



The elusive sustainable growth: The formation of institutional socio-ecological traps in Peruvian anchoveta fisheries

Gerardo Damonte^a, Isabel Gonzales^{a,b}, Susana Higuera^{c,d,*} 

^a Pontificia Universidad Católica del Perú (PUCP), Av. Universitaria 1801, San Miguel, Lima 15088, Peru

^b École des hautes études en sciences sociales (EHESS), 54 boulevard Raspail, Paris 75006, France

^c University of Oxford, Wellington Square, Oxford OX1 2JD, UK

^d University of Birmingham, Birmingham B15 2TT, UK

ARTICLE INFO

Keywords:

Marine governance
Hybrid institutions
Industrialization
Anchoveta
Socio-ecological traps
Peru

ABSTRACT

In Peru, government agencies have set out to regulate the profitable anchoveta fishery to increase its efficiency and sustainability. Current government regulations seek to eradicate informal and illegal fishing activities and include a differentiated set of regulations for industrial and small-scale fisheries to prevent overfishing. However, overfishing continues, threatening the reproduction of the anchoveta biomass. Moreover, informal and illegal activities not only persist but are intertwined with formal practices and legal frameworks, fostering processes of institutional hybridisation. Why has the implementation of sound state regulations for sustainable fishing ended up contributing to anchoveta depredation? From a political ecology perspective, we argue that we are witnessing the formation of institutional socio-ecological traps driven by power dynamics in the context of increasing institutional hybridisation. To develop our argument, we show how legal inequalities in access to anchoveta resources foster the emergence of informal fishing practices and hybrid institutions. We then analyse how, in the context of increasing demand and institutional hybridisation, powerful extractive actors are able to circumvent restrictive policies such as quotas and vessel permits designed to prevent overfishing, leading to the exacerbation of inequalities. Methodologically, this article draws on a qualitative case study of industrial and small-scale anchoveta fishing practices and regulations in Peru.

1. Introduction

In recent decades, government agencies have set out to regulate profitable fishing activities with the aim of promoting their production and sustainability on the Peruvian Pacific coast. One such fishery is that of anchoveta, exploited by both industrial and small-scale fleets along the Peruvian coast. Anchoveta is primarily used for producing fishmeal, a commodity with an established global market. It is also sold in canned, preserved, or fresh forms for direct human consumption in local, national, and international markets.

Following pro-market policies and blue economy discourses [8], the Peruvian government has been attempting to further regulate and formalise anchoveta fisheries to foster sustainable and profitable production [22,23,42,46]. Current state regulations seek to eradicate informal and illegal fishing activities and include a differentiated set of regulations for industrial and small-scale fisheries to prevent overfishing. However, the practice continues, threatening the reproduction of

anchoveta biomass. Informal and illegal activities not only persist but also overlap with formal practices and legal frameworks, fostering processes of institutional hybridisation that, in turn, have shaped the implementation of fishing regulation. Why, then, has the implementation of sound and well-intentioned state regulations for sustainable fishing ended up contributing to anchoveta depredation?

Adopting a political ecology perspective, in this study, we contend that restrictive state regulations intended to promote sustainable growth in the context of anchoveta industrialisation have been intertwined with processes of institutional hybridisation, creating the conditions for state regulations to become institutional traps. More specifically, we argue that we are witnessing the formation of institutional socio-ecological traps driven by power dynamics in which state institutional initiatives exacerbate rather than solve sustainability problems by institutionalising informal and illegal fishing practices. To develop our argument, we show how legal inequalities in access to anchoveta resources foster the emergence of informal fishing practices and hybrid institutions. We then

* Corresponding author at: University of Oxford, Wellington Square, Oxford OX1 2JD, UK.

E-mail addresses: gdamonte@pucp.pe (G. Damonte), iegonzales@pucp.pe (I. Gonzales), susana.higuera@outlook.com (S. Higuera).

<https://doi.org/10.1016/j.marpol.2025.106657>

Received 4 January 2024; Received in revised form 10 December 2024; Accepted 19 February 2025

Available online 1 March 2025

0308-597X/© 2025 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

analyse how, in the context of increasing demand and institutional hybridisation, powerful extractive actors are able to circumvent restrictive measures designed to prevent overfishing, such as quotas and vessel permits, fostering an environment for the perpetuation of unsustainable fishing practices.

Our article aims to contribute to the literature on fisheries governance in two main ways. On the one hand, several studies have highlighted the importance of promoting interactive forms of governance [30,26]. Multilevel and adaptive governance models have been proposed to enhance institutional development and policy implementation based on different social and environmental settings [2,34]. These studies address the issue of interaction between state and non-state actors as a formal mechanism to solve problems, but the way different actors interact through formal and informal institutions in the context of hybrid forms of governance is still underdeveloped. On the other hand, most studies on socio-ecological traps follow a structural approach to explain the feedback of systemic factors that lead to undesirable social situations that result in the persistence of practices that cause environmental damage [5,9,11]. However, addressing the formation of socio-ecological traps primarily as a social and political process remains an underdeveloped topic. Our article aims to contribute to this literature by analysing the formation of an institutional socio-ecological trap in the context of institutional hybridisation from an actor-centred perspective. In doing so, we aim to understand the persistence of informal and illegal anchoveta fishing [12,24].

This article draws on a case study of the practices and regulations in Peru's anchoveta fishery. To this end, we analyse two subsectors: industrial fishing at the national level, and small-scale fishing around Pisco Bay in the southern Peruvian coast. Peru is one of the world's leading fishmeal exporters and Pisco Bay is an important site for anchoveta industrialisation, mainly for fishmeal production.

The article is divided into five parts. After this introduction, we present our methodology and the concepts of institutional hybridisation and socio-ecological traps that guide our analysis within the theoretical framework. Then we develop our case study by highlighting the processes of institutional hybridisation and formation of socio-ecological traps. Finally, we present some concluding remarks.

2. Methods

Methodologically, we followed a qualitative approach to analyse the case study of the anchoveta fishery in Peru. First, we conducted a comprehensive review of secondary sources such as public databases, media and institutional reports and archives. We then collected primary data through fieldwork carried out in Pisco in 2022, using in-depth and semi-structured interviews with 30 artisanal fishers, 10 state agents and 3 leaders of fishers' organisations. Participants were purposively selected, taking into account the criteria of participation in anchovy fishing - either through the practice of the extractive activity or through its regulation - and considering their ability to provide detailed insights into the realities of local fishing practices and markets [16,41]. Sampling followed a snowball sampling strategy, which was useful for building trust with participants, as interviews often touched on sensitive issues such as informality in fishing practices [27,31]. Initial contacts were made through government officials responsible for the management, control and monitoring of artisanal fishing activities. These were used to identify the leaders of local fishermen's organisations involved in the anchoveta fishery. Once contact was established with the leaders, they in turn facilitated the researchers' contact with their members.

In terms of the profile of the interviewees, in the case of the government officials, the majority were professionals in the fields of fisheries engineering, law and economics, with extensive experience working in the public sector in the region and specifically in the fisheries sector. In the case of the fishers and their leaders, we dealt with people of different ages (between 30 and 73 years old), among crew members, skippers and owners of vessels specialised in purse seine fishing. Due to

the peculiarities of the sexual division of labour in fishing, which is also present in the government agencies associated with this activity, almost all the informants were men. Participants were guaranteed anonymity and confidentiality during the data collection process and are referred to in the text only by their general profile and age.

Finally, our position as academics and outsiders to the fishing community provided both valuable opportunities and certain challenges in the research process. On one hand, it encouraged participants to speak candidly about sensitive topics, such as non-compliant practices. On the other hand, it limited our ability to directly observe crucial moments and locations in the illegal fishmeal value chain due to safety concerns, requiring us to rely primarily on triangulation of oral testimonies from different actors.

3. Theoretical framework

Our article draws on two main conceptual threads: institutional hybridisation and socioecological traps.

Emerging as a response to the challenges of marine governance, institutional hybridity seeks to bridge the gap between traditional institutional approaches dominated by a top-down state perspective and the complexities of today's socio-environmental problems. Recent critiques have reconceptualised governance, promoting a more inclusive view that emphasises the interconnectivity of knowledge, the diversity of actors involved, and the dynamism of institutions [13,26,30,43]. The present article corresponds to these critiques in two respects. Firstly, it underscores the importance of considering institutions as deeply rooted, embedded practices and not only as entities dominated by the state. Secondly, our analysis challenges the dominant yet oversimplified narrative in the literature that celebrates hybridity as inherently good. Drawing upon critical literature on environmental and natural resource governance [32,45,47,50], we define institutional hybridisation as a process in which state and non-state actors interact through formal and informal (even illegal) institutions that intertwine to create hybrid forms of governance that stem from dynamic power relations in extractive territories. Hybrid governance is neither normative nor residual and can also be functional for state interests [14,15]. Moreover, we define hybrid institutional entanglement as the continuum of formal, informal, and legal practices undertaken for the production and circulation of a commodity: in this case, commodities derived from resource extraction [14].

The concept of social-ecological traps, which has its roots in social-ecological systems studies (SES), is based on the feedback of factors that lead to undesirable situations such as poverty and inequality, which in turn detrimentally impact ecosystems through actions such as the overexploitation of resources [5,9,11,48] (Kittinger et al., 2003). This concept, deeply rooted in studies on the role of institutions in resource governance - as proposed by Ostrom [38,39] and further developed by authors such as Berkes et al. [3] - in the framework of socio-ecological systems (SES), offers an interdisciplinary perspective that seeks to link the complex dynamics of ecosystems to institutional structures and mechanisms.

Unlike the primarily structural view that dominates the literature on SES, our work adopts a practice-centred perspective [36,37]. Specifically, we are concerned with the relationship between formal norms and non-formal social practices, or practical norms that do not conform to, and even contradict, official norms [51] when analysing the emergence of socio-ecological traps. While moving away from traditional structural definitions of socio-ecological traps, we maintain that entrenched practices can generate similar challenges such as environmental degradation and the reproduction of social inequalities.

Moreover, this article adopts a political perspective on traps, an often overlooked aspect of the socio-ecological systems literature [19]. We draw on the political ecology framework to emphasise the power dynamics embedded in institutions, which often compromise the efficient management of resources [21,44]. We agree with Mansfield's [33]

criticism of the Malthusian explanation of overfishing, which tends to attribute the problem to population growth and its consequent increase in demand for marine resources. Rather, Mansfield argues that the phenomenon is not merely an ecological consequence but a byproduct of the "industrialization of fisheries for economic development" (p. 84) and the resulting power relations that determine production and consumption in the fishing industry.

Our narrative conceives overfishing as a political process in which a perspective of nature is imposed on how and by whom it is controlled and whom it benefits [40]. In this view, overfishing is not an inevitable byproduct of increased demand or an unbalanced ecosystem but a politically induced phenomenon [6,18,33]. Power dynamics shape these practices, dictating who benefits and who controls resources, thus perpetuating and intensifying social-ecological traps. We contribute to the literature on socio-ecological traps by showing how institutional hybridisation facilitates the reproduction of socioecological traps by reproducing power inequalities between fishing groups and sectors in the context of fishing industrialisation.

In our exploration of institutional hybridity, we argue that hybridity, despite emerging as a coping mechanism for prevailing challenges, paradoxically tends to exacerbate the very dilemmas it is intended to counteract. The traps, central to this discourse, are not mere obstacles; they are institutionalised practices that some actors can strategically co-opt to their advantage. The political ecology framework is essential for discerning the power dynamics inherent in marine governance and its consequent repercussions, especially when it comes to addressing challenges such as overfishing. Yet this paper challenges the notion that dominant actors simply bypass the smallest. Instead, we highlight the intricate processes of hybridity – a process that, far from being linear, can lead to unpredictable outcomes.

4. Case study: anchoveta industrialisation process (1990–2022)

The Peruvian anchoveta (*Engraulis ringens*) is a small, short-lived, fast-growing pelagic species distributed along the western coast of South America. The Peruvian anchoveta fishery emerged in the early 1950s, and after the collapse of the Californian anchoveta fishery went on to become one of the biggest in the world in terms of landings. After anchoveta stocks decreased from the 1970s due to the El Niño phenomenon as well as overexploitation, populations started to recover in the early 1990s, giving the industry new opportunities for development [2]. With average production values of up to 5.5 million tons for the period 2005–2014 (total average production over the same period was 6.4 million tons), Peru's anchoveta fishery currently ranks as the second biggest in the world [20].

In Peru, anchoveta is the target species of two legally demarcated and distinct fleets: the primary industrial fleet, which operates vessels with a capacity of more than 32.6 cubic meters and uses modern fishing equipment; and the artisanal or small-scale fleet, which operates vessels with a capacity of less than 32.6 cubic meters and mainly relies on manual labour. The 1992 General Fisheries Law (GFL) and its regulations stipulate that the industrial fleet has the exclusive right to catch fish for indirect human consumption (IHC) – that is, for the production of fishmeal and fish oils – while the artisanal and small-scale fleet is only allowed to catch fish for direct human consumption (DHC). We will now analyse the performance of each fleet in terms of the sustainability of anchoveta stocks since the 1990s.

4.1. Anchoveta industrial fleet

The 1990s was a period of sectorial recapitalisation characterised by a large investment in new fleets, increasing the carrying capacity of existing vessels and modernising vessels and equipment [42]. These investments were financed through loans, leases, and debts to suppliers, while larger companies turned to bond issues in the domestic and foreign markets ([25], p. 19).

In 1992, the state passed the GFL. This law sought to tackle the excessive size of industrial fishing – one of the persistent problems associated with the subsector – by imposing restrictions on the expansion of the fleet and processing plants ([42], p. 13) and formalising around 80 companies involved in the production of fishmeal and fish oil ([10], p. 11).

In 1997–1998 an El Niño phenomenon slowed the growth of the anchoveta fishery. Throughout the phenomenon, the warming of the ocean temperature prompted the species to migrate further south in search of colder waters. The resultant absence of anchoveta in traditional fishing grounds led to the bankruptcy of several companies in the industrial sector, laying bare the unsustainability of the growth model [25].

This crisis, and the species' return to abundance after the phenomenon came to an end, triggered dramatic changes for the anchoveta industry. First, there was a restructuring of the economic actors involved. The state and the private sector took advantage of the crisis by implementing a program to reduce the industrial fleet by financing the decommissioning and scrapping of vessels and processing plants deemed extraneous [42]. This triggered a process of increasing concentration of the means of production in which, by 2013, seven companies controlled 70 % of Peru's production of fishmeal and fish oil through ownership of both vessels and processing plants [42]. By 2017, 71 % of the business was controlled by just four companies: Tecnología de Alimentos SA (TASA), Hayduk, Pesquera Diamante and CFG Investments.¹ At the end of 2000s, the fishmeal market rocketed, pushing up anchoveta extraction (Fig. 1: Price). However, state regulations had proven ineffective in regulating the anchoveta fishing sector.

Second, there was a general increase in anchoveta landings and fishmeal production, despite the limits that the GFL placed on the number of vessels and on overall quotas for anchoveta fishing and processing ([42], p. 13). In addition, vessels at the upper capacity limit of the small-scale category began to concentrate on fishing anchoveta and other species for IHC. Dubbed "vikingos", these independently owned boats grew in size and carrying capacity following the recovery of the anchoveta biomass and became part of the industrial fishing fleet, but with their own characteristics. The vessels have a hold capacity of between 32.6 and 110 cubic meters yet unlike those traditionally pertaining to the industrial category, they are wooden, lack efficient refrigeration systems, and, as they are not part of an integrated system of vessel and plant ownership, can sell their catch to the processing plants that offer the best prices for raw materials – including those owned by companies with boats of their own.

4.1.1. Increasing anchoveta catch by small-scale fleet in the Pisco Bay

In the early 1990s, most fishers in Pisco used boats of between 4 and 6 tons in hold capacity. "Pinta" and gillnet fishing were the predominant types of fishing gear used, in addition to freediving and diving with compressors. Fishers tended to engage in multi-species fishing (for bonito, horse mackerel, silverside, and others). However, there was one group that concentrated primarily on sardine fishing using gillnet nets around the Pisco and Paracas Bays. The catch was destined for sale in canned and preserved form, with factories in San Andres and Tambo de Mora in the department of Ica as their main buyers.

Around 1995, sardine stocks began to vanish from the Pisco and Paracas Bays while anchoveta reappeared, taking their place [7]. This change in biomass triggered significant changes in small-scale fishing activities in the bay. First, catches were reoriented towards the anchoveta market. Long-established fishers and businesses as well as newcomers saw the sudden abundance of this species as an opportunity to re-orient their businesses towards the production of anchovetas for export to European countries. Second, there were innovations in the

¹ <https://ojo-publico.com/480/la-concentracion-del-circulo-pesquero-en-el-peru>

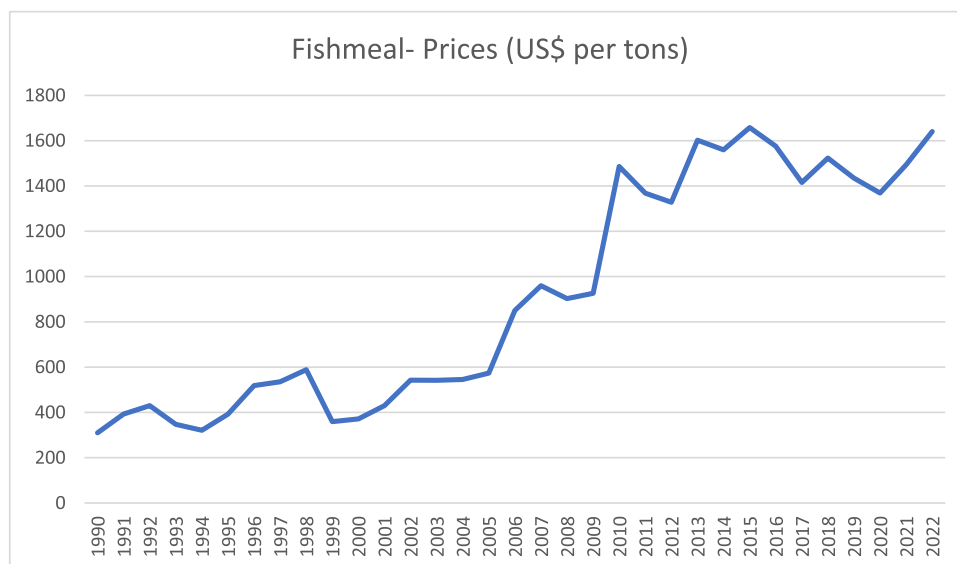


Fig. 1. Fishmeal global market prices in US\$ Tons. (1990–2022). Source: BCRP.²¹.

fishing gear used. The traditional gillnet net fishing, which works by trapping the fish by their gills, mistreated the fish and generated too much waste. Therefore, a group of local fishers opted to replicate a purse seine net (known as *boliches*) to scale using an unused silverside net. This experiment was successful, and soon others began to adopt the same method. Third, the gradual increase in both the number of vessels and their storage capacity enabled more and larger catches. The vessels, with their purse seine nets and increased storage capacity, started to become known as *bolichitos* (“little purse seiners”), while their owners stood out as an emerging new group of fishers. By 2000 *bolichito* vessels had grown in capacity, yet the larger ones remained at the limit of 7–8 tons of hold capacity while the overall number of vessels, though growing steadily, was still below 20. Notably, the state did not regulate the number of small-scale vessels at this time.

In the small-scale subsector, buoyant demand and abundant stocks sparked a process of mass migration from other fisheries to anchoveta, with operators taking out personal loans or selling assets to reorient their activity. Fishers were able to ensure a steady flow of good quality fish for processing, while relationships between traders/processors and fishers were sustained and even close. Following a common pattern throughout the fishing sector, traders acted as enablers and lenders, facilitating the technological transformation of their suppliers.

The small-scale subsector was able to participate to a marginal degree in the formal production of fishmeal by processing waste (fish not fit for human consumption) and discards (such as bait and bycatch) that remain after canning or preservation. According to law, only waste and discards from small-scale fishing were authorised to be received by the meal production plants to produce fishmeal. However, in the context of rising demand and prices in the IHC market, small-scale fishers started to provide anchoveta for IDH, integrating their production into the fishmeal value chain by selling their catch to industrial vessels or processing plants [15]. This boosted production flows, but it also triggered conflicts between the industrial and small-scale subsectors.

5. Results and discussion

5.1. New regulations and illegality in the anchoveta fishery

State regulation of the anchoveta sector was based on two pillars: the prohibition of new vessels and a quota system. In 1996 anchoveta was declared a “fully exploited resource” and a register of authorised vessels was created in order to close off access to new vessels (D.S 001–97-PE).

However, this nominally closed list was reopened several times to incorporate newly built *vikingo* boats, whose owners negotiated with the state in order to gain legal authorisation to fish. For example, in 1998, Law 26920 was passed, which exempted wooden vessels of up to 110 cubic meters from acquiring fishing permits. At a stroke, this measure formalised approximately 600 vessels until then operating illegally.³

The quota system was the other main legal instrument through which the anchoveta fishery was regulated. Under the new regulations introduced in the 1990s, the industrial fleet was governed by an overall quota (total catch allocation – TCA), but without any other restriction. In 2008, the TCA system was complemented by an individual vessel quota system for IHC anchoveta, which established a maximum catch per vessel based on the overall quota and the number of authorised industrial vessels. This approach differed from Total Quota systems in that the rights could not be bought and sold directly. However, the fact that quotas could be accumulated by vessel owners made them transferable through the purchase and sale of vessels. This provided the basis for less efficient operations to cease and the profitability of the remaining fleet to increase ([42], p. 13).

In addition to these regulations, there are also those aimed at controlling and enforcing fishery management rules related to closed fishing periods and minimum specimen sizes (12 centimetres). Until 2016, the Ministry of Production had the power to sanction vessels whose catch included juvenile fish in proportions exceeding 10 percent, and to preventively close fishing areas. This created incentives for skippers to illegally discard fish at sea when they detected a high presence of juveniles – a situation that was used as an argument in favour of amending the regulations to remove sanctions for vessels that exceeded the permitted limit of juvenile fish as long as they reported in a timely manner the area from which the fish had been taken. This measure was ultimately adopted (DS024) and despite much criticism [17] around its formalisation of irregular practices in the anchoveta industry, the National Society of Fishing, which represents industrial fishing interests, continues to defend its effectiveness.

In 2005, amid ecological concerns within the five-mile limit for small-scale fishing, the state resorted to prohibiting the construction of new small-scale vessels and the issuance of new fishing permits. The construction ban started with the largest vessels – those with hold

³ <https://peru.oceana.org/es/blog/claves-para-entender-el-manejo-de-la-pesqueria-de-anchoveta>

capacities of more than ten tons – and over time was extended to those of lower tonnage. Subsequently, from 2016 to the present, these norms would be supported by additional vessel formalisation processes and strengthened sanctions. For instance, since 2018 fishing from an unauthorised vessel is considered a criminal act punishable by law.

As with the industrial fleet, in 2011 the state drew up a register of small-scale vessels authorised to fish anchoveta intended for DHC. Then in 2017, as part of the Fisheries Management Regulation (FMR), the state established a quota for the small-scale fleet for the first time. Under this new measure, the multi-species fishing permit granted to small-scale fishers in 1992 no longer included anchoveta; to target this species for the DHC market, fishers would have to obtain a special permit. And because this provision restricts the small-scale subsector to DHC, it excludes these fishers from the fishmeal and fish-oil processing markets.

Despite these regulations, many small-scale fishers have prepared their vessels to supply the profitable fishmeal market by increasing their capacity, incorporating upgrades such as higher-powered engines, and adopting fishing conservation mechanisms.

According to the Organisation of Artisanal *Bolichitos*, when the registers of vessels for the implementation of anchoveta quotas for DHC were prepared, around 53 boats obtained a fishing permit and the list was closed. Currently, however, there are approximately 150 *bolichito* vessels with a capacity of around 10 tons. Yet unlike the industrial subsector the *bolichitos* lacked the political clout to persuade the state to reopen the register, which means that this illegal growth has never been legalised.

Thus, the small-scale sector has been increasingly involved in the production of anchoveta for the fishmeal market through different formal and informal mechanisms [15]. The small-scale fishers justify these actions by arguing that there is no technical or biological basis for their exclusion from the fishmeal business. At the same time these *bolichitos* demand legal authorisation to participate in the fishmeal industry, calling upon the state to allocate an IHC anchoveta quota for the small-scale fleet. As one fisher pointed out:

[...] the big fish eat the small fish, that's what has happened with us. The industrial companies were given a bigger quota, they have bigger vessels, and they take everything. They give us a small amount of quotas. If we had the companies, they would all be involved in direct human consumption. And there wouldn't be so many informal factories. That's why we are like this, seriously. If we were all formal, the companies would pay taxes to the state, and we would be able to give education to our children, to our people. (Fisher, 58 years old)

Far from preventing overfishing, the regulations have created conditions for the growth of informal and illegal practices, particularly in the small-scale sector. Under current legislation, the industrial subsector enjoys dominant and exclusive participation in the profitable fishmeal market. In addition, these actors have sufficient lobbying power to ensure that the state adjusts the law or establishes exceptions in line with their interests.

Against this backdrop, the Peruvian Ministry of Production (PRODUCE) took particular interest in repressing illegal fish processing activities, shutting down several formal fishmeal plants found to be processing whole fish in good condition through 2017 and 2018. With the closure of these plants, which had accepted anchoveta from small-scale landings, the small-scale fishers turned to informal fishmeal factories and "pampas de secado" – "drying pampas", places where anchoveta is dried in the sun to produce fishmeal in an artisanal way. Ultimately, the only available buyers were the illegal fishmeal plants and "pampas de secado" that survived the short-lived regulatory push by the state. According to calculations by the NGO OCEANA in 2018 [24],

there were 10 fishmeal production plants and 10 "pampas de secado" in the Pisco area alone.

In the end, even fishers with permits to fish anchoveta for the DHC market have found it difficult to operate formally. One of the conditions for placing their products in existing markets for human consumption was that each landed specimen be at least 14 centimetres in length; nonetheless, over the last seven years, fishers have identified a sustained decline in anchoveta sizes within the Pisco and Paracas Bays. While at the start of the 2000s specimens of between 18 and 20 centimetres were readily available, they now barely reach 12 cm – the minimum size established by law. To compound matters, the anchoveta began to disperse. Whereas previously the anchoveta could be found in throughout the year in the two bays, increasingly their presence came to be limited to the winter months. The causes of this change are still unclear. In the words of two fishers:

I have a friend who has his own boat, he has his fishing permit. As I said, there are very few who have a permit to fish anchoveta. He even goes out with ice. But he doesn't fish because the anchoveta are small, it stops him from fishing. They can't be adapted to canning; they are too small. (*bolichito* fisher, 33 years old).

The fish banks of Isla Chincha, San Gallán, Independencia, there were schools of jack mackerel and mackerel that the small-scale fishers could go after in winter, but not anymore. There used to be a season, people used to go to Marcona, Loma, Chala where there was a jack mackerel and mackerel season, but now there are no more. This central coast no longer has them in the winter season. The only stock in winter is anchoveta. But there is no anchoveta anymore. All those species that I was able to fish before are also disappearing, they are changing. That's how it is, there are no longer as many as there used to be, now there are very few. (*bolichito* fisher, 51 years old)

The small-scale fishers who operated illegally by supplying anchoveta for IHC realised that possessing DHC anchoveta fishing permits was a liability because it made it easier for the regulatory agency to identify and sanction them through destruction of their fishing gear and vessels or even imprisonment for illegal fishing. Many finally got rid of their fishing permits, selling them for prices ranging from US\$120,000 to US\$150,000. The main buyers are owners of vessels built after the ban who fish further offshore in bays where anchoveta of the permitted size for DHC can still be found in abundance, such as Chimbote Bay on the north-central coast of Peru. At present, only about 15 of the 53 fishers in Pisco who obtained anchoveta permits for DHC still have them.

5.2. Institutional hybridisation processes and persistent overfishing as a socioecological trap

The expansion of anchoveta fishing and the enactment of new regulations led to the development of hybrid institutional entanglements. In the industrial subsector, which is considered highly formalised, the state has adapted its regulations to suit the fleet's activities to ensure that these actors are brought onto the right side of the law. The legalisation of the *vikingo* boats and the fact that industrial vessels can now keep juvenile catch if they declare the grounds from where they were fished are examples of how the state adapts regulation to the institutionalised practices of industrial fishing. Thus, large companies and independent operators are able to maintain their fishing activities, carrying out some legal and some illegal practices as an example of hybrid institutional entanglements [14]. Indeed, they can even expect the state to legalise some of their illegal fishing practices.

Institutional hybridisation processes have also unfolded in the small-scale sector. In our case, *bolichito* fishers seek to participate in the profitable fishmeal market against regulatory restrictions, leading this group to engage increasingly in illegal fishing practices. The rise in the number and fishing capacity of formal (licensed) and informal

² <https://estadisticas.bcrp.gob.pe/estadisticas/series/anuales/resultados/PM05419BA/html>

(unlicensed) vessels despite the nominal ban on the entry of new small-scale vessels is an example of regulatory failure and the institutionalisation of informal and illegal practices in the context of the anchoveta boom. Moreover, the fact that formally registered vessels with permits to fish anchoveta for the DHC market are illegally misrouting their catch to formal and informal processing plants for the IHC markets is another example of a hybrid institutional entanglement.

Institutional hybridisation has created opportunities for the emergence and consolidation of powerful social actors: the industrial fishing companies, as well as the industrial *vikingo* and the small-scale *bolichito* vessel owners. On the one hand, the few companies that control the industrial fleet, as a result of the subsector's economic restructuring following the 1997–1998 El Niño, commercialise their anchoveta catch in the IHD market, mainly for the production of fishmeal. These actors have increased their economic benefits and capital thanks to the abundance of anchoveta stocks and increasing market prices (see Fig. 1). The companies have also increased their political capital due to Peru's economic dependence on fishmeal exports. Today, industrial fishing companies and independent vessel owners wield considerable political influence. Indeed, some of their representatives have occupied state ministries.⁴

As for the *bolichitos* fishers' group, they emerged as a group in the mid-1990s when anchoveta replaced sardines as the main resource in the bay. In the last decades, the *Bolichitos* have multiplied, taking advantage of small-scale anchoveta profitable fishing both formally to DHC markets and, mainly, informally to IHC markets. Currently, this group of fishermen has a central economic role in the Pisco bay in terms of employment and consumption, as well as a significant political influence in territorial terms. The constitution of the *bolichito* fishermen as a local economic power, and the fact that their wealth is mainly derived from illegal fishing activities, distinguishes them from other artisanal and small-scale fishing groups in the bay. They want their practices to be legalised in order to consolidate their power, so they tend to negotiate with state representatives some legal changes or exemptions in the application of current regulations, promoting institutional hybridisation processes. Thus, in this case, institutional hybridisation unfolds by social actors approaching the state rather than distancing themselves from it.

The state authorities are in constant dialogue with the *bolichitos*' owners to avoid social unrest in the bay. As a *bolichito* fisher asserts:

Artisanal fishing is not just any old thing; it is a very labour-intensive business. We call it the value chain. From the moment we go out to work, the taxi that picks us up, we give him work, he takes us to the landing site. From the moment we go out to work there are already seven of us working. When we come back we give work to the "bodegueros" (workers at the landing site), to the transporters, and when it he goes to the processing plants it gives him a lot of work, they're the ones who cut up the fish. And that's where we are adding value to the chain. (*Bolichito* fisher, 56 years old)

Importantly, the industrial and small-scale fishers have consolidated their dominant economic position through a combination of legal, informal, and illegal fishing activities, regardless of restrictive government regulations. This situation is undoubtedly related to problems of state enforcement due to a lack of adequate technical and financial resources, but it is primarily the result of a political negotiation process between state regulators and these actors with their varying degrees of power.

In this context, the state has resorted to bargaining away its

regulatory presence. On the one hand, the regulatory body for industrial fishing negotiates laws and legal amendments directly with the fishers and their representatives from the National Fisheries Society. On the other hand, at the regional scale, it has repeatedly reached accommodations with fishers to avoid social unrest.

In particular, the state implementation of regulatory and repressive measures against illegal practices is often mediated through formal and informal agreements at the local level. These agreements reveal the interdependence between the state and powerful actors in the area. While fishers seek to avoid direct confrontation with state authority, state officials seek to avoid conflict with local powerful actors. Through formal and informal agreements, state officials recognise the reproduction of non-legal practices, while fishers accept state authority. This is a way of avoiding social conflict by recognising institutional hybridisation.

Thus, power relations and negotiations at the central and local state levels define regulatory measures, their implementation, and the level of compliance. Ultimately, the different state agencies act as other social actors, negotiating their legitimacy to decide and to act. Thus, these agencies accept and participate in the reproduction of institutional hybridisation as a way to achieve sufficient legitimacy to establish their regulatory presence.

In this context, state governance initiatives for sustainable growth are trapped. In an example of a politically induced socio-ecological trap, the Peruvian government negotiated the design and implementation of anchoveta fishing regulations to avoid overfishing with the very fishermen who control anchoveta fishing and benefit from informal and illegal fishing practices. Institutional hybridisation shapes the formation of the trap at two levels.

At the macro level, state policies to increase production, modernisation processes such as the adoption of new technologies, and the scale of production and consumption have ensured the increase of fishing activities, especially industrial fishing [52]. The economic mandate for extractive growth hinders the implementation of institutional initiatives for sustainable development. Peruvian governments seek to maximise their exports, even if they come from informal or illegal extractive activities, as long as they generate state revenues. The fact that illegally fished anchoveta can enter formal global markets through this commodity value chain [15] and the gap between formal and total fishmeal exports in official statistics are just two examples of this situation.

At the micro level, the causes of the failure to prevent overfishing in the context of extractive expansion are found in the political sphere, at the level of government decisions and the way in which state agencies relate to local actors. Quota and permit regulations create inequalities between groups of fishers, favouring the economically and politically strongest (industrial companies and entrepreneurs as well as emerging groups such as *bolichito* fishers), who also happen to be those most responsible for overfishing, over other groups. This is because regulatory policies benefit larger, better equipped vessels that can catch anchoveta more rapidly and in greater volumes for the global market, boosting national exports. Thus, there arises a dynamic of exclusion of these same artisanal groups from the anchoveta boom.

Institutional hybridisation has also facilitated this process, allowing industrial entrepreneurs and *bolichito* boat owners, among other wealthy fishers, to evade strict enforcement of quota limits and other restrictions, such as the minimum anchoveta catch sizes, by institutionalising informal and illegal practices. As a result, overfishing continues to threaten the ecosystem and the reproduction of the species. Thus, it is the balance of power that explains the production and reproduction of institutional socio-ecological traps.

6. Conclusions

As in other parts of the world, the Peruvian state has promoted the industrialisation of fishing since the 1990s, following neoliberal paradigms in the context of global market liberalisation [18,28,40]. In order

⁴ <https://elfoco.pe/2023/04/reportajes/los-clientes-negocios-y-amigos-de-cayetana-aljovin>/<https://www.actualidadambiental.pe/wp-content/uploads/2017/08/La-Republica-07-08-2017A.pdf><https://pescayacuiculturaperu.wordpress.com/tag/puertas-giratorias/>

to avoid cycles of overfishing and depletion of anchoveta stocks, the state enacted new regulatory laws aimed at making the growth of the sector sustainable. However, state intervention not only failed to prevent overfishing but also created the conditions for the reproduction of unsustainable fishing practices, configuring socio-ecological traps.

The causes behind these institutional socio-ecological traps in our case study are mainly political. Paradoxically, government policies aimed at sustainable anchoveta industrialisation have ended up empowering the extractive agents who are the main perpetrators of overfishing. Industrial entrepreneurs have consolidated their economic and political power, while the *bolichito* fishers have risen to prominence within the small-scale subsector in the context of a boom in anchoveta fishing, thanks to their ability to rapidly increase their production capacity while negotiating the implementation of regulations with state authorities. Those who embraced economic rationality and learned to play by the rules of the market outcompeted the more traditional and artisanal groups who did not share in the economic benefits of the boom [40]. Interestingly, power inequalities exist not only between the industrial and small-scale subsectors [33] but also within different small-scale fishing groups. Overfishing is thus linked to a dynamic political balance of power between fishing subsectors and groups.

In turn, institutional hybridisation processes have shaped the (re) production of the socio-ecological trap of overfishing in two ways. On the one hand, the institutionalisation of hybrid institutional entanglements, including informal and illegal fishing practices, has facilitated the economic accumulation of key extractive actors. On the other hand, the reproduction of hybrid institutional entanglements has prefigured hybrid forms of governance. Thus, informal and illegal institutionalised practices are beyond state regulatory structures, but they are not outside the state realm. As Kooiman and Bavinck [30] argue, it is the interaction between state and non-state actors that defines governance. Nevertheless, we show that this interaction does not necessarily lead to cooperation to solve governance problems, but to the institutionalisation of formal-informal-illegal entanglements through which power inequalities are produced and reproduced.

How can we avoid the formation of institutional social-ecological traps? Our study points to a twofold answer. On the one hand, Peruvian government agencies must develop more inclusive policies to democratize access to marine resources. While fishers can participate in institutional spaces, they only serve as consultative forums. Our findings show that fishers, especially those who lack economic and political power, need to take part in binding decision-making processes and marine knowledge discussions with state agencies like PRODUCE and Marine Institute of Peru (IMARPE). The current system of allocating fishing resources, despite its formal procedures, creates unequal opportunities for different fishing groups. Decision-makers operate without transparent criteria or processes. The public cannot understand how and why decisions emerge because both formal and informal agreements about resource allocation remain hidden.

On the other hand, while Peru maintains strict regulatory frameworks, it fails to enforce them, particularly when dealing with economically powerful actors. Authorities rarely collect or enforce fines for catching juvenile fish or fishing in restricted areas. This selective enforcement tilts the balance of power further and reinforces existing inequalities. The quota system might continue as a cornerstone of fisheries management, but authorities must enforce restrictive regulations consistently across all actors to prevent resource depletion, even when this enforcement could slow economic growth.

Funding

This manuscript was partially prepared as part of the bilateral project 'Alternative futures of the Northern Humboldt Current upwelling system under Shared Socioeconomic Pathways', (Humboldt Tipping, <https://humboldt-tipping.org/>) funded by the Federal Ministry of Education and Research (BMBF).

CRedit authorship contribution statement

Higuera Susana: Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Conceptualization. **Gonzales Isabel:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Damonte Gerardo:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Acknowledgements

All authors would like to express their deepest gratitude to all people who have taken their time to talk with us in relation to this research.

Data availability

Data will be made available on request.

References

- [2] M. Arias-Shreiber, The evolution of legal instruments and the sustainability of the Peruvian anchoveta fishery, *Mar. Policy* 36 (2012) 78–89, <https://doi.org/10.1016/j.marpol.2011.03.010>.
- [3] F. Berkes, C. Folke, J. Colding, *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*, Cambridge University Press, 1998.
- [5] W.J. Boonstra, F.W. de Boer, The historical dynamics of social–ecological traps, *AMBIO* 43 (3) (2014) 260–274, <https://doi.org/10.1007/s13280-013-0419-1>.
- [6] P. Bresnahan, The (slow) tragedy of improvement: neoliberalism, fisheries management & the institutional commons', *World Dev.* 120 (2019) 210–220, <https://doi.org/10.1016/j.worlddev.2017.09.017>.
- [7] G. Cárdenas-Quintana, M. Franco-Meléndez, J. Salcedo-Rodríguez, D. Ulloa-Espejo, J. Pellón-Farfán, The Peruvian sardine, *Sardinops sagax*: Historical analysis of the fishery (1978–2005), *Cienc. Mar.* 41 (3) (2015) 203–216, <https://doi.org/10.7773/cm.v41i3.2466>.
- [8] L. Cavelari, Baffling shades of blue: addressing the impacts of the blue economy on small-scale fisheries in Latin America, *Int. Collect. Support Fish.* (2022).
- [9] S.R. Carpenter, W.A. Brock, Adaptive capacity and traps, *Ecol. Soc.* 13 (2) (2008) 40, <http://www.ecologyandsociety.org/vol13/iss2/art40/>.
- [10] Comisión Investigadora de Delitos Económicos y Financieros 1990-2001, *Informe final de la investigación*, Congreso de la República, Lima, 2002.
- [11] J.E. Cinner, Social-ecological traps in reef fisheries, *Glob. Environ. Change* 21 (3) (2011) 835–839.
- [12] M. Dağtekin, A.C. Gücü, Y. Genç, Concerns about illegal, unreported and unregulated fishing, carbon footprint, and the impact of fuel subsidy—an economic analysis of the Black Sea anchovy fishery, *Mar. Policy* 140 (2022) 105067, <https://doi.org/10.1016/j.marpol.2022.105067>.
- [13] K. Dalton, M. Skrobo, H. Bell, B. Kantner, D. Berndtson, L.C. Gerhardinger, P. Christie, Marine-related learning networks: shifting the paradigm toward collaborative ocean governance, *Front. Mar. Sci.* 7 (2020) 595054, <https://doi.org/10.3389/fmars.2020.595054>.
- [14] G. Damonte, Hybrid Institutions: Institutionalizing practices in the context of extractive expansion, in: G. Damonte, B. Schorr (Eds.), *Andean States and the Resource Curse: Institutional Change in Extractive Economies*, Routledge, New York, 2021, pp. 88–103, <https://doi.org/10.4324/9781003179559-7>.
- [15] G.H. Damonte, L.C. Kluger, I.E. Gonzales, Intertwined realities—hybrid institutions in the Peruvian fisheries and aquaculture sectors, *Marit. Stud.* 22 (2) (2023) 20, <https://doi.org/10.1007/s40152-023-00309-1>.
- [16] N. Emmel, *Sampling and Choosing Cases in Qualitative Research: A Realist Approach*, SAGE Publications Ltd, 2013, <https://doi.org/10.4135/9781473913882>.
- [17] G. Englander, Information and Spillovers from Targeting Policy in Peru's Anchoveta Fishery, *Am. Econ. J. Econ. Policy* 15 (4) (2023) 390–427, <https://doi.org/10.1257/pol.20210812>.
- [18] E. Eythórsson, A decade of ITQ-management in Icelandic fisheries: Consolidation without consensus, *Mar. Policy* 24 (6) (2000) 483–492, [https://doi.org/10.1016/S0308-597X\(00\)00021-X](https://doi.org/10.1016/S0308-597X(00)00021-X).
- [19] M. Fabinji, L. Evans, S.J. Foale, Social-ecological systems, social diversity, and power: insights from anthropology and political ecology, *Ecol. Soc.* 19 (4) (2014) 28, <https://doi.org/10.5751/ES-07029-190428>.
- [20] Food and Agriculture Organization (FAO), 2020. The State of World Fisheries and Aquaculture 2020: Sustainability in Action. Rome. <http://doi.org/10.4060/ca9229en>.
- [21] E.M. Finkbeiner, N.J. Bennett, T.H. Frawley, J.G. Mason, D.K. Briscoe, C.M. Brooks, L.B. Crowder, Reconstructing overfishing: moving beyond Malthus for effective and equitable solutions, *Fish Fish* 18 (2017) 1180–1191.
- [22] M. Garteizgogea, I.E. Gonzales, L.C. Kluger, G. Damonte, M. Flitner, Institutional context and governance of Peruvian fisheries and aquaculture, *Artec-*

- Pap. Nr 226 (2020) https://www.uni-bremen.de/fileadmin/user_upload/sites/artec/Publikationen/artec_Paper/226_paper.pdf. Accessed 20 November 2021.
- [23] R. González, Auge y crisis: la pesquería de la concha de abanico (*Argopecten purpuratus*) en la región Pisco-Paracas, costa sur del Perú, *Espac. Y. Desarro.* 22 (2010) 25–51.
- [24] J. Grillo, R.G. Wuest, J. Sueiro, Jc Riveros, Producción ilegal de harina de pescado en Perú a partir de anchoveta extraída por la flota artesanal y de menor escala, 2019, 10.13140/RG.2.2.18562.53448/1.
- [25] Hidalgo, J.. Cuotas individuales de pesca: Propuesta de política para la eficiencia pesquera y la conservación de los recursos hidrobiológicos (1. ed). Sociedad Peruana de Derecho Ambiental, 2002.
- [26] S. Jentoft, R. Chuenpagdee, Interactive learning and governance transformation for securing blue justice for small-scale fisheries, *Adm. Soc.* 54 (7) (2022) 1255–1282, <https://doi.org/10.1177/00953997211073947>.
- [27] C.D. Kaplan, D. Korf, C. Sterk, Temporal and social contexts of heroin-using populations: an illustration of the snowball sampling technique, *J. Nerv. Ment. Dis.* 175 (1987) 566–574.
- [28] A. Karlsdóttir, Not sure about the shore! Transformation effects of individual transferable quotas on Iceland's fishing economy and communities, *Enclosing Fish. People, Places Power* 68 (2008) 99–117.
- [30] J. Kooiman, M. Bavinck, Theorizing governability – the interactive governance perspective, in: In.M. Bavinck, R. Chuenpagdee, S. Jentoft, J. Kooiman (Eds.), *Governability of Fisheries and Aquaculture*, 7, Springer Netherlands, 2013, pp. 9–30, https://doi.org/10.1007/978-94-007-6107-0_2.
- [31] R.M. Lee, *Doing Research on Sensitive Topics*, Sage Publications, London, 1993.
- [32] M.C. Lemos, A. Agrawal, Environmental governance, *Annu. Rev. Environ. Resour.* 31 (1) (2006) 297–325, <https://doi.org/10.1146/annurev.energy.31.042605.135621>.
- [33] B. Mansfield, Modern industrial fisheries and the crisis of overfishing, in: In. R. Peet, P. Robbins, M. Watts (Eds.), *Global Political Ecology*, 1st ed., Routledge, London, 2011, pp. 84–99.
- [34] Luca Mulazzani, Richard Curtin, Marga Andrés, Giulio Malorgio, Multilevel governance and management of shared stocks with integrated markets: The European Anchovy Case, *Mar. Policy* 38 (2013) 407–416, <https://doi.org/10.1016/j.marpol.2012.06.020>.
- [36] S.B. Ortner, Theory in anthropology since the sixties, *Comp. Stud. Soc. Hist.* 26 (1) (1984) 126–166.
- [37] S.B. Ortner, *Anthropology and social theory: culture, power, and the acting subject*, Duke University Press, 2006.
- [38] E. Ostrom, A general framework for analyzing sustainability of social-ecological systems, *Science* 325 (5939) (2009) 419–422, <https://doi.org/10.1126/science.1172133>.
- [39] E. Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge University Press, 1990.
- [40] G. Pálsson, A. Helgason, Figuring fish and measuring men: the individual transferable quota system in the icelandic cod fishery, *Ocean Coast. Manag.* 28 (1–3) (1995) 117–146, [https://doi.org/10.1016/0964-5691\(95\)00041-0](https://doi.org/10.1016/0964-5691(95)00041-0).
- [41] M.Q. Patton. *Qualitative Research & Evaluation Methods*, 3rd ed., Sage, Thousand Oaks, CA, 2001.
- [42] C. Paredes, *¿Atrapados en la red? La reforma y el futuro de la pesca en el Perú*. Lima, Fondo Editor. De. la Univ. De. San. Martín. De. Porres (2013).
- [43] K.G. Provan, P. Kenis, Modes of network governance: structure, management, and effectiveness, *J. Public Adm. Res. Theory* 18 (2) (2008) 229–252, <https://doi.org/10.1093/jopart/mum015>.
- [44] P. Robbins, *Political Ecology: A Critical Introduction*, Wiley-Blackwell, 2012.
- [45] J.-P.O. de Sardan, Embeddedness and informal norms: institutionalisms and anthropology, *Crit. Anthropol.* 33 (3) (2013) 280–299, <https://doi.org/10.1177/0308275X13490307>.
- [46] Sociedad Peruana de Derecho Ambiental S.P.D.A. 2022. Wikipesca Perú. Plataforma colaborativa sobre la pesca en el Perú. <https://www.wikipesca.pe/> Accessed 20 September 2021.
- [47] A. Sindzingre, The relevance of the concepts of formality and informality: a theoretical appraisal, in: In.B. Guha-Khasnobis, R. Kanbur, E. Ostrom (Eds.), *Linking the Formal and Informal Economy*, 1st ed., Oxford University Press, 2006, pp. 58–74, <https://doi.org/10.1093/0199204764.003.0004>.
- [48] T.A. Stojanovic, The “social” aspect of social-ecological systems: a critique of analytical frameworks and findings from a multisite study of coastal sustainability, *Ecol. Soc.* 19 (1) (2014) 7.
- [50] G. Damonte, B. Schorr (Eds.), *Andean States and the Resource Curse, Institutional change in extractive economies*, Routledge, London, 2021, <https://doi.org/10.4324/9781003179559> first et.
- [51] T. De Herdt, J.P.O. de Sardan (Eds.), *Real Governance and Practical Norms in Sub-Saharan Africa: the Game of the Rules*, Routledge, London, 2015.
- [52] L.C. Kluger, A. Schluter, M. Garteizgoegascoa, G. Damonte, Materialities, discourses and governance: scallop culture in Secura, Peru, *J. Environ. Policy Plan.* (2022), <https://doi.org/10.1080/1523908X.2022.2047620>.