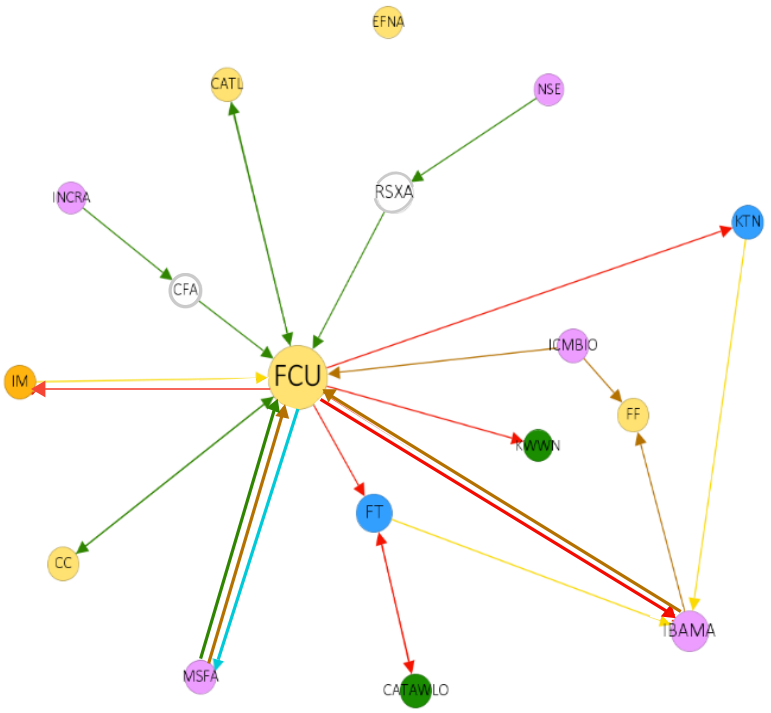
net-map#2



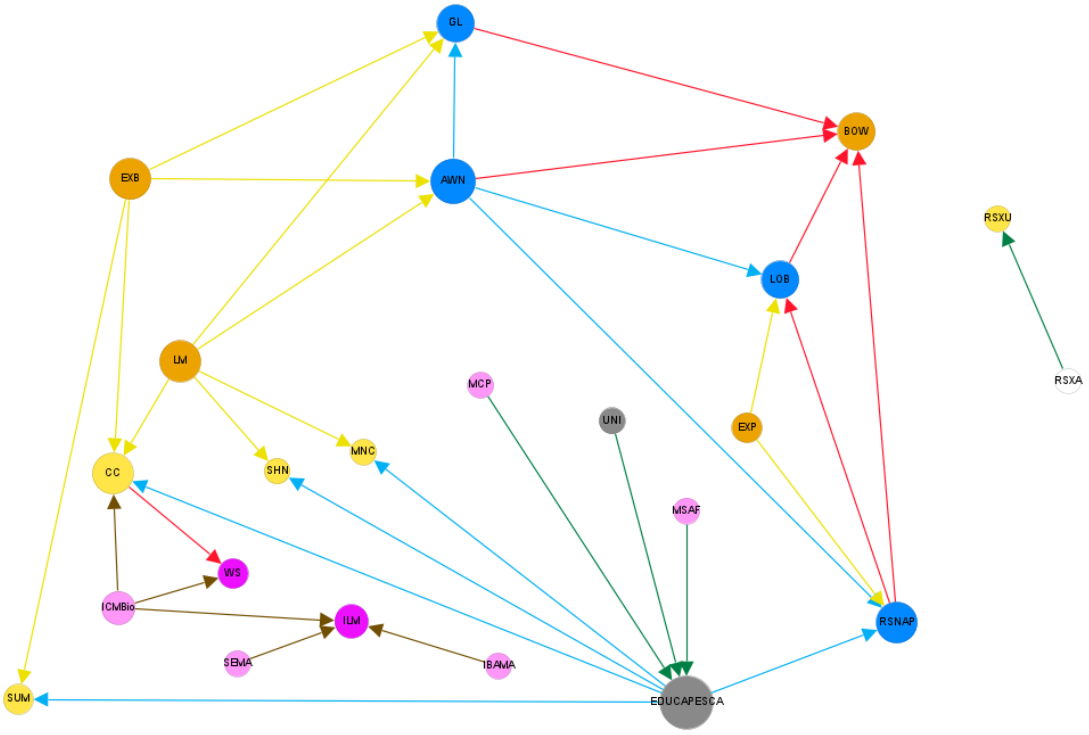
net-map#3



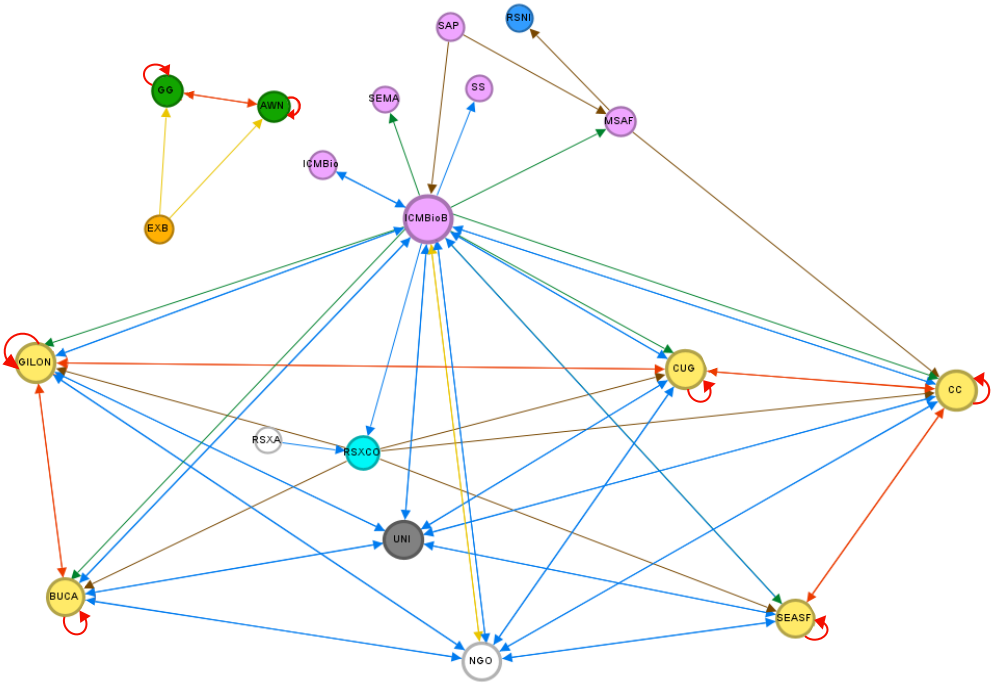
net-map#4



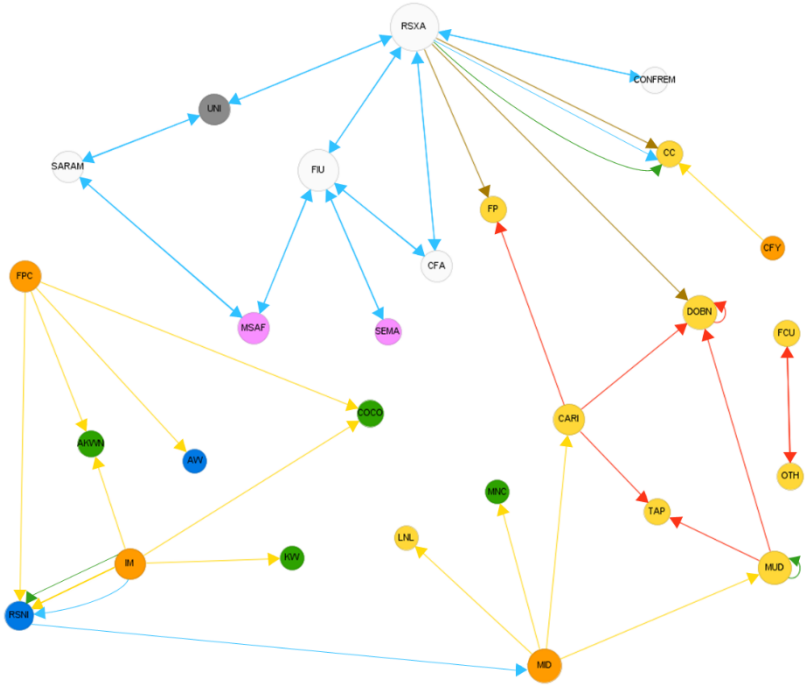
net-map#5



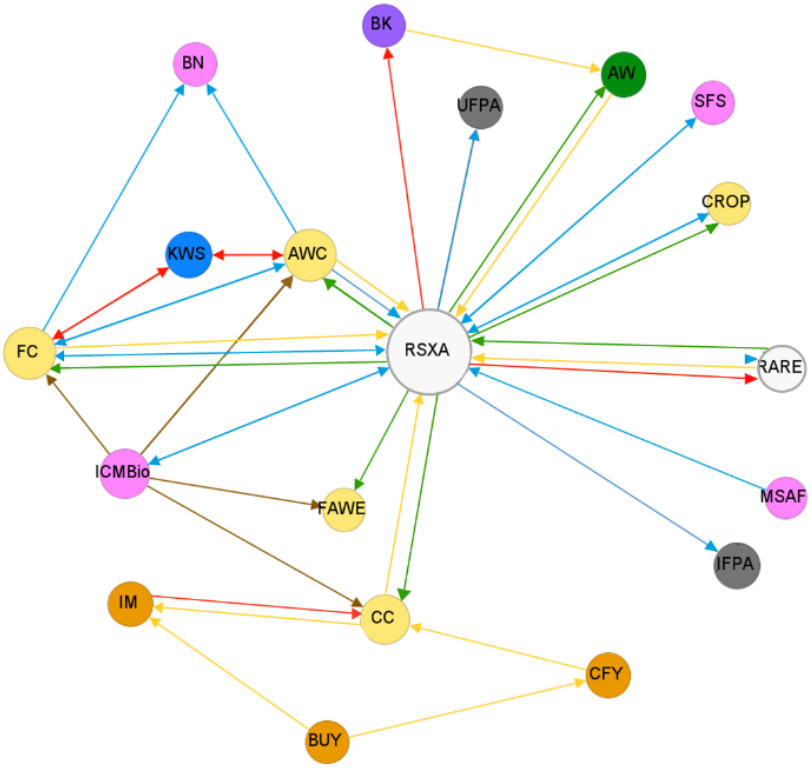
net-map#6

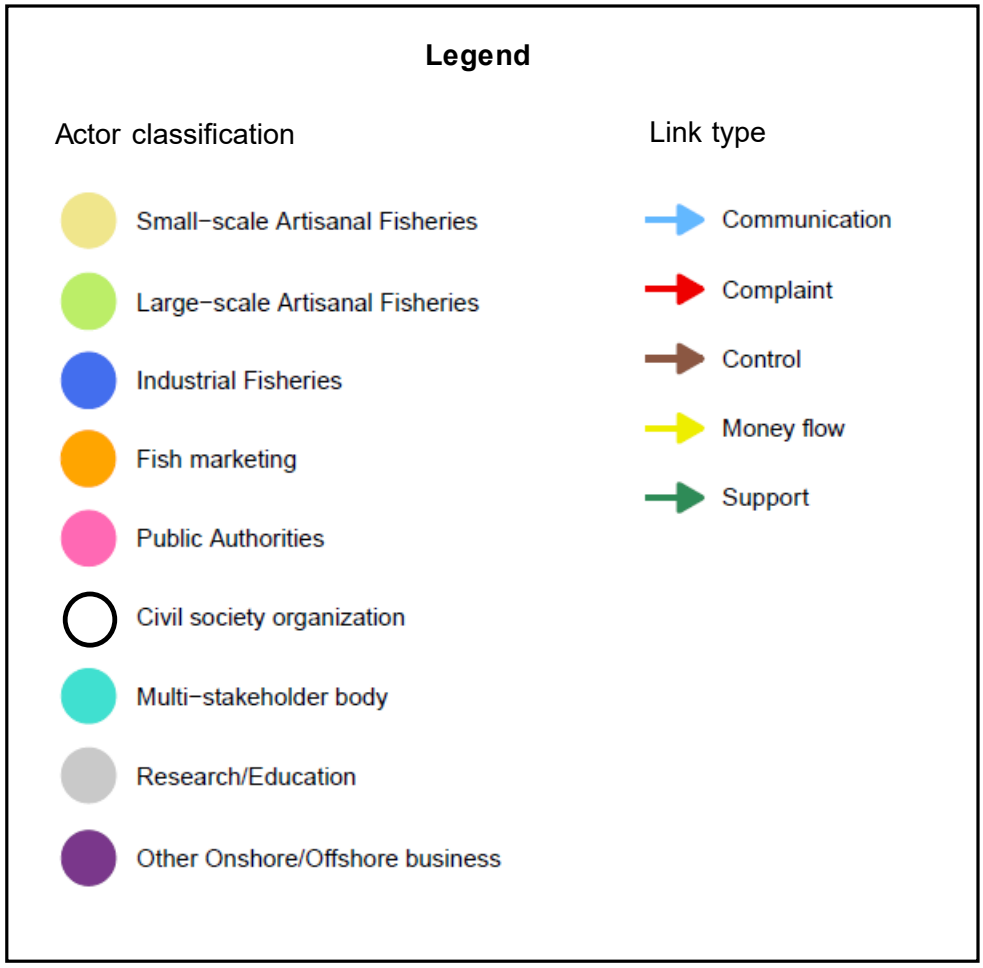


net-map#7



net-map#8




Legend
Actor classification
Small−scale Artisanal Fisheries
Large−scale Artisanal Fisheries
Industrial Fisheries
Fish marketing
Public Authorities
Civil society organization
Multi−stakeholder body
Research/Education
Other Onshore/Offshore business
Link type
Communication
Complaint
Control
Money flow
Support

Appendix 3. Selection of the three main themes per mechanisms of access, associated sub-themes, codes, and quotes for different groups of actors, all net-maps taken together.

Theme	Sub-theme	Example of code	Code-related quote (Net-Map interview ID)
SSF (n=514)			
Access through knowledge (n=184)			
Knowledge of the biogeophysical environment (n=124)	Definitions of fishing categories through relationship with biogeophysical env (n=11)	Sandbar (*barra*) does the division between those working away and SSF	"And those who are from *barra* outwards catch more fish than those who are from *barra* inwards. What divides us here from *barra* is the sandbank in front." (Net-Map#2)
	Biogeophysical conditions influence fish behavior and life cycle (n=93)	Shrimp only enters fishing traps (*curral*) when there is good current	"They only go in because there's a good current, because the *curral* where the tide flows little doesn't give shrimp. It's weak. So the current is the main thing that gets the fish into the trap, because it doesn't go on its own, it's forced, right?" (Net-Map#4)
	Nature as the work of chance (n=6)	Sometimes nature helps providing the fish, sometimes fish not abundant	"Because it's like that, right? It depends. Nature is full of mystery and then sometimes it fixes up a corner, makes it better, and then the fish gets weak." (Net-Map#4)
	Nature as the work of God (n=3)	God helps with providing the fish	"But we harvest more than we don't. We have all the time. But thank God our heavenly father is on our side to help us. But there are times when it fails, but you always have something to look forward to, you know?" (Net-Map#2)
	Negotiating fishing knowledge (n=11)	Low experienced fisher often follows highly experienced fisher	"That fisher with little experience always tries to follow that other fisher with a lot of experience." (Net-Map#3)
Language (n=25)	-	*'Cacuri'* is the net used by the estuary tapper fisher	"This is a stream, the *estiva* is a stream. Then they put a net across the stream and make a kind of *curral*. They call it *cacuri*." (Net-Map#2)
Access obstructed (n=34)	Formal education and knowledge (n=4)	Fisher working with estuary traps *(curral)* has little education	"For large companies, like Paulo. He's already done the study, hasn't he? I don't have much schooling. Normally I know how to sign my name... […] It's very demanding." (Net-Map#4)
	Fishing practices (n=3)	Some fishers quit A. weakfish (*pescada-amarela*) fishery because lack of experience	"Generally, people here go for the easiest and there are a lot of people who give up fishing for *pescada-amarela* because of this. Yeah, you have to have experience too, right?" (Net-Map#2)

	Knowledge of the biogeophysical environment (n=21)	King weakfish (*pescada-gó*) doesn't reach coasts anymore because overfished at sea	"It's a dragnet. And then they take everything, they take everything. Then they take the one that's spawned, the little one, the big one, the one that's already reproduced, the one that's going to reproduce, you know? Then what happens, the fish don't come here anymore." (Net-Map#4)
	Language (n=3)	Fishers' language is being lost with time	"I keep asking myself... when my father brought us something. He'd arrive in Caratateua, which at that time the language was so dragged, he remembers that language was general, you know what I mean. And you're like, Hey, caboco, how are you? And I'm left with a lot of things... I keep asking myself today, where did this get lost?" (Net-Map#7)
	Research and researchers (n=3)	Researchers don't return research results	"I already had, right, because you use us, you graduate, you get the benefits and we stay, right? This is a debate we're having at ICMBio." (Net-Map#8)
Access through technology (n=92)			
Adaptation to fish species and environmental conditions (n=48)	-	Net catches A. weakfish (target sp) but also croaker (*corvina*)	"We already have net material just for *corvina*, but it's always mixed [with A.weakfish]" (Net-Map#3)
Access obstructed (n=20)	Affording fishing equipment and devices (n=12)	No other fishing equipment to go fishing elsewhere	"[…] if we had another type of material net, then we'd go somewhere else, right? Antônio […] has 400 meters of fishing nets. Then his fishing won't stop, because he's already got the *pescada*, he's got the *corvina*, he's got the *uritinga*, he can fish and keep his pattern up all the time, right?" (Net-Map#4)
	Gears adaptation to fish behavior and environmental conditions (n=5)	SSF with only little canoe can't fish farther bcse of currents	"[…] the current there, my brother says that the current is very strong, so the people from Caratateua already go by boat, because the current is very strong, but those who can't afford it still go by canoe, which I'm sure they want to have a boat so that they can do their fishing, because there are people who want to live off fishing alone." (Net-Map#7)
	Declining fish populations (n=3)	*Curral* fishers have no fish anymore coming due to fishing with weighted net	"Can you imagine? 200,000 meters of net, 500,000 meters of net on a bar like this covering it. Who's [which fish] going to come through here? It's true. That's how it works." (Net-Map#4)

Developments in fishing (n=7)	-	Bambu was used to build *curral*, now it's mangrove wood	"We used to make a bamboo enclosure, a *curral* on the shore. Then we had to make the *curral* outside, not in the shore. Then we made it out of [mangrove] wood." (Net-Map#8)
Access through legal-based mechanisms (n=60)			
Access obstructed (n=26)	Lack of formal political recognition and visibility (n=10)	*Curral* fishers don't have documents to prove they are fishers	"Luis says, how can I go there, get there and say that the *curral* fishery is being harmed, if I don't have a document to prove that I'm a fisher?" (Net-Map#4)
	Basic human rights unmet (n=4)	Fishers used to pay Fisher's Guild to have some rights	"They [the fishers] paid the colony in order to have some rights, something, but in reality they had no rights at all. That's what's happened now, when the inspectors got to it and they were all arrested..." (Net-Map#1)
	Selective institutional authority and power imbalance (n=4)	Fishers request help from RESEX, IBAMA, BN but get no support	"Weighted net. That's forbidden. So, I mean, the times it happens here, we try to solve it ourselves, because we... We go after these people, in the case of RESEX, in the case of IBAMA, the Navy, we can't get their support. […] Sometimes they come to a meeting here and then the fishers mention this kind of thing to them, ask them to carry out inspections, but they're not interested." (Net-Map#3)
	Closed season insurance (n=7)	No closed season for K. weakfish and A. weakfish fisheries	"That's what's missing in these ones... The *pescada*, the *gó*. It's time for them to make this temporal fishing closure." (Net-Map#1)
	Lack of personal motivation (n=1)	Some fishers not interested in paying fisher's guild and union	"There are many who aren't interested. Understand? […] If you want to pay or if you don't understand. They don't demand, "No, you'll have to pay." Negative. Understand? Every... Every artisanal fisher knows that there's a union and there's a colony. And it's up to them if they want to go to those organizations to be entitled to other things." (Net-Map#3)
Customary fishing rules (n=17)	-	Net casted only when no longline (hook) fisher is there	"Because where you fish for catfish with a longline... With hook, we don't fish for *corvina* or *pescada-amarela* with a net. Only when the hook fisher is not in that position. It's free. Then we set the net." (Net-Map#3)

Formal fishing rules (n=17)	-	Fishers need an authorization from ICMBio to use mangrove wood	"To make a sail, you need mangrove wood to remove it, to remove, for example, a whole piece of this here, then who do you deal with? ICMBio. ICMBio protects the mangrove. Then you can't go there, for example. There's a mangrove there on the beach that we can.... We take poles to make the sail. In order to take a pole there, you have to ask permission for yourself or someone in charge […]"(Net-Map#2)
Public Authorities (PA)			
Access control trough legal-based mechanism (n=61)			
Access obstruction (n=16)	Lack of inspection and surveillance (n=7)	ICMBio was never seen at fishing community, only IBAMA	"Where is it? I have eight years here. I've never seen ICMBio come here. [...] IBAMA is the one that comes when they're looking to arrest. Their job is just to arrest. They don't educate anyone here." (Net-Map#4)
	Selective institutional authority (n=5)	IBAMA doesn't inspect bigger boats that destroy the most	"Well, why don't they go to the industrial boats, which damage a lot more? They don't control them. Because they want to control us, because it's easy to control the small ones, it's very easy."(Net-Map#2)
	Obstruction of public policy development and implementation (n=4)	Government declares there won't be any rent transfer program (*bolsa*)	"And this is the focus in Brazil of capitalism, a backward bourgeoisie. When the president declares that he's not going to give *Bolsa Família, Bolsa* of this, *Bolsa* of that, he's going to increase the minimum wage, depression and so on." (Net-Map#8)
Participation in management processes (n=9)	Creation of a multi-stakeholder body (n=5)	Creation of the Council of the Fisheries Secretariat by the MSF	"He [the current Municipal Secretary for Fisheries] set up the Council of the Fisheries Secretariat and the Environment Secretariat, which is for public bodies and civil society organizations to work together and talk to the community about their demands." (Net-Map#7)
Inspection, surveillance and enforcement (n=9)	-	ICMBio does fisheries' protection and surveillance within UCs	"ICMBio is responsible for managing the unit as a whole. So, here at the Bragança NGI we are responsible for managing four RESEX, four RESEX-type units. And here we're talking about a little over 200,000 hectares of area, tens, a hundred thousand people. Specifically, in the area of fisheries management, like any natural resource management, ICMBio is responsible for both protection and inspection activities, as well as activities related to environmental education." (Net-Map#6)
Access control through knowledge (n=14)			

Access obstruction (n=5)	Lack of knowledge about the realities of fisher(ie)s	ICMBio agents don't know fisher's everyday reality and how to fish	"It's easy for you. Now, for us, you're the boss here, of this here. You've never been to the beach, you don't even know how it works, you're given a canoe to go out in, you don't know how to steer, you don't know how to paddle. I think... He'd already been hard on me, right? "I don't think you're competent to do this job." I told him." (Net-Map#4)
Spreading knowledge (n=4)	-	ICMBio gives talks on how to get recognized as professional fisher	"Imagine that, for example, we work on an informative basis in some communities and for partners too, through lectures to instruct, let's say, for example, on the rights of the fishing community. So how do you get recognised as a professional fisherman? The target audience, which is the fishers' and fisherwomen's own families, at the university giving lessons on how the system works." (Net-Map#6)
Knowledge inclusion in management processes (n=3)	-	ICMBio is the one *de facto* managing the RESEX Caeté-Taperaçú	"And sometimes we go through ICMBio, like the person who manages the RESEX, which is ICMBio, and then he takes the pen and sends the guy there, not telling anyone. There are various conflicts on this issue. So a lot of people don't care. I do. Mainly because now I'm the president of the association and I go there, my friend, the SNUC [*Sistema Nacional de Unidades de Conservação da Natureza*], which I think is the booklet for extractivists, touches on this issue of management, because at that time we were discussing shared management, because the federal government asked them, us, how did we want management?" (Net-Map#8)
Access control through illegal-based (n=12)			
Police power (n=5)	-	IBAMA intervenes to combat crime to ensure the future of fishers	"It damages the fish. Then IBAMA gets on top of it because IBAMA wants us not to damage the fish, because it's for our future too, right? IBAMA is there to fight crime, you know?" (Net-Map#2)
Inspection (n=3)	-	IBAMA controls use of *fuzaca* (forbidden) fishing practice	"[IBAMA came here] to take away the *fuzaca*. It used to take everything from this area, right? *Fuzaca* is a type of fishing, a *puçá*, a *puçá* that they put in the place where the *curral* is... They put it there. Then it spoils the fish. Then it spoils the little fish too. This is our most forbidden fishery here." (Net-Map#4)

Selective institutional authority (n=4)	-	IBAMA does not control the big ones who have money	"Then the big guy has the money that speaks louder, so they don't go there to mess with the guys. Then they say they have the license, they have the license, but they don't have the inspection. And there's inspection on the ground when they're there. But go to the open sea and see if they'll go and see what they're doing. They won't, they'll give it up." (Net-Map#2)
Vessel Owners and Post-Harvest actors			
Access control through markets (n=57)			
Intermediaries ensure outflow of SSF production (n=29)	-	Middlemen receive all the crab to send it to other BR states	"He will relate to all the products that come out of there. It will go through the middleman. Why is that? Because in the fishing sector we don't have our [SSF's] own market, you know?" (Net-Map#7)
Processing industries ensure outflow of larger production (n=20)	-	Crab fabric in Treme has certification label	"Yes, in reality in Treme there are, I don't know if it's three or two [fabrics], but there were two legalized ones that sold already with a certification label, with... and even in some big supermarkets in Belém they already have them, even in other cities, like Brasília, Rio, these things are all already in the supermarket, the production that is exported from Bragança to there." (Net-Map#8)
High organization level (n=5)	-	Boat owners are organized with fish buyers in the case of large-scale artisanal fisheries	"The owner of the boat with the people who buy the fish. Like this. He already has several trunks, he already knows how many tons are coming on the boat, so the owner of the boat and the person who already has the trunks to buy are already waiting, so he already knows because they have that communication. Just arrive, check, weigh, check the drumsticks, because it's per drumstick, per kilo, it's just... it's just [...] and off you go." (Net-Map#7)
Access control through capital (n=17)			
Seek for profit (n=5)	-	Middlemen pays fisher little for his fish	"Yes, but it's not much [that the middleman pays SSF after he has sold the fish at the market] " (Net-Map#3)
Providing financial credits (n=7)	-	Intermediary supports SSF when catches are low	"Intermediary also comes in to help us when we don't catch the fish. But let's put it this way, more fish are caught than not." (Net-Map#2)
Fish species valued by the market (n=3)	-	Increased value of the *pescada-amarela* due to its swim bladder	"[…] for example, the fact that the swim bladder has become so valuable on the market and prices have risen a lot has made people from other fisheries decide to take the risk of

			fishing for the *pescada-amarela*." (Net-Map#2)
Access control through social relations (n=8)			
Asymmetrical relationships between SSF and intermediaries (n=7)	-	Intermediaries are needed for SSF to sell their fish	"Interviewer: And the middleman? Interviewee 1: That's the shittiest. […] Interviewee 3: He just cheats us. Interviewee 2: You know what, right? I think the middlemen are like us who vote for politicians. They almost have to, because sometimes we depend on selling our production only to them. […] Interviewee 2: We live off it. And there has to be a middleman. Because, as I always say about people... "How about we sell our own fish?" But we can't afford to... We have to have someone... Understand?" (Net-Map#4)
Certain groups get favors from authorities (n=1)	-	IF is a businessman and does not get controlled as SSF	"But if you [ICMBio] corrected the businessman outside, of course we wouldn't do here what the businessman was being corrected for. But why don't you correct him? Because he's got it, because he covers there, right? You're not going there, you're going to arrest us here, because the strong [sic] one only has a *fuzaca*. If you talk, they'll take you to jail, *fuzaca* and all. It's true. The businessman has a company; he only calls to put so much in your account there. What else am I going to think there is in our country, right?" (Net-Map#4)
Civil Society Organizations			
Access control through legal-based mechanism (n=41)			
Access obstruction (n=13)	Fishers' Guild obstructing SSF access to benefits of public policies	Fisher's Guild never gave financial support in case of illness	"Yes, because it's her right to... we paid the colony [fishers' guild] with all our heart. I'm fishing. I can't work for two, three months, five months, a year. It should pay an aid to the person, you know? And it never did that." (Net-Map#1)
Fishers' Guild and Fishers' Union to provide fishers' rights (n=7)	-	Fishers' guild and fishers' union benefit Artisanal fisheries	"It's the same thing. But these two organizations [Artisanal fishers' Union and Fishers' Guild] benefit artisanal fishing." (Net-Map#3)

Political articulation and participation (n=6)	-	Artisanal Fishers' Union part of the transition to new government	"But today we are very strong, with the movements very much in agreement and part of the transition of the new president. The union is part of this transition. We're already working together, we believe and it's a promise from the future government that there will be a Ministry of Fisheries again and within that ministry we want a secretariat or something similar, specifically for artisanal fishing." (Net-Map#7)
Access control through social identity (n=25)			
Class and people united (n=13)	-	Social movements are the society organized	"Look, we are the society organized, right? We remain social movements because we all belong to a community. So that's what I believe." (Net-Map#7)
Social visibility and status (n=6)	-	Fishers got recognition with RESEX by earning material goods	"And now, why? Because he recognized it, because we had no recognition. And since the RESEX we've started to be recognized. It's incredible. How? How? Because we got a fridge, a house, a car. All the time the association invited us to go, which I did, and I was also a counselor." (Net-Map#8)
Political participation and government support (n=4)	-	RESEX people get things more easily approved with INSS	"I could be from the RESEX and so on. Now, we're seeing this recognition with the INSS, when people say you're from the RESEX, man, we're going to approve this because it's from the federal government and stuff, you guys are really good." (Net-Map#8)
Access control through knowledge (n=14)			
Joint research projects (n=10)	-	Rare funds research with community on crab fisheries value chain	"Then came the *Projeto do Clima para Sempre* [Forever Climate Project, funded by NGO Rare], which involved more interviews in the communities about how we'd built up the production chain, what the values were, what we'd done. And then we wanted to see how the climate part was going and so on. And now, recently, we've done the *Julho Verde* [Green July] again, which was explosive. We had almost 900 people from all the associations" (Net-Map#8)
Access obstruction (n=3)	Lack of co-operation from researchers	Researchers don't communicate on their research projects	"It's more like that famous saying that the ex-president used to say: the people who are least informed are the people who are least likely to override ideas. When, I'll be honest with you, when he sees it, when he calls but there's no way, he'll have to [01:39:30] come by, right Silvio? Their other activities.

			We'll sit down, we have the community committees and the pole representatives. I'll get everyone sitting down here and they'll put the projects up for everyone to see, because that's the job of any researcher." (Net-Map#8)
RESEX creation (n=1)	-	MADAM research project allowed RESEX foundation	"It didn't, it didn't leave anything, I mean, we benefited from the research that went into founding the RESEX." (Net-Map#8)