Ocean and Society
2025 • Volume 2 • Article 8851
https://doi.org/10.17645/oas.8851

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Open Access Journal

Navigating Coastal Dynamics: Illegal Institutional Arrangements, Gangs' Activities, and Knowledge Mobility in the Gulf of Guayaquil

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Submitted: 19 June 2024 **Accepted:** 8 October 2024 **Published:** 6 January 2025

Issue: This article is part of the issue "Knowledge Integration in Ocean Governance" edited by Dorothea Wehrmann (German Institute of Development and Sustainability) and Annegret Kuhn (Kiel University), fully open access at https://doi.org/10.17645/oas.i435

Abstract

This study investigates how corruption and criminal gangs affect small-scale fisheries, driving forced displacement and reshaping fishing knowledge through the process of epistemic mobility. The research focuses on the interactions between the fishing communities of Puerto Bolívar and Puerto Roma within the Gulf of Guayaquil, Ecuador. By tracing the movement of fishers and their knowledge, the study reveals how the imitation and attempted learning of fishing techniques, such as the use of plastic tubes to detect fish, occur between communities. Displaced due to the illegal encroachment of semi-industrial vessels (*bolicheros*) protected by criminal gangs, Puerto Bolívar's fishers have been forced to migrate northward to fish near Puerto Roma, and then return to Puerto Bolívar. While they are fishing in the northern waters, Puerto Roma's fishers observe their techniques and attempt to imitate them. Nonetheless, the transfer of this knowledge is imitative and incomplete, as it is observed from a distance rather than fully understood. The study highlights that, while the displacement caused by corruption and illegal activities brings fishers into new contexts, it is the fishers themselves who contribute to the mobility and transformation of knowledge. By focusing on epistemic mobility, this study highlights how knowledge is not always successfully transferred but is adapted, hybridized, or even resisted, offering new insights into the resilience and vulnerability of small-scale fishers in the context of systemic corruption and ecological conflict.

Keywords

conflicts in fisheries; criminal gangs; epistemic mobility; fishing industry; illegal institutional arrangements; knowledge; small-scale fisheries

1. Introduction

When asked who advocates for their needs, artisanal fishers responded simply: "No one. We do it ourselves" (fisherman, personal communication, May 31, 2023). This answer illustrates the daily life of communities in the Gulf of Guayaquil, a critical ecological and economic zone now facing immense challenges due to the interplay of the entry of the fishing industry into the artisanal fishery zone, corruption, and the socio-economic dynamics of small-scale fishing communities. Illegal fishing vessels, known as *bolicheros*, increasingly encroach on areas designated for artisanal fishing, creating resource depletion that forces local fishers from Puerto Bolívar (downstream) to temporarily move to fish grounds in Puerto Roma (upstream) as the stocks in their own areas diminish. The corruption within institutional frameworks further complicates these dynamics, as bribery enables industrial operations to exploit these areas with little oversight. This situation not only threatens the livelihoods of small-scale fishers but also fosters conflicts among them as competition for dwindling resources escalates. In this context, this study explores how these factors impact local fishers and how the movement of knowledge (termed epistemic mobility) plays a crucial role in shaping fishing practices and community resilience. This study investigates how knowledge is shared, transformed, and sometimes contested within the context of displacement and environmental change.

This article is structured as follows: Section 2 outlines the conceptual framework, including theories on institutional arrangements, corruption, and epistemic mobility. Section 3 presents the background of the fishing communities in Puerto Bolívar and Puerto Roma, detailing their historical and ecological contexts. The methodology employed to gather data is described in Section 4, followed by the results in Section 5, illuminating the current dynamics of fishing practices and conflicts. Finally, the discussion and conclusions in Section 6 synthesize the findings, linking them back to the theoretical framework while advancing our understanding of the complex relationships between knowledge, mobility, and fisheries management in the face of industrial pressures.

2. Conceptual Framework

We define institutions as "an aspect of culture, a set of habits, rules or values" (Jentoft, 2004, p. 138). Institutions are frameworks that shape social interactions through norms and rules. As institutional arrangements, we refer to the formal and informal rules or practices that "guide and constrain behavior" (Olivier & Schlager, 2022, p. 341), "provide opportunities" (p. 347), and "condition and shape interactions" (p. 343) within an organization or between organizations. Institutional arrangements are influenced by history and culture and can breed prosperous as well as perverse practices, which can in turn breed the prevalence of illicit rent-seeking or corruption and undermine the performance and legitimacy of institutions (Nunan et al., 2018).

The occurrence of corruption, "through the payment of briberies to avoid sanctions and to enable illegal practices to continue" (Nunan et al., 2018, p. 60), is a factor that indicates weak enforcement and non-compliance (Gezelius & Hauck, 2011; Sundström, 2013, 2016). In general, in the case of fisheries, the navy is the patrol institution in charge of governmental surveillance of the interior waters, which includes controlling and stopping the fishing industry from entering such waters, whether by means of industrial or semi-industrial vessels. Active bribery is defined as "the promise, offering or giving to a national public official…of an undue advantage, in order to act or refrain from acting in matters relevant to official duties"

(United Nations Office on Drugs and Crime, 2019, p. 3). Bribery by the fishing industry to the navy enables illegal fishing—defined as a "violation of applicable international, regional, or national fisheries regulations" (Petrossian, 2019, p. 23)—and indiscriminate fishing in areas reserved for small-scale fisheries, leading to resource depletion, heightened conflicts (Spijkers et al., 2021), and the displacement of artisanal fishers in search of new waters.

While historically fishers have been mobile, following the seasonal availability of fish (Lund, 2020), in the Gulf of Guayaquil recent shifts in mobility are more closely tied to illegal institutional arrangements. In our case study, criminal gangs have played a key role in these dynamics by protecting semi-industrial boats connected to the fishing industry since 2016. This illicit collaboration allows *bolicheros*—semi-industrial trawlers with advanced radar systems capable of locating large shoals of fish (Ertör & Ertör-Akyazi, 2023)—to encroach on artisanal fishery zones. These zones, intended for traditional fishing, are increasingly co-opted by industrial operations under illegal agreements between the navy and industrial players. The resulting overexploitation renders these spaces unsustainable for artisanal fishers, driving their forced displacement and exacerbating resource conflicts.

This conflict between the fishing industry and small-scale fisheries in artisanal fishery zones creates consequences that impact not only the communities directly affected but also other communities due to the displacement of artisanal fishermen searching for fishing grounds. In summary, the presence of *bolicheros* leads to increased pressure on upstream fishing grounds, illustrating the spatial interdependence of communities and ecosystems within the Gulf of Guayaquil. Spatial interdependence refers to the concept that geographic phenomena are interconnected, meaning that the characteristics or behaviors of one spatial unit can influence those of another. This principle is often encapsulated in Tobler's first law of geography, which posits that "everything is related to everything else, but near things are more related than distant things" (Schimohr et al., 2022). This foundational idea highlights the importance of proximity in understanding spatial relationships and interactions, and at the same time underscores how local decisions and movements can have broader impacts, despite seeming like isolated events. This concept echoes Partelow's (2023) emphasis on the interconnectedness of marine spaces and the need for governance frameworks that account for these spatial dynamics.

To develop our argument about fishers' displacement we use the "mobilities paradigm" (Sheller, 2018; Sheller & Urry, 2006) and the notion that different forms of mobilities "of people, materials, ideas, technologies, knowledge and risks are already producing and reproducing social relations" (Boas et al., 2022, p. 3368) at the local, regional, and global scales (Boas et al., 2022; Wiegel et al., 2019). Displacements of fishers are embedded in socio-economic, cultural, political, and environmental contexts (Hapke, 2001; Lund, 2020; Weeratunge et al., 2010). Considering illegal institutional arrangements as one of these factors, we will unveil how the movement of fishermen from an affected area to a destination area is carried out, how it evolves, and what it brings to the picture when other communities receive the displaced fishers. The location of this case study in the Estuary of the Gulf of Guayaquil allows us to explore both the downstream areas near the Pacific Ocean as well as the upstream regions within the Central Interior Estuary, weaving a narrative that, while context-specific, can offer insights into local mobilities in other coastal areas around the world.

The movement of fishers is accompanied by the movement of their knowledge, a phenomenon known as epistemic mobility, which is central to this research. The fishers from Puerto Bolívar have adapted their

knowledge of fishing over time, incorporating innovative techniques such as the use of a plastic tube to listen for fish. Ruddle (1994, p. 163) describes this integration of modern materials and methods into their fishing repertoire as "hybridized knowledge," a mix of traditional practices and adaptations influenced by outside factors. As these displaced fishers displace fishing operations upstream to the point of Puerto Roma and further, they bring this evolved knowledge with them, and some local fishers begin to adopt these practices. This exchange illustrates the process of epistemic mobility, where embodied knowledge is transferred from one community to another (Hornidge et al., 2020).

Upon migrating upstream, Puerto Bolívar's fishers are faced with a new ecological context to which they must once again adapt. Their ability to adjust is not just a reflection of their practical knowledge, but also of their capacity to experiment and innovate. As Hornidge et al. (2020, p. 1498) point out, these fishing techniques "embody knowledge, genius, and practices of experimentation that are semistable and transferable to a certain extent." This knowledge, once displaced, becomes part of a process of translation and transformation, evolving as it interacts with a different ecological and social setting.

When downstream fishers bring their local open-sea knowledge to the upstream community, two distinct responses emerge in the latter: while some fishers adopt and imitate these new techniques, others continue to rely on the ancestral methods traditionally used in the mangrove estuary. This ancestral knowledge passed down through generations, belongs to the community and reflects a way of life intimately connected to the coast and its resources (Molina Camacho et al., 2018). The difference in approaches highlights a divergence in fishing practices, where one group embraces the incoming knowledge and another—the one we refer to as the "mangrove-ancestral" group—remains loyal to their longstanding methods, which have undergone fewer changes. This stability in their practices is partly because the upstream fishers have not experienced displacement, allowing them to preserve their techniques. Drawing on Scott's (1989) concept of everyday forms of resistance, these fishers quietly maintain their ancestral practices, avoiding attention, remaining unorganized, and eschewing open confrontation, yet continuing to pass down their knowledge to future generations.

3. Background: Downstream and Upstream Case Studies

In the coastal province of El Oro, where Puerto Bolívar belongs, there are 11,000 artisanal fishers and 67 fishers' associations (Fernández-Espinosa et al., 2021). Puerto Bolívar is located in the downstream area of the Interior Central Estuary of the Gulf of Guayaquil. This southern area is the closest area to the Pacific Ocean (Ecologically or Biologically Significant Areas, 2017). It is a port with a history of mangrove resource gathering and fishing practices ("La pesca es," 2014; Fernández-Espinosa et al., 2021), that has spread local knowledge to other communities. For example, during fieldwork, fishermen from other southern coastal communities said that some techniques, such as fishing with the help of a plastic tube, were practices learned from the fishers of Puerto Bolívar. Puerto Bolívar's fishers say that, over time, different techniques have been used. For example, 25–30 years ago, they would place their heads on the floor of the boat to listen for the sounds of the fish. Another technique involved sticking the boat's wooden paddle into the water and placing their ear on top of it to hear the fish (Figure 1). These methods evolved over time and, by 2015, they began using a plastic tube with lids on both ends, which they submerged into the water to listen for fish. They can identify different species by their sounds—according to them, for instance, the sea bass makes a croaking noise.

Figure 1. Adaptation of fishing techniques by Puerto Bolívar fishers to detect fish through sound. Notes: The first two techniques shown in Figure 1 were used almost three decades ago, while the use of the plastic tube started in 2015; The illustrations were created by Subash Surendran Padmaja, an Indian researcher, for this article.

Puerto Bolívar is in the proximity of the Jambelí Archipelago (the downstream part of the Gulf of Guayaquil) and therefore has a close relation with those communities. When asked why some fishers of the communities of the Archipelago know how to use the tube, the president of one Puerto Bolívar association said that some of them are relatives or friends who have come to Puerto Bolívar to take part in the fishing work, which has allowed the teaching and the learning of the technique. Currently, the use of this technique is common among the communities in the Jambelí Archipelago.

Regarding fishing methods, Puerto Bolívar's fishers used to fish with large-mesh green textile nets, but these have also evolved. Currently, they use what is known as the electronic fishing net, which has a smaller mesh and is made of transparent nylon. They explained that the older green net becomes heavier when wet, which is why they stopped using it. The nylon nets are more convenient and easier to handle. Since they fish in the area of the Gulf facing the Pacific Ocean, which is vast, they cast the nets and wait for a while until the fish become entangled in them.

Navigating upstream in the Gulf we find Puerto Roma, a community located in the north of the Interior Central Estuary of the Gulf of Guayaquil, surrounded by thick mangrove forest. The fishers here recognize themselves proudly as ancestral crab gatherers of that area of the Gulf, compared to other nearby communities that used to dedicate themselves mostly to mangrove cutting or fishing (fisherman, personal communication, March 15, 2024). They have an association and a cooperative of crab gatherers and fishermen with 338 members, out of whom only 17 are dedicated exclusively to fishing using different techniques. There are approximately 43 fishermen in the community, though the others are not members of the Fishermen's Association or the Crabbers' Cooperative. We highlight that, during the closed season of the red crabs, some crabbers dedicate themselves to fish as their alternative source of income.

In contrast to the Jambelí Archipelago and the open-sea type of fishing, the communities of the Interior Estuary have been accustomed to a "mangrove type of fishing," which is characterized by fishing in narrow estuaries. Also, this type of fishing retains the characteristics of the past (Koelle, in press), and their techniques have experienced a very low level of change, compared to the Puerto Bolívar fisheries. For example, they still use the large-mesh green textile nets, and they fish in a very slow way, throwing the fishing nets into the water and waiting for a while to retrieve them, because that is how they learned to do it.

4. Methodology

For this research, the first author carried out nine months of intensive fieldwork between October 2022 and June 2023 in different places in the Gulf of Guayaquil to develop an understanding of the general living conditions and the dynamics between coastal communities. Specific for this research was the two-month ethnography carried out in Puerto Roma as well as two visits to Puerto Bolívar. To understand the dynamics of the entrance of the downstream fishers in the upstream area we held five focus groups. In Puerto Roma, we conducted two focus groups (nine participants), each consisting of daily fishers who use distinct fishing practices. In Puerto Bolívar, we held two focus groups with the Pesquerita Fishermen's Association (seven participants) on separate occasions. One focus group was conducted in another downstream community to discuss the relationship between semi-industrial vessels and criminal gangs. For security reasons, we anonymized the names of the downstream communities and the Puerto Bolívar association since the locality has a high crime rate due to the presence of criminal gangs. Interviews and focus groups were conducted with informed consent, which was approved by the Center for Development Research of the University of Bonn. The recordings of this material are stored in a digital cloud under the first author's custody. Part of the inputs was an informal interview with the president of an association in Puerto Bolívar to validate information in 2024, from which notes were taken, and the names of the person and organization anonymized.

At the public-sector level, we interviewed the director of policy of the Vice-Ministry of Fisheries of Ecuador along with two officials from the National Institute of Fisheries, and we held one off-the-record interview with a high-level official from the Ecuadorian navy (Puerto Jambelí Department).

In addition, we analyzed 14 articles from national and local media newspapers (Table 1) over the period 2007–2024, that covered news about conflicts related to the presence of semi-industrial vessels in Puerto Bolívar waters, the gang situation, and the entrance of small-scale fishermen of Puerto Bolívar into Puerto Roma (only two articles in grey literature had covered the latter).

Printed maps of the Gulf were used in the focus groups and interviews to locate the entrances of the vessels and to understand the path of the displacement. Fishing trips were recorded in the PocketTravel app. After that, we used the programs QGIS and Canva Pro to generate and illustrate our narrative.

5. Results

5.1. Illegal Institutional Arrangements Cause Displacements Between Downstream and Upstream Areas

Puerto Bolívar's coast experiences a constant entrance of semi-industrial ships called *bolicheros*, which belong to the fishing industry and are smaller than industrial vessels; therefore, they can more easily enter artisanal fishing waters and anchor offshore. The *bolicheros* are trawler vessels using trawls or nets to catch fish. They catch 20 to 40 times more than artisanal fishers (López, 2020, p. 168). In Puerto Bolívar, different species of fish can be captured, but the most important, due to its high price on the market, is the sea bass, or as locals call it, "the croaker."

Based on interviews between February and March of 2023, there were 23 *bolicheros* anchored near the coast, fishing in the water for several days. Fishermen from the Pesquerita Association indicated that these ships belong to the Ecuadorian industry. While some come from northern provinces, others come from the northeast (Posorja), and yet others are from Puerto Bolívar (Figure 4). In total, these semi-industrial vessels fish in the Puerto Bolívar area, violating Article 104 of the Law of Aquaculture and Fisheries of Ecuador, which indicates that "the zone established for artisanal fishing shall be declared as the area within eight nautical miles, where the recruitment processes of bio-aquatic species are carried out" (Asamblea Nacional del Ecuador, 2020, Article 104).

The entrance of semi-industrial vessels has led to a decrease in the fishing stock of Puerto Bolívar. For this reason, small-scale fishers have "followed the seabass fish shoal" and, in this quest, have moved upstream in the Gulf. Currently, they travel to places such as Puná and Puerto Roma (Figure 4). As recorded, "before we had no need to go to Puná" (Participant 1, focus group), meaning that they did not need to move upstream in the Gulf looking for the fish, as they do nowadays.

The navy's role is ambiguous since some media reports indicate that certain vessels have been held back (OANNES, 2011), but others indicate that small-scale fishers complain about the authorities' inaction ("Naves grandes van," 2010). Social media and newspaper material have covered both the successes and failures of the Navy in capturing *bolicheros* (Table 1). Interviews with fishermen from Puerto Bolívar implied that the navy was not safeguarding the coast from criminal gangs (called "pirates") but was receiving bribes from the industry. Fishers in Puerto Bolívar claimed that "the navy goes closer to the *bolicheros* when they have put the nets in the water, they [the officials] get in the boats, to the wheelhouse, and then they leave, and the *bolicheros* stay there fishing" (Participant 2, focus group). Additionally, fishers reported that the navy asked them to indicate on a map where the *bolicheros* fish, but they answered that they had done this before and that the navy already had this information, yet there was no resolution to the problem. This goes in hand with other complaints such as the navy's lack of budget to patrol the ocean, which is an answer fishers receive when requesting surveillance in the artisanal fishery waters.

Regarding the encroachment on the part of the *bolicheros*, we also consulted the vice-ministry of Fisheries. A representative indicated:

> We can only track through the satellite tracking devices that are installed by law on industrial vessels, and we can see where they are, how many they are, in which areas they are, and we can control the issue of the eight miles [the artisanal zone].

However, fishers from different localities state that this tracking is not always effective. For example: "There have been some sanctions, but what is the industrial ships' strategy? They turn off the detector, and if the Ministry comes, they say it has been damaged" (fisherman, personal communication, March 3, 2023). In Puerto Bolívar, fishers said, "This is a lie that they do not even believe themselves" (Participant 3, focus group), meaning that control is not effectively executed. The president of another Puerto Bolívar Association indicated that another strategy used is to remove the radar from the *bolichero* and place it on another vessel that will remain outside the eight miles so, while the *bolicheros* enter the interior waters, their radar appears to comply with the law (fisherman, personal communication, September 9, 2024).

Table 1. Local news coverage of escalating conflicts: Displacement of artisanal fishers, illegal intrusions of *bolicheros*, and criminal gangs operations.

No.	Date	Title of the news	Local newspaper or website
1	July 20, 2020	"Fishermen Complain About Croaker Exploitation"	*El Universo*
2	August 17, 2010	"Big Vessels Go to the Artisanal Fishery Area"	*El Comercio*
3	October 27, 2011	"In Puerto Bolivar Industrial Vessels Continue to Disrespect the 8 miles"	*OANNES & La Hora*
4	December 30, 2012	"Artisanal Fishers Report the Invasion of Vessels"	*El Telégrafo*
5	May 29, 2014	"Operation 'Marea Alta' Dismantled Dangerous Pirate Gang Operating Along the Coast of El Oro"	*Ministry of Government of Ecuador*
6	August 14, 2018	"11 Arrested in Puerto Bolivar Riots"	*El Telégrafo*
7	August 26, 2019	"Fishermen Say They are Threatened if They Report: Four Criminal Gangs Cause Terror in Fishing Sector"	*Diario Correo*
8	November 26, 2020	"Why Ecuador is Victim and Accomplice of Illegal Fisheries?"	*Magazine Fisheries and the Environment*
9	February 15, 2020	"Gangs at War"	*Diario Correo*
10	February 22, 2020	"Crimes at Sea are Shipwrecked in Impunity"	*Plan V*
11	May 2, 2022	"Artisanal Fishermen in Ecuador Struggle Against the Tide"	*Revista La Brava*
12	December 28, 2023	"T-shirts on Engines, Extortion to Fishermen"	*Bitácora Ambiental*
13	May 28, 2024	"Terror Rules in Puerto Bolivar: People Live Silenced by Violence"	*Diario Extra*
14	May 28, 2024	"Puerto Bolivar: War Between Fractions of Los Lobos Keeps the Population in Anxiety"	*Primicias*

Another illegal institutional arrangement that has caused Puerto Bolívar fishers' displacement to the north is that claiming their rights to artisanal fisheries is not an option when the *bolicheros* are protected by criminal gangs. Any action against the *bolicheros* can result in the death of small-scale or artisanal fishers of Puerto Bolívar. So far, grey literature has reported on the problem of piracy through a narrative that sees the semi-industrial vessels and the small-scale fishermen as victims of piracy. Though this has been happening for a long time, our informants indicated that a critical juncture in the dynamics of the Gulf started around 2015–2016 when tired of being attacked by the pirates or criminal gangs, some of the semi-industrial *bolicheros* vessels that belonged to the industry, took the initiative of entering into a pact with them requesting their protection. The way they operate now is fishing illegally while being safeguarded by the pirates (Figure 2).

This informal arrangement between the industry and the gangs has made the communities even more vulnerable because they are afraid to complain about the invasion of the *bolicheros*. This research is the first academic source that documents this arrangement. Extracts from a focus group are:

> They formed an alliance, we are talking about…2015 or 2016….The *bolicheros* were also afraid because they were being robbed too, so they found a better strategy, which was to pay them [the pirates and the gangs]…with fish, to protect them. The thing is it is not just one gang. There are several gangs.

Figure 2. *Semi*-industrial trawlers guarded by criminal gangs. Note: The illustrations were created by Juan Carlos Gilbert, an Ecuadorian artist, for this article.

> Moreover, if one thief comes, then another thief comes. So [they thought]: it is better to have this guy [a pirate] protect me. (Participant 4, focus group)

The complexity is highlighted by the fact that pirates also live in Puerto Bolívar. Fishers have normalized living in these conditions, saying they do not complain or report because "at any time we can be taken" (Participant 5, focus group). Pirates are also related to narcotrafficking gangs, which have started charging an extortion fee called *la vacuna* (the vaccine) to fishers: "Not to be stolen [from] we pay the vaccine, which is $100 monthly" (Participant 6, focus group).

Our map in Figure 3 weaves the narrative of coastal dynamics in the Gulf: Extraction through semi-industrial vessels operating within the artisanal fishery zone from (1) Posorja and (2) Puerto Bolívar, with protection from criminal gangs, forces small-scale fishers from (3) Puerto Bolívar to move following the fish shoal to (4) Puná and (5) Puerto Roma. Though they are forced to move, these fishers disseminate their knowledge in upstream communities before returning home to Puerto Bolívar after each journey.

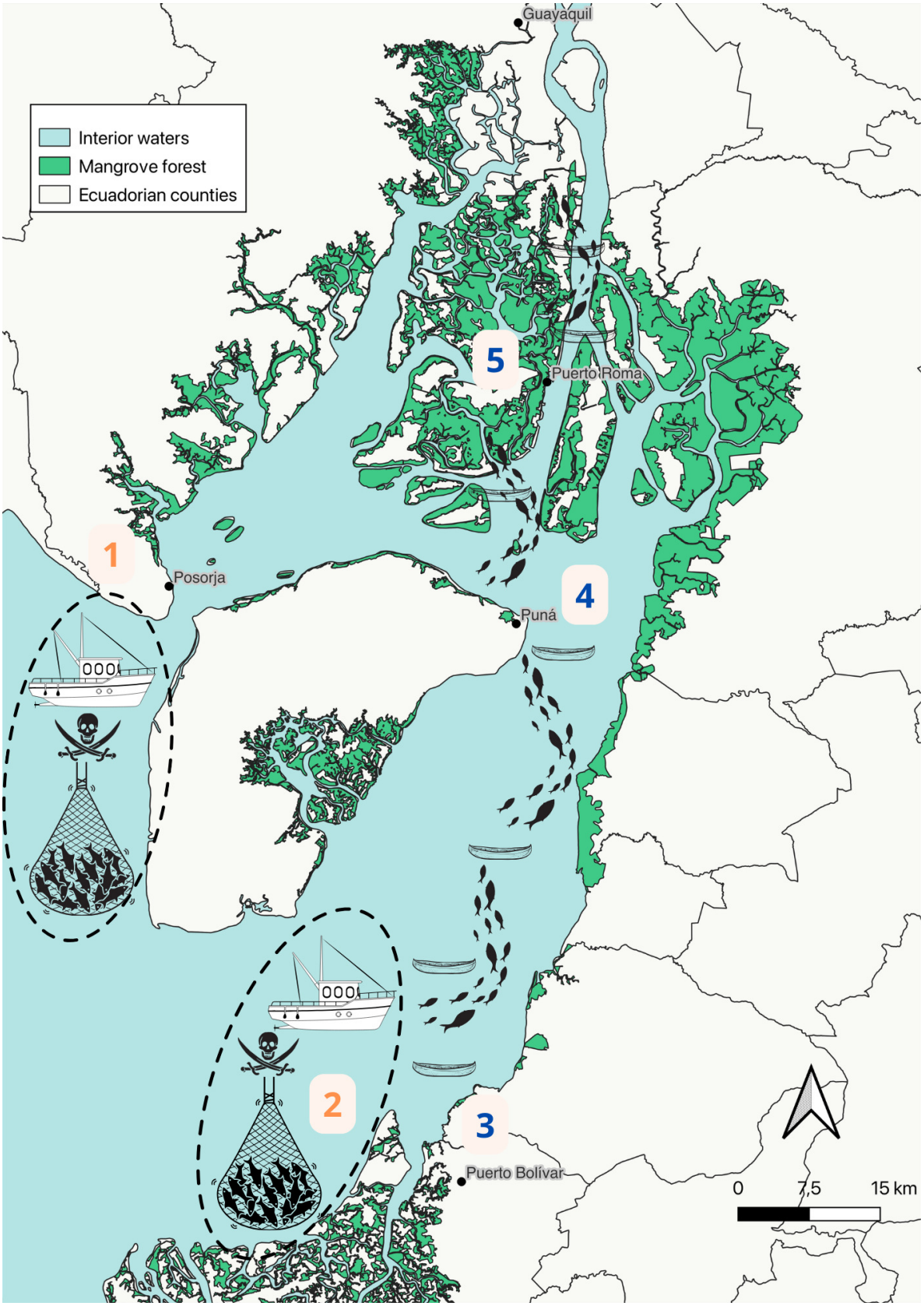

Figure 3. Illegal institutional arrangements force the displacement of downstream fishers to upstream waters.

5.2. Epistemic Mobility Woven Through Displacement

Affected by the illegal entry of *bolicheros*, fishers from Puerto Bolívar have moved across the Gulf of Guayaquil, spreading their local knowledge to other towns. When fishermen from Puerto Bolívar navigated upstream to the waters around Puerto Roma, the local fishers were unaware of the abundance of sea bass in their area, nor did they know how to fish as effectively as the people of Puerto Bolívar. The latter had mastered their techniques, and now use the plastic tube casting their nets once the sound of the sea bass is detected. The fishermen of Puerto Roma observed the arrival of these newcomers with curiosity and, seeing the large quantities of sea bass they caught, sometimes asked for fish, which the Puerto Bolívar fishers would toss over to them from their boats. Eventually, some of the Puerto Roma fishermen inquired about the methods used by their downstream counterparts, and the Puerto Bolívar fishers shared information about the type of fishing nets and the plastic tubes they use.

However, unlike the relationship between Puerto Bolívar and the Jambelí Archipelago where knowledge and work are shared as part of kinship networks and work relations, the connection with the people of Puerto Roma lacked this close bond. Knowledge mobility occurred not through collaboration, but through distant observation. In fact, while on a fishing trip during fieldwork, one Puerto Roma fisherman was using the tube to listen for sea bass but admitted he could not recognize the sound. This confession, later echoed by other fishermen, confirmed that the method had not been fully taught to them.

Through their experience of moving upstream over the past four years, the fishermen of Puerto Bolívar have developed a deep understanding of the differences between fishing downstream in the open sea and upstream in the inner estuary. In their local waters around Puerto Bolívar, where they say depths reach around 10 meters, they cast their nets and wait for the fish to become entangled, as the vastness of the open sea means that fish are more dispersed. This method of fishing is slower, requiring more time for the catch to accumulate. However, upon moving upstream to Puerto Roma, where the waters are narrower and shallower, with depths they estimate to be of 5–6 meters, they quickly realized that fishing could be faster. The confined space of the estuary makes it easier to locate fish, allowing them to haul in their nets more quickly. This contrast in fishing conditions led the Puerto Bolívar fishers to adapt their techniques, optimizing for speed in these new, narrower waters.

The adaptation of Puerto Bolívar fishers has not gone unnoticed by their counterparts in Puerto Roma. In recent years, two distinct groups have emerged within the Puerto Roma fishing community. The first group, comprising around 25 fishers, has fully embraced the techniques they observed from Puerto Bolívar. They have adopted the same "electronic" nets and added weights to ensure the nets reach the necessary depths for catching sea bass, just as the Puerto Bolívar fishers do. When Puerto Bolívar fishers arrive in Puerto Roma, this group closely follows them, positioning themselves at a discrete distance to observe their methods. Although they have purchased plastic tubes, they do not yet recognize the sound of the croaker; therefore, they wait for the Puerto Bolívar fishers to cast their nets before they also throw their nets into the water. They also replicate the fast retrieval of the nets, a hallmark of the Puerto Bolívar fishers' upstream adaptation. In contrast, the second group, consisting of approximately 18 fishers, has chosen to remain loyal to their traditional mangrove fishing methods. They use lighter weights and maintain a slower pace, casting their green textile nets and allowing for longer waiting periods before hauling them in, adhering to the practices that have been passed down from generation to generation in the mangroves.

In Table 2 we summarize the characteristics between the three types of fisheries that we cover in this article, and we describe their consequences for the environment: the *bolicheros*, the fishers of Puerto Bolívar who have adapted their local knowledge (including the ones in Puerto Roma who imitate them), and the fishers from Puerto Roma who continue to use ancestral knowledge of the mangroves.

Table 2. Differences in the fisheries and the vessels operating in interior waters in the Gulf of Guayaquil.

Characteristic by vessel type	Open-sea semi-industrial vessels (*bolicheros*)	Artisanal vessels from the South (Puerto Bolívar; local open-sea knowledge)	Artisanal vessels from the North (Puerto Roma; mangrove-ancestral knowledge)
Ship length	100 meters (Puerto Bolívar)–200 meters (Posorja)	Mostly 7.30 meters	Between 6 and 7 meters
Detector device	Radar	Plastic tube	None
Detection of the fish shoal	Find the fish shoal using radar	Find the fish shoal by putting a plastic tube in the water and hearing the sound of the fish	Based on the tides, the application of knowledge is handed down from generation to generation by word of mouth or by observation and gesture (Crean & Symes, 1996, p. 112)
Technique	They use trawl nets for catching fish and then hoisting them up using pulleys, making the fishing process more efficient	They surround the fish with the fishing net and make a noise with the motor to force the fish to gag	They go with the boat, pull the nets, and fish in a straight line
Type of gear	Small-mesh fishing net: 0.5 inches and bigger	Medium-mesh fishing net: 3.5 inches and bigger	Large-mesh fishing net: 5 and 6 inches
Consequences of using the type of gear	Highly predatory because it catches all fish possible (including juveniles)	Catch small and bigger fish but it functions at a much smaller scale than industrial techniques	Non-predatory because it only catches bigger fish
Consequences in the seabed	The *bolicheros* fish with large nets and tend to scrape the seabed	They fish by paying attention to the depth of the different parts of the Gulf and adapt their techniques so as not to scrape the seabed	They do not fish deep and there is no risk of scraping the seabed
Dynamic of fishing	Quick removal with pulleys	Quick removal with their hands	Slow removal with their hands
Quantity caught	2,000–12,000 croakers	100–300 croakers	Up to 100 fish

5.3. The Other Side of the Coin: The Small-Scale Fisheries Conflict

During fieldwork in the waters of Puerto Roma, the first author observed a conflict between vessels caused by entangled nets, which led to a dispute over the catch. At that moment, the most important thing for the fishermen was to finish their work in that spot by continuing to search for another shoal in the waters. Amid

insults from both sides, one of them decided to take out a knife to cut the nets and take the catch. The other fisherman was left with a damaged net and expressed his frustration over the loss. The cost of repairing a fishing net depends on the damage but can range between $100 and $200 while losing one means having to purchase a new net, which can cost between $1,000 and $1,200 (sometimes they must buy a new net if it gets lost in the water with the tide).

In the information gathered during fieldwork, it was documented that, on some occasions, fishermen coming from Puerto Bolívar fired shots into the air before or during the collection of their nets, intending to deter others from approaching their catch. A common fear within the community of Puerto Roma is that criminals may infiltrate the groups of fishermen from Puerto Bolívar. The dynamics of how these criminals operate involve intimidating fishermen into handing over their catch or threatening them with weapons to force the surrender of both their catch and the engines of their boats. These situations have been documented in a newspaper article (Carrión, 2021) and are mentioned in this article as part of the narrative regarding the conflict dynamics unfolding in the Gulf of Guayaquil.

5.4. The Subtle Resistance of the Mangrove-Ancestral Fishers

Currently, in Puerto Roma, opinions about the Puerto Bolívar's practices are divided. Though the community mainly gathers crabs, fishing is crucial for some families during the closed crab seasons (February and August) as an alternative source of income. Climate variations and other factors can affect crab populations, putting pressure on fishing resources, highlighting the importance of this research in analyzing alternative and potential sources of income and conflict.

The mangrove-ancestral fishers in Puerto Roma, numbering about 18—with some of them fishing for about 40 years—use green nets with 5–6-inch mesh sizes to catch only larger fish, and they fish slowly. They describe their way of fishing as *más tranquila* (more peaceful/relaxed), indicating that they "go fishing according to the tide," and they say when Puerto Bolívar's fishers do not come for several days "there are more fish" (Participant 7, focus group). In their own words, they could rely on fishing until four years ago, before the arrival of fishers from Puerto Bolívar, now "the fishery is running out" (Participant 8, focus group). In their opinion, newcomers' boats initially caught 100–200 croakers each, depleting the fish population. Ancestral fishers believe the newcomers' smaller nets (3.5 inches) catch juvenile fish, and hence consider them "predators" who take fish that should mature over 5–6 months. They have been spectators of the fact that other people of Puerto Roma have bought the same nets as the Puerto Bolívar's fishers and now imitate their practices. However, they resist adopting these methods, believing them short-sighted:

> Because it would be thinking only for today and not for tomorrow. And those who come after us, what are they going to live on? The children, the grandchildren. Everything is coming to an end, we feel the consequences of that type of fishing, not them. (Participant 7, focus group)

Unlike the crabbers, mangrove-ancestral fishermen are not organized as a group of fishers. The Association of Crabbers has been an institution with a trajectory since 2012 when they started managing a mangrove area that was granted for stewardship and sustainability as a concession by the Ecuadorian government. As an institution, they have a management plan for the area. To comply with it and manage the institution, they charge a fee to its members. They are equipped with radios and organize guard shifts for surveillance, unlike

the ancestral fishermen. The ancestral fishermen admit that, when they are fishing and fishermen from Puerto Bolívar arrive unexpectedly, they often choose to "pick up their nets and leave" due to their fear, stating, "They stop us from working" (Participant 8, focus group). Additionally, they worry that among the groups of Puerto Bolívar fishermen, thieves may also appear to steal their belongings and may even carry weapons.

In their families, other members are dedicated also to fishing or domestic labor, selling fish in the city market, and other activities. Hence, family work is essential for their sustainability. Mangrove-ancestral fishers know fishermen from other communities who also fish ancestrally and maintain cordial relations, greeting them from their boats when they meet. Though encounters happen in an unplanned way, when they see each other, they coordinate the depth to which they will cast their nets to avoid conflict. They stated that nobody would cause damage to others if all of them cast their nets in an organized way so that they would not become entangled. Their nets are of the same size, covering 3–4 varas long. The vara is a measure of length with colonial origins, that has been adopted and adapted by fishing communities in Latin America. The vara measures approximately 0.80–0.84 meters. Its use reflects both cultural heritage and a practical adaptation to fishing practices. We write here varas and we do not change it to another metric system because it serves as the standard measure for fishers when referring to the length of their fishing nets.

In Figure 4, we illustrate in orange two trips conducted during fieldwork with the fishers from Puerto Roma (on May 22, 23, and 31, 2023), while following the Puerto Bolívar fishers. These trips involved traveling long distances and conducting fast fishing to the north (12.7 km) and to the south (18 km) in search of the shoal. In turquoise, we depict a trip with a traditional mangrove fisherman, covering shorter distances (6.7 km) and practicing slow fishing in the waters of Puerto Roma.

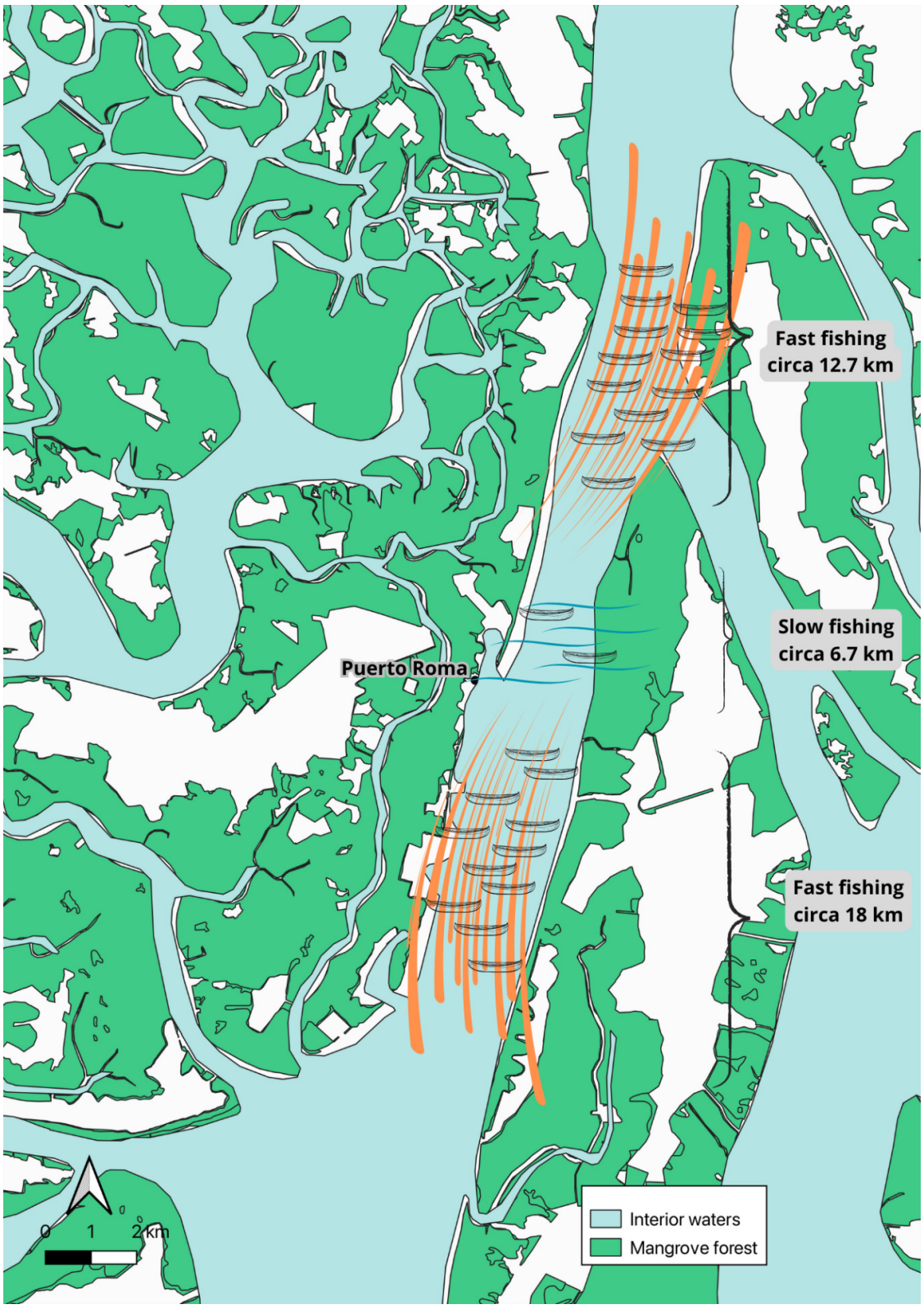

Figure 4. Zoom in on the fast and slow fishing in the Interior Central Estuary of the Gulf of Guayaquil. Note: The arrival of the southern fishers from Puerto Bolívar has caused a differentiation among the fishers of Puerto Roma. Some join the Puerto Bolívar's fishers in their quest for croakers, following them, traveling long distances up and down the Interior Central Estuary, and fishing fast (orange curves), while others continue to use mangrove-ancestral methods and slow fishing (turquoise curves).

6. Discussion and Conclusions

This study has provided substantial insights into how illegal institutional arrangements and criminal activities drive the forced displacement of fishers in the Gulf of Guayaquil. It also highlights that, despite these challenges, fishers actively contribute to epistemic mobility as they adapt to new contexts and navigate conflicts. By comparing theoretical frameworks with empirical data from fieldwork, we demonstrate how knowledge mobility is influenced by these institutional and socio-economic conditions. This understanding ultimately advances our knowledge of coastal and fisheries management dynamics.

In line with the conceptual framework's emphasis on institutional arrangements as both formal and informal practices guiding social interactions (Olivier & Schlager, 2022), our results confirm how these frameworks can breed illegal practices like corruption (Nunan et al., 2018). The illegal encroachment of industrial vessels, or *bolicheros*, into zones reserved for small-scale fishing—protected by bribery and criminal gangs—illustrates the prevalence of weak enforcement and non-compliance (Sundström, 2016). The findings of our study support the theories of Gezelius and Hauck (2011) and those of Sundström (2016) by providing further evidence that corruption and bribery within the Navy enable these illegal activities to persist, exacerbating resource conflicts and driving the displacement of artisanal fishers.

Hornidge et al. (2020) explain that epistemic mobility entails the movement and transformation of knowledge, which becomes semi-stable and adaptable across different contexts. Our study expands on this by demonstrating how displaced fishers from Puerto Bolívar carry not only their fishing techniques but also an embedded knowledge system shaped by their interactions with the open sea. When these displaced fishers migrate to upstream communities like Puerto Roma, they introduce their more advanced fishing techniques, such as the use of plastic tubes to detect sea bass shoals. However, the transfer of southern fishing techniques to the north can contribute to overfishing in their new locations. This means that, while our study highlights the role of epistemic mobility, forced displacements may complicate resource management and contribute to depletion in destination areas.

Reflecting on epistemic mobility, it is important to recognize that the movement of knowledge can encounter significant barriers and misinterpretations. In Puerto Roma, knowledge was not fully integrated but functioned through distant observation, where fishers replicated the actions of Puerto Bolívar fishers without fully understanding the techniques. This is evident in their use of plastic tubes: While Puerto Roma fishers imitated the method by placing the tube in the water and listening, they were unable to discern the sounds of the fish as the Puerto Bolívar fishers do. This demonstrates how epistemic mobility does not always result in effective learning but can lead to the adoption of techniques without mastery. Such incomplete or misunderstood knowledge aligns with Ruddle's (1994) concept of hybridized knowledge, where external methods are blended with local practices, often resulting in uneven or partial outcomes. However, as epistemic mobility is a dynamic process, it remains possible that, with more prolonged interaction and/or stronger relationships between the two communities, a deeper understanding and mastery of the techniques could develop, suggesting that this learning process is still ongoing and open to evolution.

Following the mobility paradigm (Sheller & Urry, 2006) that focuses on the movement of people, ideas, and knowledge, our study demonstrates that this mobility also generates conflicts between small-scale fishers

themselves. These conflicts, as observed in Puerto Roma, not only stem from the tension between industrial and small-scale fisheries but also arise from competition among small-scale fishers. The displacement of Puerto Bolívar fishers into Puerto Roma's waters led to entangled nets and disputes over fishing grounds, highlighting the occurrence of conflict over resources. Also, the introduction of rapid fishing techniques by Puerto Bolívar fishers has caused a differentiation in Puerto Roma between those who adopt the new methods and those who resist them.

Building on Scott's (1989) theory of everyday forms of resistance, we observe that fishers who adhere to mangrove-ancestral knowledge in Puerto Roma quietly resist the pressure to adopt new fishing techniques. These fishers prefer to maintain slower, less invasive methods, continuing to rely on traditional knowledge passed down through generations. This form of resistance underscores the socio-cultural importance of ancestral knowledge in maintaining sustainable fishing practices in the face of external pressures. The resistance to the modern methods brought by displaced fishers from Puerto Bolívar shows that epistemic mobility is not a unidirectional or uncontested process; rather, it involves adaptation, and, at times, rejection.

This research advances the body of knowledge on fisheries management and epistemic mobility by highlighting the complex relationship between corruption, displacement, and knowledge mobility. Our findings extend the work of Sheller and Urry (2006) by demonstrating how mobility involves not only the movement of fishers but also the movement and transformation of their knowledge systems, which adapt to new socio-ecological contexts. The introduction of the concept of epistemic mobility in the context of fisheries conflicts offers a fresh perspective on how knowledge flows between local communities, emphasizing the hybridization of techniques and the resulting socio-ecological implications.

More research is needed to understand how illicit and criminal activities inland affect coastal areas. We refer specifically to the corruption and bribery between the navy and the fishing industry, particularly concerning semi-industrial vessels, as illegal. The analysis of the security issue in Ecuador is complex and encompasses various factors that we were unable to address in this article. However, we can state that both those providing illegal armed protection for semi-industrial vessels and those collecting the extortion fee known as *la vacuna* are linked to criminal organizations ("Supuesta seguridad de," 2023). In Ecuador, the 22 gangs operating as organized crime have been declared "terrorists" by the current president due to their transnational nature ("Puerto Bolívar: Guerra," 2024a; "La rebelión narco," 2024; "En casi 40," 2024b). We recognize that this issue has become increasingly pronounced and widespread in Ecuador ("4 gráficos que," 2024; Insight Crime, 2023), leading to harsher penalties for criminal activities ("El código penal," 2023; "Congreso de Ecuador," 2024). Despite this, there is a significant lack of academic research on how these organizations operate and their consequences for the Ecuadorian population and coastal communities, as this issue is primarily covered in newspapers and social media.

Another area that requires exploration is the analysis of the power dynamics surrounding the industrial fishing fleet. There is a lack of easily accessible data for researchers to determine who owns these industrial vessels or whether they are controlled by oligopolies. Additionally, when reviewing fishing policies, it is imperative to take action against corruption and engage in a critical self-assessment. While discussions about industrial fishing fleets often focus on foreign vessels illegally operating within Ecuador's 200-mile territorial waters, it is important to recognize that Ecuador's national fleet operates within the eight nautical

miles designated for only artisanal fishing. Despite this, although the issue receives media coverage, it remains inadequately addressed in academic discourse and governmental action. More comprehensive efforts are needed to highlight, and tackle, this critical aspect of the Ecuadorian fishing industry.

Overall, the dynamics described here illustrate how geographic phenomena are interconnected, as the behaviors and decisions of fishers in one region directly influence the ecological and socio-economic dynamics of nearby communities. In the Gulf of Guayaquil, the proximity of these fishing communities intensifies the effects of their interactions. Consequently, the ongoing conflicts arising from industrial encroachment should be understood as part of a broader tapestry of relational dynamics, where local decisions, resource management practices, and ecological impacts are inextricably linked. This understanding emphasizes the need for holistic fisheries management strategies that consider the interconnectedness of communities and the ecological systems they rely upon, rather than viewing each community's struggles in isolation. In conclusion, this research provides a nuanced view of the dynamics of fisher displacement, knowledge mobility, and conflict within the Gulf of Guayaquil. By linking empirical findings to theoretical frameworks on institutional arrangements, epistemic mobility, and resistance, we demonstrate how systemic corruption and criminal activities exacerbate the challenges faced by small-scale fishers.

Acknowledgments

We are grateful for the support provided by the individuals interviewed and those who participated in the focus groups of this research, as well as the fishing organizations, cooperatives and associations, local NGOs, Ecuadorian Government, and the German Institute of Development and Sustainability (IDOS). We also extend our gratitude to the Ministry of Environment, Water, and Ecological Transition of Ecuador for providing the shapefiles of the Mangrove Ecosystem Sustainable Use and Custody Agreements, which were essential for producing the maps included in this study.

Funding

Funding for this research was provided by the German Academic Exchange Service (DAAD) through the EPOS scholarship for the BIGS-DR program at the Center for Development Research (ZEF) of the University of Bonn.

Conflict of Interests

The authors declare no conflict of interests.

Data Availability

The information generated during this research is highly sensitive. If detailed information is required, the first author should be contacted to review whether this affects the integrity of the individuals involved.

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