A Global Database of Tenure and Access Rights for Small-Scale Fisheries: A Preliminary Assessment

by

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EXECUTIVE SUMMARY:

Illuminating Hidden Harvests (IHH) is a collaborative project between Duke University, WorldFish, and the Food and Agriculture Organization of the United Nations (FAO) that provides valuable evidence on the the contribution of small-scale fisheries (SSF) to sustainable development. SSF that are governed through tenure and access rights are particularly important for development outcomes, including food security, poverty alleviation, and social benefits, as reflected in Sustainable Development Goal 14.b.

This study addresses the data gap in tenure and access rights in SSF through seeking evidence of Territorial Use Rights in Fisheries (TURFs) in 51 countries. Data sources include IHH Governance data, a co-management database from Gutierrez, Hilborn and Defeo (2011), the Environmental Defense Fund (EDF) Fishery Solutions Center, and a Google Scholar literature search. The resulting 42 Functional TURF Types span 19 countries and five FAO World Regions.

By using a broad definition of TURFs, I explore how fishers access resources, what rules and rights govern their interactions, and if their power is *de jure* or *de facto*. This assessment reveals "new" TURFs from old systems of self-governance and finds evidence of property rights in freshwater and inland fisheries, seasonal or temporary arrangements, specific fishing methods, and family lineages.

TURFs may provide a starting point for identifying and declaring "Other Effective (Area-based) Conservation Measures" (OECMs), which may be used to meet the "30 by 30" target of Convention of Biological Diversity. For this reason, I include two detailed case studies on potential OECMs: Fish Refugia in El Corredor, Southwestern Gulf of California, Mexico and *Arapaima* Management in the Santarém Region, Lower Amazon, Brazil.

The evidence presented in this study builds the case for recognizing *de facto* property rights as a potential means for the conservation of biodiversity and sustainable development and lays the foundation for future research efforts through the establishment of a TURFs Database.

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ABSTRACT:

Small-scale fisheries (SSF) provide essential protein and nutrition to billions of people worldwide, employ more than 90 percent of the world's fishers, and account for about 40% of the global fisheries catch. Yet, their contribution to sustainable development is often overlooked and undervalued. Using data from 51 country case studies from the Illuminating Hidden Harvests (IHH) Project, the EDF Fishery Solutions Center, and a co-management database from Gutierrez, Hilborn and Defeo (2011), I compile a database of tenure and access rights in SSF, an indicator for Sustainable Development Goal 14.b to "provide access for small-scale artisanal fishers to marine resources and markets." By using a broad definition of Territorial Use Rights in Fisheries (TURFs), I explore how fishers access resources, what rules and rights govern their interactions, and if their power is *de jure* or *de facto*. This assessment reveals "new" TURFs from old systems of self-governance and finds evidence of property rights in freshwater and inland fisheries, seasonal or temporary arrangements, specific fishing methods, and familial lineages. In addition, two case studies highlight the potential benefits and challenges of declaring rights-based fisheries "other effective area-based conservation measures" (OECMs) – a new area-based designation. The evidence presented in this study builds the case for recognizing *de facto* property rights as a potential means for the conservation of biodiversity and sustainable development and lays the foundation for future research efforts.

Keywords: small-scale fisheries, territorial use rights, other effective area-based conservation measures, Illuminating Hidden Harvests, Convention of Biological Diversity, sustainable development goals

INTRODUCTION:

Small-scale fisheries (SSF) provide essential protein and nutrition to billions of people worldwide, employ more than 90 percent of the world's fishers, and account for about 40% of the global fisheries catch (WorldBank, 2012; FAO, 2021). As 97 percent of small-scale fishers or fish workers live in developing countries, SSF are closely linked with food security and sustainable development, yet are often overlooked, undervalued, and underappreciated (Mills *et al.*, 2011; WorldBank, 2012). Illuminating Hidden Harvests (IHH) is a collaborative effort between the Food and Agriculture Organization of the United Nations (FAO), Duke University, and WorldFish. Due out in Spring 2022, with over 800 authors and case studies from 58 countries, IHH is one of the most extensive studies on the contribution of SSF to sustainable development to date (FAO, 2021). IHH provides essential evidence that supports the implementation of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines), which emphasize a human rights-based approach and the full participation of small-scale fishers, fish workers, and vulnerable and marginalized populations in management decisions (FAO, 2015).

Good governance of SSF requires a distinction from the governance of large-scale fishery (LSF) operations, which tend to maximize and rationalize rather than support and empower (*see* Smith and Basurto (2019)). Good governance is participatory, transparent, responsive, and equitable, and in SSF, has the potential to uplift coastal communities and achieve global food and nutrition security (UNESCAP, 2008; Bennett *et al.*, 2021; Hamilton *et al.*, 2021). Broadening the scope of analysis to include pre- and post-harvest activities further enhances benefits (Basurto *et al.*, 2020).

The FAO is the custodian agency for Sustainable Development Goal (SDG) Target 14.b to "provide access for small-scale artisanal fishers to marine resources and markets." This can be measured through indicator 14.b.1: "Degree of application of a legal / regulatory / policy /institutional framework which recognizes and protects access rights for small-scale fisheries." Territorial Use Rights in Fisheries (TURFs) are one way fishers can access SSF, in which individuals or a collective group of fishers are granted exclusive access to harvest resources within a geographically defined area (Christy, 1982). Tenure or property rights include access and withdrawal, management, exclusion, and alienation (transferability) and can be *de jure* or *de facto* (Schlager and Ostrom, 1992). SSF with the full "bundle" of rights have the most power devolved to local end-users and are the most likely to demonstrate self-governance (Schlager and Ostrom, 1992).

In an effort to contribute to SDG indicator 14.b.1, I apply a broad definition of TURFs to compile a database of geographic areas with any combination of collective-choice property rights. These include management, exclusion, and alienation (Schlager and Ostrom, 1992). The database is rooted in institutional arrangements reported in the Governance dimension of the IHH project and is supplemented with additional evidence of TURFs found in the literature.

In addition, two case studies highlight the potential benefits and challenges of declaring rights-based fisheries "Other Effective (Area-based) Conservation Measures" (OECMs) – a relatively new policy tool designed to recognize terrestrial and marine areas that demonstrate biodiversity outcomes without Protected Area (PA) status. Recently negotiated in Geneva ahead of the 15th Conference of the Parities of the Convention of Biological Diversity, the Post-2020 Global Biodiversity Framework allows Parties to the Convention to use OECMs to meet the "30 by 30" Target to protect 30% of the world's land and oceans by 2030. As TURFs may be a

starting point for identifying and declaring these outcome-based measures, I create an "OECM Triage" to prioritize relatively high data-available TURFs for recognition as OECMs.

METHODS:

TURFs Database

Expanding the definition of TURFs

In order to identify the full array of tenure and access rights in the IHH Governance data, I decided not to constrain my definition of TURF to the right of exclusion (whether or not resource users are allowed to decide on who can engage in resource extraction). TURFs, in this context, are defined as a spatial form of property rights in which a collective group (i.e., kin, fishing cooperatives, residents, etc.) is free to access and withdraw resources from a sufficiently small, geographically defined fishing territory. A territory is sufficiently small if it can be managed by fishers and/or the relevant local authorities. This caveat was added to discount Exclusive Economic Zones (EEZ) and SSF Exclusion Zones that are too large for a group of local authorities to reasonably manage. Areas leased to private companies for the purpose of aquaculture were also excluded. There is one case in which both fishers and a private aquaculture company have overlapping property rights in Indonesia. In my analysis, I focus on the rights of the fishers. Collective choice rights in the database are sourced from both IHH and supplementary literature. I prioritized *de facto* rights.

I attempted to only include active TURFs. I excluded emerging TURFs, recommendations for the creation of TURFs in areas with no pre-existing tenure rights, and historical cases of property rights. However, often, the most recent source was several years ago, and many small-scale fisheries may have changed since then, especially after disruptions from

the COVID-19 pandemic. This is important to keep in mind while reading the results: even cases of "success" are simply snapshots in time, and may have changed drastically, or operate differently on the ground. Alternatively, cases with limited data and many holes in the database may be operating sustainably with limited outside interference.

"Ground truthing" TURF Claims

The authors of the 51 Country Case Studies that participated in the Governance dimension of IHH were asked to list institutional arrangements present in their country's SSF from 2014-2017 and indicate whether each arrangement was always, sometimes, or never managed as TURF or not sure or not applicable. In addition, authors indicated whether arrangements had spatial restrictions in place or not, and if fishers had the right to management (whether or not resource users participate in some form of resource management of the fishery), exclusion (whether or not resource users are allowed to decide on who can engage in resource extraction), and/or alienation (whether or not resource users are allowed to dispose of a right to resource extraction). Since TURFs are spatially defined, I only considered the arrangements with spatial restrictions in place and that were always or sometimes managed as a TURF for this analysis. I also included the uncertain cases for both characteristics.

I then began to "ground truth" the claimed or uncertain TURFs through a preliminary literature search. Countries had diverse interpretations of "arrangements." Some cited specific regulations (i.e., arrêté 471/2018; Lake Balbina fishing agreement), others cited groups of regulations (i.e. Regulations for fishing in Santa Fe province), actors (i.e., Wildlife Conservation Society), or even fisheries (i.e., Pacific turban snail). In each of these cases, I attempted to find access arrangements that might overlap or align with the listed arrangement. For this reason, not

all the TURFs identified in Appendix A are a one-to-one match with the arrangement they were borne from. In addition, Appendix A is not an exhaustive list of global TURFs, as it is ultimately rooted in IHH data and limited to the 51 countries which contributed to the Governance Chapter.

Functional TURF Type as the unit of analysis

A literature search of the arrangements using Google Scholar revealed TURFs that could not be linked to any existing arrangements but could be linked to a geographic area. This caused me to reframe the data with "Functional TURF Type" as the unit of analysis. Functional TURF Types are groups of TURFs that operate in a network or with similar rules. They can be defined as specifically as "Mexican Vigia Chico Cooperative Spiny Lobster TURFs" or as broadly as "Communal Property Rights in Beach Seine Fisheries, Eastern Caribbean."

The EDF Fishery Solutions Center database (https://fisherysolutionscenter.edf.org/database) and Auriemma *et al.* (2014) were instrumental in adding pre-existing TURFs from the countries of interest to my dataset. In addition, I consulted an extensive database (1,168 documents, consisting of white and grey literature) on co-management arrangements from Gutierrez, Hilborn and Defeo (2011).

I attempted to capture the *de facto* rights and informal institutions, in addition to and with priority over *de jure*. Co-management pilot programs that were effectively functioning as TURFs were included (i.e. Peruvian COPMAR Pilot TURFs), but policies that simply created an enabling framework that have not yet given rise to defined TURFs (i.e. the Small Scale Fisheries Policy in South Africa, see Sowman *et al.* (2014)) were excluded. Aquaculture leases were also excluded (i.e., the United Kingdom Several Order System previously classified as a TURF in Auriemma *et al.* (2014)).

Other Effective (Area-based) Conservation Measures (OECMs)

Case Study Selection

I selected two case studies of TURFs that could be potential OECMs. Decision 14/8 of the Convention of Biological Diversity established the current, internationally-agreed upon definition of an OECM: "A geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long- term outcomes for the in-situ conservation of biodiversity with associated ecosystem functions and services and where applicable, cultural, spiritual, socio–economic, and other locally relevant values." This can be broken down into three criteria:

1) The area is geographically defined and not currently recognized as a protected area.
2) The area is governed and managed in ways that achieve positive and sustained long-term outcomes for the *in-situ* conservation of biodiversity.
3) The area supports associated ecosystem functions and services and where applicable, cultural, spiritual, socio–economic, and other locally relevant values.

The two cases were selected based on data availability in relation to the three criteria. I selected one marine and one inland TURF as potentials for one marine and one terrestrial OECM, respectively.

OECM Triage

After completion of the TURFs Database, I ranked each Functional TURF Type on its priority for recognition as an OECM based on relative data availability. The scheme is as follows:

OECM Triage	Definition
1	First priority to recognize as an OECM; relatively high data availability
2	Second priority; medium data availability
3	Low priority; low data availability; too small/too temporary
NA	The area does not qualify as an OECM due to Criteria 1. It is in a pre-existing Protected Area (PA).

These scheme does not reflect the ability of a Functional TURF Type to meet OECM Criteria 2 or 3, but rather, higher-ranking TURFs may contain enough data to make a determination. Even the first priority TURFs require additional research, as they may be outdated (IHH data spans 2014-2017), impacted by COVID-19, or recently enveloped in a Protected Area.

RESULTS:

TURFs Database

I identified 42 Functional TURF Types in 19 countries representing 5 FAO regions of the world (all except for North America) (Appendix A). Twenty-eight had not been previously identified as a TURF. Twenty-two could be directly linked to governance arrangements provided in IHH country case studies.

		Asia Pacific (12)	Europe and Central Asia (2)	Latin America and Caribbean (16)	Near East and North Africa (1)	Sub-Saharan Africa (11)	**Total**
Fishery Type	Marine	9	2	11	0	3	**25**
	Inland	1	0	4	1	5	**11**
	Brackish	2	0	1	0	1	**4**
	Both	0	0	0	0	2	**2**
Arrangement Type	Formal	5	2	11	1	6	**25**
	Informal	6	0	5	0	5	**16**
New TURFs		6	0	11	1	10	**28**

Table 1. Summary Table of the TURFs Database (Appendix A).

The following sections highlight groups of TURFs. First, I discuss two classic examples of TURFs. Then, I explore TURFs that emerged in this study that are less commonly identified as TURFs: examples of tenure rights in freshwater/inland/brackish fisheries, temporary instances of water tenure, and cases in which access rights are assigned through place of residence or passed down through kinship. I highlight an example of an informal rule system, *dina*, governing two different types of TURFs in Madagascar, and I include an example of *de facto* tenure rights due to social marginality in the swamps of Bahia, Brazil.

Classic examples of TURFs

The largest system of TURFs was the Chilean National Benthic Resources TURFs Program (AMERB) with 774 known number of instances according to IHH (793 according to the EDF Fishery Solutions Center). TURFs emerged in Chile in the 1990s after the collapse of the abalone (or "loco") fishery in the 1970s and 1980s that, despite last-ditch efforts from the government to set stricter fishing regulations, led to a nation-wide closure of the fishery in 1989 (Earthjustice, 2016). During this time, a group of fishermen negotiated exclusive access rights to benthic marine resources (such as loco) in a swath of nearshore habitat. Spurred by the success of this small experiment, the Chilean government passed sweeping regulatory legislation in 1991 and 1995 that established and outlined a coastal TURF co-management system for benthic resources (Earthjustice, 2016). The General Fishing Law/Chilean Fishery and Aquaculture Law (No. 18,892) of 1991 stipulates that a group of fishers who want to access the loco fishery must apply to gain access to a *caleta* (cove) in the AMERB system, and provide an independent

scientific assessment of the area (Van Leuvan, 2013). If approved, the concession lasts 4 years (Van Leuvan, 2013). Only licensed artisanal fishers belonging to a fishing organization (a cooperative, union, or guild) and residing in a *caleta* can participate. Fishing organizations create additional rules for membership (i.e., fees, training, commitment to assist with monitoring and enforcement) (Van Leuvan, 2013). The system now comprises 18,000 artisanal fishers and stretches along 2,500 miles of Chilean coastline (Earthjustice, 2016).

A second classic example of TURFs co-management also emerged in Latin America in the 1990s. In 1992, perhaps following the example of the Chilean AMERB system, the Mexican government granted nine TURFS to a federation of 13 Pacífico Norte cooperatives, the Federación Regional de Sociedades Cooperativas de la Industria Pesquera de Baja California (Baja California Regional Federation of Fishing Cooperative Societies, or FEDECOOP). A tenth TURF further south was added in 2000. The FEDECOOP TURFs were granted as 20-year species concessions on lobster, abalone, and other benthic species and follow a co-management regime with the National Fisheries Commission (CONAPESCA) (McCay *et al.*, 2014). After meeting biological, economic, and social goals, the FEDECOOP concessions were renewed 2012 (Cunningham, 2013). FEDECOOP TURFs have not just increased the stock of many valuable fisheries but have met many social and economic goals and have become a model for sustainable SSF management worldwide (Cunningham, 2013). In 2004, the Marine Stewardship Council (MSC) certified the spiny lobster fishery sustainable in 9 Pacífico Norte cooperatives, making it the first artisanal fishery in a developing nation to earn the certification worldwide, and earning TURFs an international reputation as a productive and sustainable means of fisheries management (McCay *et al.*, 2014).

The examples of TURFs in Chile and Mexico follow a similar story: local fishing associations are recognized by the national government as effective co-managers and allowed to lease small, coastal areas of the ocean for harvest of benthic species. These concessions are temporary and reevaluated at the end of their terms, the government assists with monitoring and enforcement, and the fisheries are high-value and have gained international recognition. However, this is just one story of TURFs. In the next sections, I explore the lesser-known cases of community tenure rights.

Freshwater/Inland/Brackish TURFs

Seventeen TURF Types manage inland or brackish fisheries. Inland fisheries are freshwater. Brackish fisheries include coastal estuaries or lagoons that have a mix of salt and freshwater.

In Bangladesh, NGOs have played a dominant role in organizing inland fisheries. From 1995 to 1999, for example, local fishers, the Department of Fisheries, five local NGOs, and WorldFish co-managed the Community-Based Fisheries Management Project (CBFM) (Pemsl *et al.*, 2008). After a history of the government leasing pieces of the more permanent inland waterbodies (jalmohals, or fishery estates) to the highest bidder under 3-year leases, the aim of CBFM-1 was to pilot participatory approaches to fisheries management to test which arrangements resulted in more sustainable and equitable management. With the help of CBFM partner organizations, fishers leased jalmohals for 10 to 50-year periods and in many cases, organized to plan management strategies through community-based organizations (CBOs). In the second phase, from 2001 to 2007, the project expanded to 116 sites and 131 CBOs, and saw the addition of six more NGOs (Pemsl *et al.*, 2008).

In the Brazilian Amazon, community-based management of the freshwater fish *Arapaima* contains a few cases of access control through property rights. In the Mamirauá Sustainable Development Reserve, for example, indigenous *Ribeirinhos* have the exclusive right to harvest the large, high-value fish from a Sustainable Use Zone (Castello *et al.*, 2009). In the Juará community, in particular, practitioners have developed an ethic of community stewardship, and have organized into local community associations, meet to develop management protocols, and developed a monitoring protocol for *Arapaima* in partnership with Mamirauá Institute and described in Castello (2004) (Castello *et al.*, 2009). Another type of tenure right, Agro-Extractivist Settlement Projects (PAEs), is being applied to *Arapaima* management in the floodplains in Pará State (*See OECM Case Study:* Arapaima *Management in the Santarém Region, Lower Amazon, Brazil*).

Beach Management Units (BMUs) around Lake Victoria in Kenya have the framework for TURFs: groups of stakeholders collectively own landing sites and coastal waters and partner with local government agencies in a co-management regime (Etiegni, Kooy and Irvine, 2019). However, BMUs may concentrate power in local elites, reducing the benefits of co-management (Etiegni, Kooy and Irvine, 2019).

Freshwater/brackish TURFs were also found in Sri Lanka, Egypt, Chad, the Congo Republic, Nigeria, and Sierra Leone.

Temporary TURFs

In April and October -- transitional months between the dry and wet seasons in Brazil -- individual longline fishers hold property rights over defined fishing spots on the Rio Grande (Castro and Begossi, 1995). They may hold these spots for many years, and others must gain

verbal permission from fishing spot-owners to fish near the spots. In addition to being gear-specific, the TURFs focus on one species, *P. pirinampu*, a high value, migratory fish in the region. Fishers define boundaries verbally and enforce sanctions (i.e., line-cutting) on intruders. Fishers exert their rights during transitional months due to the scarcity of fish yet influx of recreational fishers during this time (Castro and Begossi, 1995).

In Mossaka, situated on a floodplain in the Republic of Congo, property rights are said to be owned by water spirits and passed down through family lineages (Comptour, Caillon and McKey, 2016). The head of the lineage serves as an intermediary between the spirit and human worlds, and relays fisheries management rules to the humans. In the wet season, when the floodplains are inundated, the fishery is open access. However, in the dry season, property rights reemerge with the land, and people can only fish within the traditional territory of their lineage. When the water recedes, fishes and reptiles are left trapped in ponds, and men, women, and children must harvest the ponds collectively. If anyone is caught harvesting individually, they are sanctioned (Comptour, Caillon and McKey, 2016).

Residence and kin-based TURFs

Some TURFs control access by residence. In the Patos Lagoon Estuary in Brazil, only residents that can prove fishing is their main source of income are allowed entry to the pink shrimp fishery (Kalikoskia, Vasconcellos and Lavkulicha, 2002). In the northern Gulf of California, Seri fishers that reside on indigenous territory have the full bundle of property rights in the Infiernillo Channel (Basurto, 2005). In the Chilean AMERB system described earlier, fishers must be residents of the *caleta* from which they harvest (Van Leuvan, 2013).

Fisheries that control access via residence often also pair it with kinship. In the Negombo and Chilaw Lagoons in Sri Lanka, for example, tenure is inherited through families – only the descendants of the clans who originally settled the lagoons are allowed to fish (Kurukulasuriya, 1994). Fishers in Brazil (at Buzios Island, Bahia, and Minas Gerais) and Nigeria (through traditional management of lakes and ponds) also access SSF through kinship (Cordell, 1989; Begossi, 1995; Thé, 2006).

Madagascar: Customary institutions as a local enforcement mechanism

I identified two potential Functional TURF Types in Madagascar: Locally Managed Marine Areas (LMMAs) and community associations granted management authority of specific areas under Gestion Locale Securisee (GELOSE).

The case for LMMAs as TURFs is more clear-cut. LMMAs are "areas of near-shore waters and coastal resources that are largely or wholly managed at a local level by the coastal communities, land-owning groups, partner organisations, and/or collaborative government representatives who reside or are based in the immediate area,"(Govan *et al.*, 2008). In addition to access and withdrawal, communities with LMMAs have, at the very least, management rights. However, whether LMMAs are sufficiently small to qualify as TURFs (in that they are well-managed by the relevant local authorities), remains to be seen. Rocliffe *et al.* (2014) suggest that LMMAs and TURFs "overlap in many key areas because managed access rights are often implemented by communities within LMMAs." Much like TURFs, LMMAs have found benefit in linking into networks. In 2012, LMMA associations in Madagascar came together to establish an informal national network (locally known as MIHARI) (Mayol, 2013). The goals of MIHARI are "to facilitate peer-to-peer learning amongst coastal communities, improve communication,

raise the profile and expand the use of the LMMA approach and serve as a unified lobbying platform for the interests of Madagascar's traditional fishers," (Mayol, 2013).

Contracts under GELOSE are more rigid than LMMAs (Cinner *et al.*, 2009). The GELOSE policy (Act 96-025, 1996) is a legal framework that allows local communities to develop by-laws consistent with national policy to manage natural resources (Antona *et al.*, 2004). The policy was originally developed for terrestrial resources, but applied to a mangrove system in 1999 (Antona *et al.*, 2004). A community-based organization (CBO) may request the right to manage their local natural resources (Antona *et al.*, 2004). With the help of a local mediator (who is ideally also a government official), the CBO, a State representative agency, and adjacent communities/stakeholders negotiate the boundaries of the managed area to be devolved, considering the various user groups and biological attributes of the resource (Antona *et al.*, 2004). The contracts drawn up as a result grant CBOs exclusive rights to manage the defined resources in a defined area for up to 3 years, or 10 years if the CBO's management approach is found to be effective (Cinner *et al.*, 2009). GELOSE contracts require technical expertise (often facilitated by NGOs), and the rules established at the outset are difficult to change (Cinner *et al.*, 2009).

Both LMMAs and communities with rights under GELOSE use *dina* to enforce local regulations. *Dina* is a customary institution, a local social code that has been formalized to some extent through codification and use in regional courts (Cinner *et al.*, 2009). *Dina* is created and modified by consensus on a local level, so although LMMAs are organized into a network, they place emphasis on deriving their own *dina* (Mayol, 2013). This is not to say that *dina* do not follow common themes; rules banning destructive fishing practices, for instance, are common across LMMAs (Mayol, 2013).

Bahia, Brazil: Tenure due to social marginality

> "Living in the swamps is the ultimate measure of marginality; there is no way back into the Brazilian economic mainstream." – Cordell, 1989

In shallow estuarine swamps and mangroves in Bahia, *beirados*, marginalized fishers, use sail canoes and lines, nets, traps, corrals, and traditional purse seining techniques to harvest over 200 species of marine fauna (Cordell, 1989). Groups of fishing captains, extended kin groups, and individual canoe captains hold exclusive rights over inshore fishing spots for varied amounts of time (hours, days, or permanent) on various species (sometimes just one migratory species, other times an entire reef or spawning ground). Rights are passed to a limited number of apprentices or kin. "Pesqueiros" are the basic tenure units. They are divided into smaller areas "lancos" based on changes in current, tide, visibility due to the moon phase, and bottom conditions. In this way, fishers rotate fishing location (and sea tenure) based on the tide (Cordell, 1989).

Those that have come to live in the swamp, by one way or another, have found themselves in a community overlooked by the service-providing and regulation-setting eyes of the government; they are marginalized and isolated from society. In the absence of a formal government, fishers have learned to operate on the institution of "respeito" – social reciprocity. Access is determined not by permit, but by residence and apprenticeships, and to some extent, by the forces that got them there: socio-economic class.

OECMs

Case Studies

Although the 11 Fish Refugia in El Corredor are small, they demonstrate positive social, economic, and ecological outcomes in the greater southwestern Gulf of California region (*see* ***Appendix C1*** *for the full report*). For fishers, the social and political benefits of organizing have been realized first, and initial ecological outcomes seem hopeful. Declaring the area around the El Corredor Refugia Mexico's first OECM is a way to recognize community-based stewardship and facilitate a highly adaptive approach to conservation with the potential to change and expand over time. To strengthen this case, I recommend evaluating the spillover effects of the Refugia into the larger region, highlighting social and political benefits, and facilitating the expansion of San Diego Island Refuge by determining a leader community and an enforcement mechanism.

The *Arapaima* fishery in the Santarém Region of the Lower Amazon will take more legwork to establish effectiveness and declare an OECM but has an outsized potential to conserve global biodiversity (*see* ***Appendix C2***). The *Arapaima*'s biology and economic importance has caused it to be driven to extinction in some areas, but preserved and well-managed in others. One promising local management strategy, Agro-Extractivist Settlement Projects (PAEs), grant property rights to communities in exchange for sustainably managing the fishery. By combining this technique with a few management changes (i.e., establishing clear boundaries, use rules, and market controls), expanding the managed area to the nearby forests and grasslands, and rethinking incentive structures before establishing an OECM, Brazil has the opportunity to revive the *Arapaima* fishery and contribute positively to biodiversity conservation, economic development, and the livelihoods of women and indigenous people.

OECM Triage

OECM Triage	Count
1 – high priority	8
2	5
3 – low priority	22
NA – in a PA	7

Table 2. Results of the OECM triage based on data availability.

Eight out of the 42 Functional TURF Types had relatively high data availability, and thus, should be prioritized when researching potential areas to declare OECMs. High priority TURF areas include:

- Co-management of leased waterbodies through the Community-Based Fisheries Management (CBFM) Projects [Bangladesh]
- Fijian Customary Marine Tenure System (Qoliqoli System)*
- Malalison Island TURFs [Philippines]
- Spanish Galicia Goose Barnacle Cofradía System
- Agro-Extractivist Settlement Projects (PAEs) in Santarem Floodplains, Lower Amazon [Brazil]
- Chilean National Benthic Resources TURFs Program (AMERB)
- Fish Refugia, El Corredor, Baja California Sur [OECM Case Study]
- LMMA Network in Madagascar*

*Note: It is unclear whether Locally Managed Marine Areas (LMMAs) count as PAs. If they do, they would be ineligible as OECMs, as they violate Criterion 1.

DISCUSSION:

The evidence presented in this study challenges a narrow definition of TURFs and builds the case for recognizing *de facto* tenure rights that indicate global progress toward SDG 14.b to "provide access for small-scale artisanal fishers to marine resources and markets." The TURFs

Database and OECM Case Studies are intended to serve as a starting point for research endeavors on tenure, access, and institutional arrangements in SSF, and highlight the community-managed spatial areas that could qualify as OECMs for national policymakers. Future work could examine the institutional frameworks that best enable sustainable management of SSF, how devolved rights contribute to community resilience to climate change and other disturbances (i.e., pandemics), study the origin of property rights, or map their spread around the world.

Considerations for future analyses

When using these data, there are a few points to keep in mind.

First, small-scale fisheries are dynamic socio-ecological systems. The IHH Country Case Study authors were asked to provide institutional arrangements data that spanned 2014 to 2017, and much of the literature used to supplement these data was much older. Common-property institutions are not a given and require constant action from an assemblage of actors brought together in an alignment of enabling conditions (*see* Nightingale (2019)). Tenure rights are agreements, either formal or social contracts that require constant reapproval or renegotiation. They require actors to "stay with the trouble" and persevere through hardships like climate change impacts and pandemics (Haraway, 2016). Even the strongest social organizations are vulnerable to shifts in the external environment (i.e., market forces, migration) that could lead to collapse. For this reason, descriptions of some of the fisheries in the database may describe an older reality or articulate an outsider perspective that leaves out internal power dynamics.

Second, even if the property rights described are maintained in these areas, the presence of rights does not fully equate to empowerment. In some cases, the only sources of property

rights are formal government agreements, and community members may not realize their power. In others, rights may be auctioned off to the highest bidder, concentrating power in the hands of a few wealthy individuals. In order for rights to be exercised equitably, enabling political conditions and social relations must be present and maintained (Schlager and Ostrom, 1992).

Challenges of using the OECM Criteria

While OECMs are an opportunity to highlight community-managed fisheries and value sustainable use over strict conservation areas, I came across many challenges while evaluating SSF using the OECM Criteria established by the CBD and elaborated by the IUCN in "Recognizing and Reporting Other Effective Area-based Conservation Measures," (IUCN-WCPA, 2019).

The first is the fact that PAs and OECMs must be mutually exclusive. In an international policy context, this makes sense. As Target 3 of the post-2020 Global Biodiversity Framework is currently written, PAs and OECMs can both count towards the goal to protect 30% of land and sea by 2030. Requiring the two to be mutually exclusive avoids the issue of double-counting. However, in a practical sense, it is difficult to exclude PAs from potential OECMs. For example, if Mexico found the fisheries on the eastern coast of Baja California Sur to be sustainable, from Ensenada Blanca to La Paz, and wanted to declare an OECM, they would have to exclude five distinct areas that currently form three PAs (see MPA Atlas). Or if Tanzania wanted to declare the community-managed areas on the north coast near Tanga OECMs, they would have to exclude the protected coastal mangrove habitat, which winds and juts out in a non-uniform pattern (see MPA Atlas). Writing off large potential OECMs because they contain small PAs in

tedious and counterproductive. Alternatively, if PAs are successfully "punched out" of OECMs, it may be more difficult to establish PAs in these areas going forward.

The second challenge comes with proving effectiveness. Effectiveness has been interpreted to mean the positive and sustained conservation of biodiversity. This requires gathering data, likely Western-approved scientific data, in data deficient, underserved communities. The reason many of these communities have functioning, sustainable fisheries and a stewardship ethic in the first place is because they live intimately with their environments and had to establish community rules in the absence of formal authority. Now asking them to produce scientific assessments requires capacity and resources that they may not have. This could lead to a sentiment from marginalized groups that as soon as they are allowed into the conversation, they are demanded to prove their worth by using unfamiliar protocols and standards that do not translate into effectiveness in their eyes. In order to create more equitable participation from local communities, any participants who inform OECM design should be 1) compensated fairly for their time, 2) allowed to provide data in ways compatible with their ways of knowing, i.e., through oral histories, and 3) asked to speak to the social, political, economic, and cultural outcomes of conservation that may not be directly related to biodiversity, but impact it nonetheless through feedback loops.

Lastly, OECMs seem to be a solution to a problem that could simply be addressed by making PAs more adaptable, more participatory, and more encouraging of sustainable use. Adding an entire new designation with new criteria that requires an international task force months to decode and years for countries to negotiate the rules of only to require more data and more resources from resource-poor communities, is counter-productive. Yet, the intentions of OECMs to include more community-management and sustainable use are good. As a global

community, we should spend more time thinking about how to put these good intentions into practice, and how to involve more local and marginalized communities, rather than holding them accountable to international standards made at a table in which they do not have a seat.

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APPENDIX A) TURFs Database

https://tinyurl.com/turfsdatabase [Link to Google Sheet]

APPENDIX B) OECM Case Studies

B1)

OECM Case Study: Fish Refugia in El Corredor, Southwestern Gulf of California, Mexico

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Executive Summary
"Other effective area-based conservation measures" (OECMs) are a relatively new policy tool designed to recognize terrestrial and marine areas that demonstrate biodiversity outcomes without Protected Area (PA) status. Parties to the Convention on Biological Diversity (CBD) may use OECMs to meet the "30 by 30" Target to protect 30% of the world's land and oceans by 2030. Temporary, voluntary no-take zones, or "Fish Refugia" provide a unique opportunity for Mexico to demonstrate leadership in sustainable, community-led fishing initiatives. This case study uses three criteria to assess the potential of 11 Fish Refugia near "El Corredor" in Baja California Sur to be recognized as an OECM. Although the refugia themselves are small, they demonstrate positive social, economic, and ecological outcomes in the greater southwestern Gulf of California region. Declaring the area around the El Corredor Refugia as Mexico's first OECM is a way to recognize community-based stewardship and facilitate a highly adaptive approach to conservation with the potential to change and expand over time.

The "30 by 30" Target is within reach for Mexico. In order to meet the anticipated Target 3 of the Convention on Biological Diversity (CBD)'s Post-2020 Global Biodiversity Framework, Mexico has committed to protect 30% of land area and 30% of marine waters by 2030 (CBD, 2021; Campaign for Nature, 2021). Mexico needs to protect an additional 8% of its territorial ocean to meet the marine goal – about 254,961 km^2 – in the next 8 years (Marine Conservation Institute, 2021). One option is expanding current Marine Protected Areas (MPAs), such as the Revillagigedo MPA. A second option is to designate geographically defined areas that are not official PAs but governed and managed in ways that achieve positive long-term outcomes for the *in-situ* conservation of biodiversity as "Other Effective (Area-based) Conservation Measures," or OECMs (CBD, 2018). Unlike PAs, OECMs are outcome-based, do not require a "single shot" game, offering more adaptive capacity to climate and community change, and tend to recognize grassroots-led conservation efforts rather than top-down approaches (IUCN-WCPA, 2019).

Community-established no-take zones, or "Fish Refugia," and their surrounding waters may qualify as OECMs. Forty-one Fish Refugia (Zonas de Refugio Pesquero) in Mexico currently comprise an area of 20,185 km^2 (CONAPESCA, 2019). Fish Refugia are voluntary no-take zones that are renewed every 5 years (DOF, 2007). To be considered an OECM, these areas must be geographically-defined, not considered a PA, governed and managed in ways that achieve positive and sustained long-term outcomes for the *in-situ* conservation of biodiversity, support associated ecosystem functions and services, and where applicable, support cultural, spiritual, socio–economic, and other locally relevant values (CBD, 2018). These individual criteria are broken down and examined in the context of El Corredor Refugia below.

El Corredor Fish Refugia: Summary Table

Area (% of national marine waters)	69.66 km^2 (0.002%)
Fishery Type	Marine
Location	San Cosme to Punta Coyote, Baja California Sur (Southwestern Gulf of California), Mexico
Known # of Instances	11
Length of Contracts	5 years
Targeted Species	Yellowtail (*Seriola lalandi*), red snapper (*Lutjanus peru*), leopard grouper (*Mycteroperca rosacea*), creole fish (*Paranthias colonus*), triggerfish (*Balistes polylepis*), yellow snapper (*Lutjanus argentiventris*), cenizo snapper (*Lutjanus novemfasciatus*), mulato snapper (*Hoplopagrus guentherii*), jacks (*Caranx* sp.) and parrotfish (*Scarus* sp.).
Arrangement Type	Formal
Access Type	Permit
Devolved Rights	Management (*de facto*), Exclusion (*de facto*)

Table 1. *Arrangement Type* can be formal or informal. Formal arrangements are recognized and enforced by the State where government officials explicitly grant rights to the resource users. These rights are given lawful recognition by formal, legal instrumentalities (e.g., formal fishing permits granted by the State to individuals and granting them the right to harvest a specific set of species) (Schlager and Ostrom, 1992). *Access Type* is the criteria for fishers to gain access to this fishery. The options include: based on formal permit application (leases or licenses), based on kinship, based on place of residence, based on historical access or use, other, no access required, unknown, not applicable. *Devolved Rights* are the property rights devolved to community members, in this case, El Corredor fishers. The full bundle of property rights includes access and withdrawal, management, exclusion, and alienation (Schlager and Ostrom, 1992). *De jure* are legal rights, *de facto* are rights in practice. In El Corredor, CONAPESCA has the *de jure* rights of management and exclusion (Quintana and Basurto, 2020). By law, no one is permitted access and withdrawal rights in the Fish Refugia, except for potentially fishers from Ensenada Blanca who hold a "UMA" permit for the harvest of sea cucumber (Quintana and Basurto, 2020). In practice, there is still some ongoing fishing in Fish Refugia (Quintana and Basurto, 2020).

Testing the OECM Criteria

Criterion 1: The area is geographically defined and not currently recognized as a protected area.

Is the area a geographically defined space?

Yes. The area is a network of 11 temporary fisheries closures ("Fish Refugia") in the Gulf of California along "El Corredor" – a stretch of coastline from San Cosme to Punta Coyote on the eastern shore of Baja California Sur, Mexico. Since the initial proposal in 2012, community members in Agua Verde voted to expand the San Marcial Refuge from 5.92 to 32.91 km^2 and added La Brecha (26.80 km^2) in 2017 (**Figure 1**) (Quintana *et al.*, 2021).

It should be noted that defining a larger area that encompasses the Fish Refugia and their surrounding waters is recommended to strengthen the case for an OECM in the southwestern

Gulf. More data is needed on the spillover effects of Refugia and management of fisheries in the larger area.

Figure 1. From Quintana et al., 2021.

Is the area currently recognized as a protected area?
No. Fish Refugia are governed by Mexico's Fisheries Commission (Comisión Nacional de Acuacultura y Pesca, "CONAPESCA") rather than the National Commission for Protected Nature Areas (Comisión Nacional de Áreas Naturales Protegidas, "CONANP"). They are not currently listed on Protected Planet as Protected Areas (PAs) (see https://www.protectedplanet.net/country/MEX).

Criterion 2: The area is governed and managed in ways that achieve positive and sustained long-term outcomes for the *in-situ* conservation of biodiversity.

"Governed"
The CBD, in conjunction with the International Union for Conservation of Nature (IUCN), has defined four types of governance for area-based conservation measures (PAs and OECMs): (1) Governance by governments (at various levels); (2) Governance by private individuals, organizations, or companies; (3) Governance by Indigenous Peoples and/or Local Communities; and (4) Shared governance (i.e., governance by various rights holders and stakeholders together) (CBD, 2018; (IUCN-WCPA, 2019).

El Corredor Fish Refugia are governed via *shared governance*, a co-management regime between communities in the 13 towns of El Corredor and CONAPESCA, the national fisheries commission. The legal framework for Fish Refugia originates in a 2007 national general fisheries law, which defined the objective of Refugia as "conserving and contributing, natural or artificially, to the development of fishing resources by protecting their reproduction, growth or

recruitment areas, as well as preserving and protecting the environment that surrounds them," (DOF, 2007). A local civil society organization, La Sociedad de Historia Natural Niparajá, A.C. (Niparajá), took the initiative to engage local fishers in the process through a rapid assessment of local needs, workshops for Fish Refugia site design, and garnering support of the final site maps from most (60%) of the full-time resident fishers in El Corredor (Quintana and Basurto, 2020). Niparajá submitted the proposal to CONAPESCA in October 2010 with the hope that the scientific branch, INAPESCA, would add suggestions to improve ecological benefits (Quintana and Basurto, 2020). However, INAPESCA did not have the capacity to conduct ecological assessments and sat on the proposal for two years before issuing a technical assessment in July 2012 (Quintana and Basurto, 2020). With the renewed support of fishers, CONAPESCA passed the proposal in November 2012 (DOF, 2012).

In the 2017 renewal process, although local academic experts agreed expansion would improve ecological outcomes and at least one fisher proposed expansion of the total no-take area in nearly every community's meeting, only the community of Agua Verde expanded their Fish Refuge (they also created La Brecha, an additional large refuge) (Quintana *et al.*, 2021). Expansion relied on strong leadership and the majority fishers to agree that any positive outcomes of Refugia outweighed the opportunity cost of closure (Quintana *et al.*, 2021).

Fishers in La Paz were excluded from the decision-making process despite protest (Quintana and Basurto, 2020). CONAPESCA cited their lack of legal landings in El Corredor as justification. Shrimp trawlers were also left out of both processes (Quintana and Basurto, 2020). However, their level of involvement in the future is uncertain, as CONAPESCA denied a large shrimp-trawling ban proposed by El Corredor fishers due to lack of consultation with industrial shrimp fishers (Quintana and Basurto, 2020).

Governance System: Actors

El Corredor Fishers	Fishers from 13 permanent fishing towns with a total of 659 residents and 104 fishing vessels (Niparajá, 2016). Vessels are typically 6-8-meter fiberglass "pangas" with an outboard motor. Ninety-three percent of fishers use hook and line and 30% use targeted gillnets (mainly for sharks and rays) (Niparajá, 2009).
La Sociedad de Historia Natural Niparajá, A.C. (Niparajá)	Civil society organization with the mission conserve the natural heritage of Baja California Sur and promote sustainable development in the region (see https://Niparajá.org/en/about-us/). Organized El Corredor fishers and proposed the network of Fish Refugia. Since 2009, has overseen the collection of socioeconomic, ecological, and fish landing data (Quintana *et al.*, 2021).
"Buzos Monitores"	Niparajá's dive monitoring program. Since 2012, divers have conducted annual surveys of fishes and invertebrates within the Fish Refuges and nearby control sites (Quintana *et al.*, 2020).
CONAPESCA	Mexico's Fisheries Commission (Comisión Nacional de Acuacultura y Pesca). Approves or denies Fish Refugia, holds the *de jure* rights of management and exclusion (Quintana and Basurto, 2020).

INAPESCA	National Institute of Fishing (Instituto Nacional de la Pesca); the scientific body of CONAPESCA. Responsible for technical assessments of Fish Refugia proposals.
University academics	Students partake in monitoring efforts.
Outsiders: Fishers with UMA permits, La Paz fishers, industrial shrimp trawlers	"UMA" (Unidad de Conservación, Manejo y Aprovechamiento Sustentable de Vida Silvestre) permits grant some fishers from Ensenada Blanca exclusive access to harvest sea cucumber in large area that overlaps with El Corredor fisheries (Quintana and Basurto, 2020). El Corredor fishers claim that UMA fishers harvest more than just sea cucumbers and interfere with their catch (Quintana and Basurto, 2020). Together with La Paz fishers and shrimp trawlers, UMA fishers are regarded as outsiders that undermine management efforts of El Corredor Refugia. This group has limited power and influence in decision-making.

Governance System: Boundary Rules

- Fishers must fish in El Corredor (La Paz fishers who did not land fish in El Corredor were denied entry)
- Fishers that propose Refugia hold permits (CONAPESCA)
- Fishers in cooperatives have access to permits
- Fishers not in cooperatives must provide a voter card and a birth certificate to apply for a permit
- Shrimp fishers need to participate in decisions that ban shrimp-trawling in a large area

<u>"Managed"</u>

Is the area managed in a manner consistent with the ecosystem approach and likely to achieve long-term biodiversity conservation outcomes?

According to the IUCN's guidance on recognizing and reporting OECMs, "'managed' can include a deliberate decision to leave the area untouched," (IUCN-WCPA, 2019). Since 2012, fishers in El Corredor have agreed not to fish in Refugia, and even expanded the no-take area during renewal in 2017. Although some fishing still takes place, there is evidence of continued improvement in management (Quintana and Basurto, 2020). A regional committee for fisheries management was formed in 2015 and includes CONAPESCA and INAPESCA representatives in addition to El Corredor fishers (Quintana and Basurto, 2020).

Fish Refugia are likely to achieve long-term biodiversity conservation outcomes that extend beyond the designated areas. Inside Refugia, fish biomass, richness, and diversity increased from 2012 to 2016 while catch data remained stable (Quintana and Basurto, 2020). About half of commercially targeted species increased in average size and 60% of commercial species showed signs of recuperation. Within the larger region, fishers' perceptions of fisheries became more optimistic, moving from 86% reporting fisheries had been in decline in the past 10 years in 2009 to only 4% reporting decline in 2016. Fifty-two percent of fishers in 2016 reported an improvement in fish stocks (Quintana and Basurto, 2020).

Establishing Fish Refugia can enhance socio-economic benefits for local fishers and increase compliance with Government policies. Fishers who establish Fish Refugia gain the *de facto* rights of management and exclusion, empowering them to design rules to benefit economically from local fisheries and reduce interference from foreign fleets (Quintana and Basurto, 2020). In 2016, when 63% of El Corredor fishers reported the right to manage Fish Refugia, about half, or 29% of all fishers, were involved in formal, government-led fisheries meetings, up from a supposed 0% in 2009. With more government involvement, legal fishing (measured by the proportion of permitted boats) increased from 50% in 2009 to 88% in 2016 (Quintana and Basurto, 2020).

Describe any current monitoring efforts that could be used to assess the area's effectiveness at conserving biodiversity.
Fishers trained as monitoring divers ("Buzos Monitores"), Niparajá staff, and students from a local university monitor the Fish Refugia (Quintana and Basurto, 2020). The Buzos Monitores program, in particular, has produced outcomes beyond enhancing ecological knowledge, building individual capacity, local environmental stewardship, facilitating collaboration between stakeholders, and serving as an alternative livelihood means during the off season (Quintana *et al.*, 2020).

Criterion 3: The area supports associated ecosystem functions and services and where applicable, cultural, spiritual, socio–economic, and other locally relevant values.
Which ecosystem services does the area support?[1]
Provisioning services. In addition and perhaps owing to Niparajá's initiative, El Corredor became the first region in Mexico to establish Fish Refugia due to the decline of important fisheries in the Gulf of California (responsible for 71% of Mexico's total fisheries volume) over a period of 10 years (Quintana and Basurto, 2020). In 2016, after four years of Refugia, fishers seemed more hopeful about the El Corredor fisheries: 41% reported stable stocks and 52% reported improvement (Quintana and Basurto, 2020).

Cultural, recreational, and education services. "Buzos Monitores" – fishers-turned-dive monitors trained in SCUBA, marine life identification, monitoring protocols, etc. – exemplify the benefits of local capacity development (Quintana *et al.*, 2020). They report greater environmental stewardship and place higher value on education, often seeking it out for their children (Quintana *et al.*, 2020).

Supporting socio-economic values.
In its technical review in 2012, INAPESCA approved the El Corredor Fish Refugia based on the high potential for social outcomes (due to the "backing of its own community") rather than the technical prowess (Quintana and Basurto, 2020). Indeed, when fishers had the option to eliminate or shrink Refugia in 2017, they decided to reinstate and expand the Refugia – reducing their own allowable fishing area. Why would fishers choose to do this? One explanation is that

[1] The FAO outlines four types of ecosystem services: (1) Provisioning services (energy, food and feed, materials and assistance, medicinal, biochemical and genetic resources); (2) Regulating services (habitat creation and maintenance, regulation of air quality, regulation of climate, regulation of ocean acidification, regulation of freshwater and coastal water quality, regulation of hazards and extreme events, regulation of organisms detrimental to humans); (3) Supporting services (habitat for aquatic species, biomass production, nutrient cycling, water cycling); and (4) Cultural, recreational and educational services (learning and inspiration, physical and psychological experiences, supporting identities, maintenance options).

it's easier to do nothing than to renegotiate (this also ties into conflict avoidance) (Quintana *et al.*, 2021). Another is that the fishers are already seeing tangible results – whether ecological, social, political, or a combination of the three (Quintana *et al.*, 2021). Social benefits may be easier to see in the first five years. Fishers, through collaboration with Niparajá, organized themselves into a network, gained the right to manage their resources and exclude the interests they perceived as outsiders (Quintana and Basurto, 2020). There was a shift in trust in the government and fishing compliance (Quintana and Basurto, 2020). The number of fishing permits doubled, and government subsidies increased (Quintana and Basurto, 2020).

These social and political benefits have the power to create positive feedback loops: communities that perceive Fish Refugia as a good thing are more likely to vote to expand their Refugia, creating greater ecological benefits (Quintana *et al.*, 2021).

Recommendations: Strengthening the Case for an OECM

1) **Evaluate the spillover effects of the Fish Refugia in the greater El Corredor region.** Fish Refugia are but one mechanism of fishery management and show evidence of contributing to stewardship and sustainable management of fish stocks in the greater El Corredor area. Mapping the well-managed area beyond the Fish Refugia will contribute to the ecosystem approach to management and lead to the creation of a larger OECM within which managers can adapt no-take zones to changing desires and conditions.

2) **Highlight the social and political benefits of Refugia in addition to ecological.** The benefit of a network of Refugia is that one successful aspect of the network can serve as an example for the rest. This can be a large no-take area that demonstrates particularly noticeable ecological outcomes (i.e. larger fish in the reserve), or a program that provides technical training for fishers and/or provides an alternative livelihood means during the off season (i.e. "Buzos Monitores"). Celebrating these victories as a network can provide incentive for expansion of areas that are slower to demonstrate ecological change.

3) **Determine a leader community and enforcement system to facilitate the expansion of the San Diego Island Refuge.** San Diego Island covers ecologically productive sites yet is far from the mainland, making it difficult to establish ownership and exclude outsiders (Quintana *et al.*, 2021). Holding facilitated meetings to determine a leader community will allow one group of fishers to take ownership over San Diego's management decisions. In addition, a rotating enforcement mechanism of all participating communities will allow for shared participation in management and help keep out poachers. These tweaks to the governance system should alleviate concerns and help expand San Diego Island Refuge, creating even greater ecological and social benefits that fuels further expansion.

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B2)

OECM Case Study: *Arapaima* Management in the Santarém Region, Lower Amazon, Brazil

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Executive Summary
"Other effective area-based conservation measures" (OECMs) are a relatively new policy tool designed to recognize terrestrial and marine areas that demonstrate biodiversity outcomes without Protected Area (PA) status. In the Lower Amazon, the freshwater fish genus *Arapaima* has a complicated relationship with humans. It's biology and economic importance has caused it to be driven to extinction in some areas, but preserved and well-managed in others. One promising local management strategy, Agro-Extractivist Settlement Projects (PAEs), grant property rights to communities in exchange for sustainably managing the fishery. By combining this technique with internal use rules (i.e., minimum size, quota), expanding the managed area to the nearby forests, and establishing an OECM, Brazil has an opportunity to revive the *Arapaima* fishery and contribute positively to biodiversity conservation, economic development, and the livelihoods of women and indigenous people.

Protecting local and indigenous rights is necessary to preserve biological and cultural diversity in the Brazilian Amazon. Nearly 900,000 indigenous people live in the Brazilian Amazon (IWGIA, n.d.). Their deep cultural ties to and traditional knowledge of the largest and most biodiverse tropical rainforest in the world has outsized potential to conserve global biodiversity. However, land use changes in the Amazon, including the intensification of agricultural production, threatens the sustainable use of forest and fishery products (Schmidt *et al.*, 2021). Future policy should emphasize an ecosystem-based approach and reflect local values for the highest potential for long-term sustainability.

A national OECM in the Lower Amazon may be better suited than a PA to conserve critical habitats and support local rights. "Other Effective Conservation Measures" (OECMs) are a relatively new area-based policy tool that can be used to meet Target 3 of the post-2020 Global Biodiversity Framework. They must be geographically-defined, not considered a Protected Area (PA), governed and managed in ways that achieve positive and sustained long-term outcomes for the *in-situ* conservation of biodiversity, support associated ecosystem functions and services, and where applicable, support cultural, spiritual, socio–economic, and other locally relevant values (CBD 2018). Unlike PAs, OECMs are outcome-based, do not require a "single shot" game, offering more adaptive capacity to climate and community change, and tend to recognize grassroots-led conservation efforts rather than top-down approaches (IUCN-WCPA, 2019).

The *Arapaima* fishery is culturally, ecologically, and economically important in the Lower Amazon. *Arapaima* species, also called pirarucu or paiche, are large, freshwater fishes weighing up to 200 kg and growing up to 3 meters in length (Gurdak *et al.*, 2019a; Arantes *et al.*, 2021).

They are obligate air breathers, and surface to breath every 5-15 minutes (Castello, 2004). This characteristic, combined with their high market value, has made them vulnerable to overexploitation by harpoon and gillnet fishers (Castello, Viana and Pinedo-Vasquez, 2011). In some cultures, *Arapaima* are said to be the "mother and father of other fishes," reflecting a local knowledge that killing a large *Arapaima* has negative impacts on the population and other species (Fernandes, 2005). *Arapaima* move between floodplain lakes in the Lower Amazon and rely on woody vegetation as critical nesting habitat (Gurdak *et al.*, 2019b). In some areas, such as the Mamirauá Sustainable Development Reserve, community-based management of *Arapiama* has caused the population to rebound significantly (Castello *et al.*, 2009). In others, such as those near urban centers, the fish is commercially extinct (Castello, Stewart and Arantes, 2011).

Tenure rights are one way fishers control access to the *Arapaima* fishery. In the Santarém region in the Lower Amazon, Agro-Extractivist Settlement Projects (Projetos de Assentamento Agro-Extrativistas, or PAEs) grant land concessions to floodplain communities (McGrath *et al.*, 2008). These new arrangements lack a clear management policy but are often paired with fishing agreements that control use through gear restrictions and closures and attempt to limit pressure from outside fishers (Arantes *et al.*, 2021). This case study explores whether the PAE model of Territorial Use Right for Fisheries (TURF) can be used as a starting point for identifying a sustainably managed zone in the Santarém region that can be declared an OECM.

***Arapaima* Management in the Santarém Region: Summary Table**

Area (% of national terrestrial area)	2,600 km^2 (0.03%)
Fishery Type	Inland
Location	Floodplain communities near the city of Santarém, Lower Amazon, Pará State, Brazil
Known # of Instances	~83 communities as of 2010, encompassing 1,897 km^2 (Arantes *et al.*, 2021). Maybe 2% do not fish Arapaima (Castello *et al.*, 2015).
Targeted Species	40 species, mostly *Arapaima sp.*
Arrangement Type	Formal
Access Type	Permit
Devolved Rights	Management, Exclusion, Alienation (IHH)

Table 1. *Area* is the area of floodplain managed by the Regional Fisheries Councils in the Santarém region (McGrath *et al.*, 2008). The total terrestrial area in Brazil is 8,529,399 km^2 (Protected Planet). *Arrangement Type* can be formal or informal. Formal arrangements are recognized and enforced by the State where government officials explicitly grant rights to the resource users. These rights are given lawful recognition by formal, legal instrumentalities (e.g., formal fishing permits granted by the State to individuals and granting them the right to harvest a specific set of species) (Schlager and Ostrom, 1992). *Access Type* is the criteria for fishers to gain access to this fishery. The options include: based on formal permit application (leases or licenses), based on kinship, based on place of residence, based on historical access or use, other, no access required, unknown, not applicable. *Devolved Rights* are the property rights devolved to community members. The full bundle of property rights includes access and withdrawal, management, exclusion, and alienation (Schlager and Ostrom, 1992). *De jure* are legal rights, *de facto* are rights in practice.

<u>Testing the OECM Criteria</u>

Criterion 1: The area is geographically defined and not currently recognized as a protected area.

Is the area a geographically defined space?

The Santarém region in Pará State in the Lower Amazon can be defined by the area of floodplain managed by the Regional Fisheries Councils (McGrath *et al.*, 2008). PAEs are also geographically defined, and include both collective land concessions and private property rights ((McGrath *et al.*, 2008).

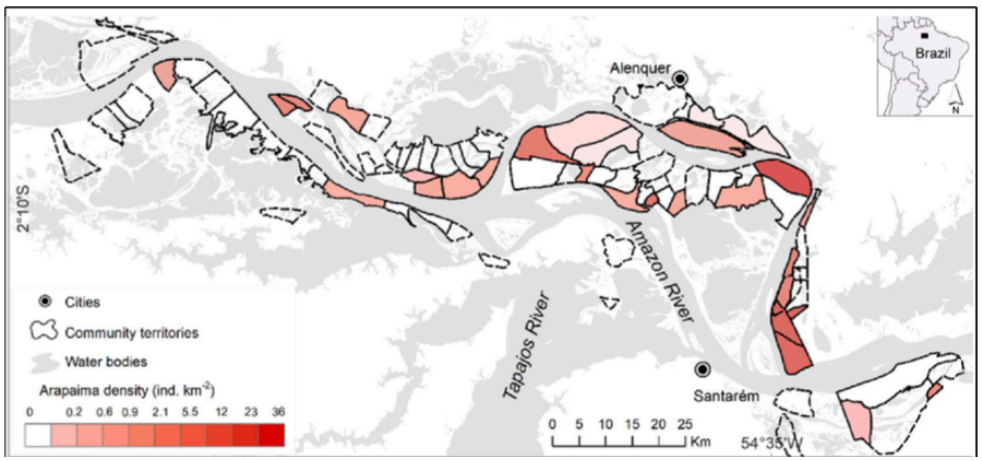

Fig 1. Figure 1 from (Arantes *et al.*, 2021). Arantes et al., 2021 indicates the presence of about 100 floodplain communities in the Santarém region, 83 of which were included in the study and are identified above (encompassing an area of 1,897 km^2). McGrath et al., 2008 estimates that the region managed by the seven Regional Fisheries Councils encompasses about 180 communities, 40,000 people, and 2,600 km^2.

Is the area currently recognized as a protected area?

No.

Criterion 2: The area is governed and managed in ways that achieve positive and sustained long-term outcomes for the *in-situ* conservation of biodiversity.

<u>"Governed"</u>

The Convention of Biological Diversity (CBD), in conjunction with the International Union for Conservation of Nature (IUCN), has defined four types of governance for area-based conservation measures (PAs and OECMs): (1) Governance by governments (at various levels); (2) Governance by private individuals, organizations, or companies; (3) Governance by Indigenous Peoples and/or Local Communities; and (4) Shared governance (i.e., governance by various rights holders and stakeholders together) (CBD 2018; IUCN-WCPA 2019).

The Santarém region is governed via *shared governance*, a co-management regime between Regional Fisheries Councils (RFCs) and the National Institute of the Environment and Renewable Natural Resources, IBAMA. Local fishing agreements or "acordos de pesca" are incorporated into RFC management agreements, which define the access and use rules of floodplain lake fisheries (McGrath *et al.*, 2008; Arantes *et al.*, 2021). The eight RFCs (seven rural, one urban) represent the communities of the major lake systems in the Santarém floodplain

(McGrath *et al.*, 2008). Once approved by IBAMA, RFC management agreements become administrative decrees, or "Instrucao Normativa" (McGrath *et al.*, 2008). In Pará State, the responsibility for fisheries management policies has been transferred from the federal level to a state agency, the Secretariat of the Environment and Sustainability (SEMAS) (Arantes *et al.*, 2021).

In addition, INCRA grants property concessions to control access to fisheries through PAEs. These, too, incorporate fishing agreements where possible (Arantes *et al.*, 2021). The Utilization Plans of PAEs include management measures for both fisheries and cattle grazing on collective grasslands (McGrath *et al.*, 2008). Expanding their use is an opportunity for more integrated management.

Governance System Summary Table: Actors & Institutions

Regional Fisheries Councils (RFCs)	Represent the communities of the major lake systems in the Santarém floodplain (McGrath *et al.*, 2008). Draft management agreements, co-manage floodplain resources with IBAMA. There are 8 RFCs representing an estimated 180 communities, 40,000 people, and 2,600 km^2 of floodplain (McGrath *et al.*, 2008).
Volunteer Environmental Agents (VEAs)	Trained by IBAMA; responsible for implementation and enforcement of fishing agreements at the local level (McGrath *et al.*, 2008).
PAEs (Projetos de Assentamento Agro-Extrativistas)	Agro-Extractivist Settlement Projects. Grant collective land tenure to members of a PAE association in exchange for a membership fee and a commitment to sustainably use natural resources in their territories (McGrath et al., 2008; Arantes et al., 2021). Used in the floodplain context in combination with and in addition to fishing agreements.
Fishing Agreements (Acordos de pesca)	Intercommunity agreements that allow floodplain communities to control access and use to local fisheries, starting in the early 1980s (McGrath *et al.*, 2008). Incorporated into RFC management plans in the 1990s, and more recently, PAEs (McGrath *et al.*, 2008).
INCRA (Instituto de Nacional de Colonizacao e Reforma Agraria)	State colonization and agrarian reform institute. Implemented PAE model in Santarém in 2006 (McGrath et al., 2008).
SEMAS (Secretaria de Estado de Meio Ambiente e Sustentabilidade)	The Secretariat of the Environment and Sustainability in the State of Pará. State agency in charge of fisheries management.

IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis)	The National Institute of the Environment and Renewable Natural Resources. Co-manages the Santarém floodplain fisheries with the RFCs.

Boundary Rules for non-floodplain PAEs (may or may not be extended to floodplain PAEs) (McGrath et al., 2008)

- Must be a member of the PAE association to obtain a concession
- Pay association dues
- Must comply with Utilization Plan or face cancellation of the concession/expulsion from the settlement

However, there are many places where governance of the PAEs and *Arapaima* fishery in the Santarém region falls short. As the PAE model operates without a formal government decree, there is no government institution responsible for Utilization Plans (Gurdak *et al.*, 2019a). IBAMA has instituted a minimum length (1.5m) and closed season (December-May) for the *Arapaima* fishery, however, fishers were not consulted and do not comply with these rules (Castello, Viana and Pinedo-Vasquez, 2011). Pará State has no specific regulations on *Arapaima*, and as the management has largely been left up to communities, many simply have not created enough use rules, leading, in some cases, to local extinctions (Castello *et al.*, 2015; Gurdak *et al.*, 2019a). Finally, although PAE Utilization Plans in other contexts include the right to exclude or charge fees to outsiders, the floodplain PAEs have left the exclusion right undefined (McGrath *et al.*, 2008).

"Managed"

Is the area managed in a manner consistent with the ecosystem approach and likely to achieve long-term biodiversity conservation outcomes?

Arapaima is only well-managed in 5% of the 41 fishing communities near Santarém studied by Castello et al., 2015. It is depleted in 76% of the fishing communities, locally extinct in 19%, overexploited in 17%, and unfished in 2% (Castello *et al.*, 2015).

Yet, there is potential for better management. In the in the nearby Mamirauá Reserve, community-based management strategies resulted in a 9-fold increase in the *Arapaima* population, a 10-fold increase in harvest quota and a doubling of the number of participating fishers in seven years (Castello *et al.*, 2009). This is likely due to the formation of a local fishers' association, prohibition of gillnets during certain times of the year, and the implementation of a monitoring program. The same trait that makes *Arapaima* vulnerable to overfishing – their need to come to the surface to breathe – also makes them an easy species to monitor (Castello *et al.*, 2009).

Establishing use rules through fishing agreements is a good starting point. In a study that compared managed and unmanaged lakes with similar levels of fishing activity in the Lower Amazon, lakes with a fishing agreement were on average 60% more productive than those without (Almeida, 2004).

The PAE Utilization Plans also hold the potential to design more holistic policy that follows an ecosystem approach. In the Lower Amazon, which is 90% grassland, 10% forested, and seasonally inundated with many large, shallow floodplain lakes, integrating forest, ranching, and fishing uses is imperative (McGrath *et al.*, 2008). For example, there is evidence that *Arapaima* rely on woody vegetation for nesting (Gurdak *et al.*, 2019b). Logging, therefore, is a direct threat to *Arapaima* reproduction, as the same forests serve as an *Arapaima* nesting ground during the wet season.

Criterion 3: The area supports associated ecosystem functions and services and where applicable, cultural, spiritual, socio–economic, and other locally relevant values.

The Lower Amazon supports several ecosystem services, including provisioning services (fish, forest, medicinal products), regulating services (habitat creation and maintenance, regulation of global climate), supporting services (habitat for aquatic species, biomass production, nutrient cycling, water cycling), and cultural services (maintenance of traditional culture and identities).

In addition, the *Arapaima* fishery has the potential to generate many of the social and economic benefits that come with involving women. According to Freitas et al., 2020, women involvement in Arapaima co-management in the Juruá River is an important source of income and power for women (Freitas et al., 2020).

Recommendations: Strengthening the Case for an OECM

1) **Enhance effectiveness through small changes to management.**
    - *Establish clear boundaries.* According to Gurdak *et al.* (2019a), "although most communities in the region are zoned under the PAE system, conflicts exist regarding specific lakes and rights to use along boundary zones." Clarifying these boundaries will incentivize local communities to bear the costs of conservation by granted them higher certainty of receiving the benefits. Indeed, communities with high *Arapaiama* abundance in the Santarém region were correlated with clearly defined boundaries (Arantes *et al.*, 2021).
    - *Establish an owner of the Utilization Plans.* Either communities or RFCs could incorporate the Utilization Plans into fishing accords and other management plans.
    - *Expand the PAE model to better integrate other uses.* PAE Utilization Plans have the benefit of integrating the management of grasslands and floodplains through ranching and fisheries. Adding forest management through logging and other uses would create a positive feedback loop for the *Arapaima* fishery, in particular, as *Arapaima* rely on submerged vegetation for nesting.
    - *Require* Arapaima *monitoring protocols and use rules.* Fishing communities in the Santarém region should adopt the monitoring protocol used in the Mamirauá Reserve and detailed in (Castello, 2004) to better set use rules for *Arapiama* species.
    - *Add market controls to prevent illegal fish from entering luxury markets* (Gurdak *et al.*, 2019a).

2) **Rethink incentive structures.** Currently, there is greater economic incentive to cut down the forests for farming than to leave the forests intact (even if forested land leads to better fishing in the wet season). Managers need to address this perverse incentive. Could alternative livelihoods in ecotourism help incentivize keeping the forests? Are there ways to make the fishery income last year-round?

3) **Establish a large, terrestrial OECM in the Lower Amazon.** The Amazon provides ecosystem services for much of the global population, and the international community has made it clear that it has stake in its preservation. By declaring a national OECM, Brazil has the opportunity to act as a leader for and steward of the conservation of global biodiversity.

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