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research paper

The importance of understanding self-governance efforts in coastal fisheries in Peru: insights from La Islilla and Ilo

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ABSTRACT.—Understanding self-governance efforts in small-scale coastal fisheries may hold the clue to establishing effective coastal fisheries policies or strengthening existing ones. Here, we explored the diversity and the rationale behind the self-devised control rules implemented by two groups of coastal fishers in Peru, and the pathways to promote compliance under self-governance systems, as a prerequisite to sustain such efforts. We drew on an exploratory methodological approach and used semi-structured interviews and a questionnaire, designed following Ostrom's socio-ecological system (SES) framework, to characterize each experience. A compliance framework was used to identify the pathways and factors driving compliance. Results showed a variety of informal control rules have been set and used by fishers, from catch limits to patrolling activities. Each addresses specific fisheries governance and management issues. Results also showed that setting control rules has not been a one-time event; instead, it is an evolving learning process. Furthermore, both traditional (La Islilla) and non-traditional (Ilo) SES frameworks have built their own ways to promote compliance and sustain self-governance efforts. These two experiences provide insights for understanding self-governance of coastal fisheries, with particular attention to identifying ways to improve the governability of small-scale fisheries through cogovernance type arrangements.

Self-governance of small-scale fisheries is a bottom-up effort in which fishers, using their empirical knowledge through trial and error processes, set a variety of locally-tailored control rules and sustain group compliance (Townsend 1995). Such an approach has increased (to some extent) the effectiveness of addressing local common-pool resource issues, creating opportunities for local fisheries development (Ostrom 1990, Gelcich et al. 2006, Basurto et al. 2013). Thus, understanding such efforts may constitute an opportunity for policymakers, fishers, scientists, and practitioners to foster good governance and effective fisheries management systems (Adams 1998, Zann 1999, Makino and Matsuda 2005).

Existing self-governance arrangements may hold the clue to establish effective fisheries institutions or to adjust the existing ones as a way to strengthening the governability of coastal fisheries (Cinner and Aswani 2007, Kooiman et al. 2008, Hauzer et al. 2013). Neglecting such efforts when establishing fisheries policies and reforms might deteriorate informal institutions that were crafted, tested, and tuned for years, eventually leading to potential local conflicts and overfishing (Johannes et al. 2000, Caddy and Cochrane 2001, Hauck and Sowman 2001, Gelcich et al. 2006, Cinner and Aswani 2007).

In Peru, the formal governance of small-scale coastal fisheries is currently characterized by a hierarchical approach and a de facto open access regime. This, coupled with the social heterogeneity, natural variability, dynamism, and intensity of these fisheries, contributes to its limited governability. In this context, lessons from self-governance experiences could be a useful input to inform the design of effective policies and regulations for coastal fisheries. Unfortunately, studies aiming to understand self-governance experiences in Peru have been limited. Here, we attempt to fill this knowledge gap, in the hope that it will inform related policy developments.

Our study focuses on two groups of small-scale coastal fishers that have managed to self-govern the extraction of their main coastal resources. It identifies the control rules implemented by the two groups to address their respective management issues, and it also explores the factors and pathways taken to promote compliance in each of these self-governance systems. Finally, we discuss insights to promote compliance with formal regulations and enhance the governability of coastal fisheries in Peru.

Research Setting

In Peru, fishing resources available in the first 5 nmi from the coastline are for exclusive use of artisanal fishers (Peruvian Council of Ministries 1991). Only fishers holding "artisanal fisher permits" are allowed to fish commercially within this zone. These permits are granted upon completion of inductive courses and administrative procedures. Also, fishing boats equipped with a vessel capacity <32.6 t require an artisanal fishing license to operate within the exclusive artisanal zone. This license is granted only after safety inspections are conducted by the maritime authority.

Fishers holding a permit fit the category of authorized users of Schalger and Ostrom (1992), since they can access and extract fishing resources. The authority to regulate the access and extraction lies within the exclusive mandates of the Ministry of Production (PRODUCE). As the main fishery authority, PRODUCE is responsible for, among other aspects, framing fishing practices through adopting and enforcing management plans and regulations to promote the sustainability of the fishing sector in Peru. The National Institute for Marine Research (IMARPE) is the scientific body responsible of providing science-based recommendations to PRODUCE regarding fisheries management in Peru. While PRODUCE holds the exclusive authority for establishing fisheries policies and regulations, law enforcement for artisanal fisheries is decentralized to regional governments.

There has been limited progress in setting formal regulations for small-scale coastal fisheries. PRODUCE has established size restrictions and closures for several economically important coastal resources (PRODUCE 2001). As a precautionary approach, since 2010, artisanal fishing boat permits have been issued only to fishing boats with fish-hold capacity <10 t due to the over-capacity of the small-scale scale fishing fleet (PRODUCE 2010). However, most Peruvian coastal fisheries have limited

or no data concerning their social and ecological conditions, imposing a challenge for management (TNC & SPDA 2014). In addition, ensuring high levels of rule compliance has been a great challenge. Law enforcement has been a complex task for regional governments, whose enforcement budgets and capacities are insufficient to control the compliance of more than 45,000 artisanal fishers (of which around 25,000 are frequent coastal fishers), operating in at least 116 landing sites distributed along the 3000-km long Peruvian coastline.

Coastal fishing resources in Peru are under de jure closed-access regimes to individuals without a valid permit, but still open to all permits holders. However, important levels of informality and insufficient enforcement capacity promotes a de facto open-access regime. Even though informality has declined over the last 20 yrs, 48.7% of artisanal fishers (around 20,000 fishers) are still working without valid permits and licenses (IMARPE 2010, PRODUCE 2012). Over the years, a common understanding has emerged in which small-scale coastal fishers are perceived to have benefited from such "informality" and insufficient enforcement by fishing as much as they can while they can, leading to tragedy-of-the-commons-like situations that have led to the decline of the ecological, social, and economic performance of coastal fisheries. From such a perspective, participatory fishery governance and management might be difficult to realize. An almost unknown reality of this sector shows/captures small-scale coastal fishers who have engaged in collective actions to address common fishing problems, mostly via their artisanal fishing associations (OSPA). Our study focuses on exploring the diversity and emergence of self-governance in two coastal fisheries in La Islilla and Ilo, where fisher groups have self-devised control rules, and monitoring and sanctions systems, to sustain their livelihoods.

Study Area

La Islilla.—La Islilla is a coastal fishing community located 1061 km north of Lima, Peru (5°12′S, 81°11′W). Founded in the 1800s by immigrant fishers from the lower Piura River (El Bajo Piura), it is home to around 1400 inhabitants, whose economy depends almost entirely on artisanal fisheries. La Islilla is a remote fishing town with unpaved roads, no running water, and limited access to electricity. It is a traditional community, where all members know each other, share familiar bonds, cultural backgrounds, and fishing practices. Social and economic conditions remain relatively homogeneous among members of the community (V Vite, La Islilla fisher's association, pers comm).

For centuries, local fishers have used hook and line fishing gear and their traditional *balsillas* (V Vite, La Islilla fisher's association, pers comm). Balsillas are a very basic type of boat made of five *palillos* (trunks of balsa wood) fastened one next to the other and propelled with a wooden stick at the rear (Fig. 1C). Approximately 100 fishers, mostly elder, use balsillas to fish demersal finfish, particularly *cachema* [*Cynoscion analis* (Jenyns, 1842)], as an important livelihood strategy (Fig. 1A). The younger generations, around 400 fishers, mostly fish open water pelagic resources (e.g., sharks, mahi mahi, tunas, etc.) using bigger boats and long-lines. They join the elders when coastal resources are abundant. There is a shared understanding among members that coastal and demersal resources must be fished following customary practices.

Ilo.—Ilo is a coastal city located 1250 km south of Lima, Peru (17°38′S, 71°20′W), with a population of 59,132 people (INEI 2007). The active population is distributed

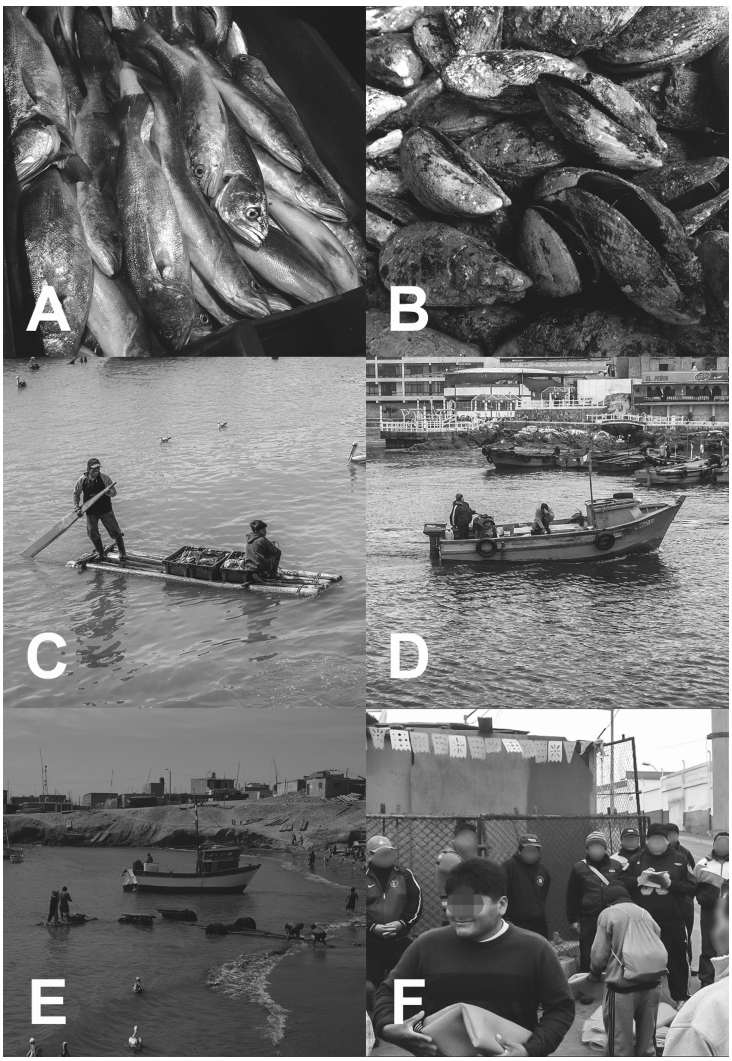

Figure 1. Pictures of (A) La Islilla and (B) Ilo main fishing resources, difference between (C) La Islilla's and (D) Ilo's fishing boats, and (E) La Islilla landing site and (F) the allocation for a small volume of mussel in Ilo.

between trading (19.1%), transport and communication (10.7%), construction (9.5%), and fishing (8.8%) (INEI 2010). Industrial and artisanal fisheries sustain the livelihoods of approximately 2300 fishers, of which 328 hookah divers and their crew are members of the Ilo's Hookah Divers and Crew Committee. The remaining 2000 fishers are free divers and shore gatherers, or use hook and line, gillnets, or purse seines targeting benthic resources, as well as demersal and pelagic fishes. Unlike La Islilla, Ilo is an important urban area in the southern coast of Peru, with paved roads, running water, and stable electricity supply. Its diverse population is the result the influx of immigrants of different origin, where the social and cultural background of fishers is not as homogenous as in La Islilla.

The Hookah Divers and Crew Committee targets benthic resources, such as mussels [*Aulacomya atra* (Molina, 1782)], chanque [*Concholepas concholepas* (Bruguière,

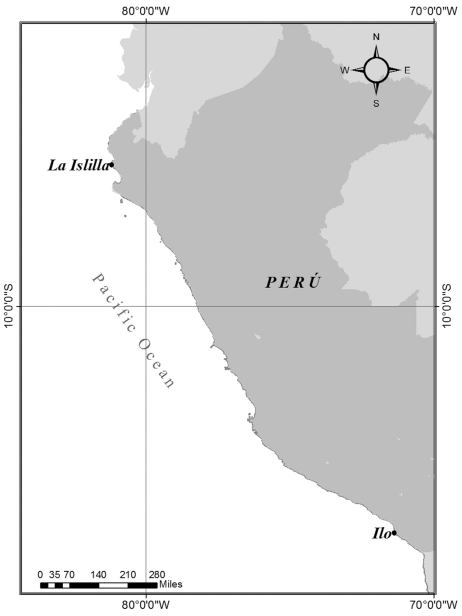

Figure 2. Location of La Islilla (north) and Ilo (south) in Peru.

1789)], and octopus (*Octopus mimus* Gould, 1852), among others. In the last four years, mussels have become the main target species (Fig. 1B, D). Before 2011, there were only 20 boats targeting benthic resources. Most hookah divers were not interested in extracting mussels because of low prices (USD$15 per bag of approximately 70 kg of mussels) and small commercial orders that did not compensate the health risks of diving beyond 18 m depth. In 2011 and 2012, the committee was in the privileged position to supply the wholesale seafood market of Ventanilla, one of the two largest market facilities in Lima, and largest seafood consumer. This opportunity arose when other fishing communities failed to comply with market requirements (a weekly shipment of 21 t of fresh and commercial sized mussels). The committee met all the conditions to provide the product in a day, however, they started to face sustainability issues. To address the risk of depleting their resource base, the committee developed its own control rules.

Methodology

Our research used a two-stage exploratory methodological approach. It focused on exploring the diversity of control rules and pathways promoting rule compliance of the two coastal fishing communities, rather than making a comparison between eachother. In this respect, the study first applied the social-ecological system (SES) framework of McGinnis and Ostrom (2014) to characterize the La Islilla fishing community and Ilo's Hookah Diver and the Crew Committee, including the identification of operational rules (known as control rules). La Islilla traditional coastal fisheries governance and Ilo's Hookah Divers and Crew Committee were selected for the present study because of the existence of self-governance efforts in different social-ecological settings (Fig. 2). To understand the diversity of control rules

Table 1. Attributes evaluated to understand the factors behind sustaining compliance in both local governance of coastal fisheries (La Islilla and Ilo) in Peru.

Legitimacy	Group behavior	Monitoring and sanctioning
L1. Reaching agreement with other users	GB1. Social cohesion	MS1. Monitoring
L1.1. Number of users	GB1.1. Reciprocity	MS1.1. Monitoring of members
L1.2. Relationship with other users	GB1.2. Social Network	MS1.2. Monitoring of poachers
L2. Collective-choice rules	GB1.2.1. Residence location	MS2. Gradual sanctions
L3. Leadership	GB1.2.2. Cultural dependency	MS3. Deterrent factor
	GB 2. Internal conflict resolution system	MS3.1. Economic dependency
		MS3.1.1. Economic value of fishing resources
		MS3.1.2. Peer pressure

implemented by La Islilla and Ilo, we classified the rules based on the purpose of each management strategy (Cochrane 2005). Further division was made following the classification of Morison (2004) regarding the nature of the control rules (input and output control rules). Then, we applied a rules compliance framework (Becker 1968, Raakjær Nielsen 2003) to identify the pathways and SES attributes that promote control rules compliance, and consequently sustain self-governance (Table 1) (Ostrom 1990, Agrawal 2001, Hauck 2008).

Fieldwork and Data Collection Methods

The fieldwork was conducted in September 2015. Primary data about the attributes of each social-ecological system were collected. Semi-structured interviews and questionnaires were used to characterize each self-governance experience based on Ostrom's social-ecological system (SES) framework (Basurto et al. 2013, McGinnis and Ostrom 2014). Semi-structured interviews (see Online Appendices 1–2) were conducted with the representatives of each self-governance initiative. In addition, the questionnaire (see Online Appendices 1–2) was applied to a random sample of fishers involved in the self-governance initiatives to collected data about their perceptions of their experiences. Respondents were selected randomly by the researchers as fishers arrived to the fishing port after selling their catch. The group's representatives introduced the researcher and the purpose of the questionnaire to each respondent.

In total, in-depth interviews were conducted with fisher's representatives (leaders) in La Islilla (2) and Ilo (2), and 28 questionnaires (13 in La Islilla and 15 in Ilo, 13% and 4.5% of total fishers, respectively) were completed with member fishers. In addition, interviews were held with non-member fishers, middlemen, local scientists, and authorities regarding their perception of the self-governance system. Finally, informal conversations were held with the fishers from the initiatives at landing sites.

Results

Fishing Control Rules

La Islilla.—The fishers assembly of La Islilla, which is the highest authority within the association, have identified four main problems regarding their fishing activities: spatial variability (mobility) of their traditional demersal finfish, the scarcity of fishing resources, conflicts among members using different fishing gears, and low prices

of squid (Table 2). The assembly has agreed to act collectively to address these issues and decided to set a variety of control rules to address these fisheries management issues. Results show that there is a tendency to implement input control rules rather than output ones. In addition, these rules have remained active for >5 yrs.

With the understanding that spatial variability of their traditional fishing resources is mostly due to natural conditions, the fishers of La Islilla and neighboring communities have been traditionally sharing their fishing grounds to adapt to these conditions, and there is a common understanding that hook and line gears are the only fishing gear allowed in their fishing grounds. Individuals using other fishing gears are requested to leave, at first by reasoning, then by using force (e.g., break fishing gear). Interviews and informal conversations revealed that fishers from La Islilla perceive that the impact of their customary fishing practice is minimal as it has existed for centuries without significant negative impacts on fishing resources. They alleged that the intrusion of artisanal and industrial purse seiners or trawlers has diminished the availability of their fishing resources, making it difficult to sustain their customary practices and rules (also known as technological externality; Ostrom et al. 1994). The intrusion of industrial boats is also a violation of formal law. To confront this problem, the assembly has implemented a voluntary patrolling system to monitor the intrusion of purse seiners and trawlers.

Fishing gear conflicts occur within the La Islilla community, in which hook and line fishers argued that gillnets scare away fishing resources from their traditional fishing grounds, making it even more difficult for them to fish (technological externality). As a result, the assembly has self-devised a spatial fishing gear restriction. Under this rule, gillnets cannot be used in traditional hook and line fishing spots. Unlike the control and sanctioning system applied to trawlers and purse seine fishers, there has been some flexibility in controlling and sanctioning fishers using gillnets within local and traditional fishing grounds. The assembly recognizes that local gillnet fishers have been part of the community for decades, and therefore, sanctions must be less strict than the one applied to trawlers and purse seine fishers.

In addition to demersal finfish, La Islilla fishers also target squids. Squid production is destined almost entirely to processing plants. Middlemen, who are also members of the community, facilitate the commercialization. Each middleman works with a specific group of fishers with whom they maintain familiar bonds or friendship. The processing plants set prices depending on group production quality, particularly when its maximum capacity is reached. Due to high temperatures and the limited space in the balsillas to install an insulated cold storage, the quality of fished squid declines rapidly, increasing the likelihood of lower prices or even the rejection of their catch. To ensure that all members received similar prices, the assembly agreed initially on a catch limit restriction, expecting that all fishers would land around the same time to ensure the same quality. But, it did not work as expected since the effect of different fishing capabilities was underestimated, and landing times varied depending on fishers' capacities to reach their catch limits. As a result of the coordination between the assembly and middlemen, the catch limit was modified by a landing time restriction. This control rule sets a time (commonly around 13:00 hrs) at which all members must land their catch. Failing to comply with this rule would automatically mean that the landed catch will not be accepted by middlemen, and the offender may be publicly embarrassed if a frequent offender. Unlike the catch

Table 2. List of control rules, and their relations with problems collectively identified at their respective assemblies, its management purpose and the type of rules.

	Resource-based and social		Economic	
Management strategy	Input	Output	Input	Output
La Islilla fishery				
Spatial stock variability	Share fishing ground with neighboring communities and only traditional customs are allowed	–	–	–
Resource scarcity of traditional Demersal due to the use of inappropriate fishing gears	Fishing gear restriction + voluntary patrolling activity	–	–	–
Conflict between hook and gillnet fishers	Area-based fishing gear restriction	–	–	–
Commercial opportunity to maintain prices	Only hook and line	–	Landing time restrictions	Catch limits (failed)
Ilo fishery				
Commercial opportunity to exploiting mussels, and keeping prices high	–	–	Membership	Catch limits, size and cleanness restriction
Potential deterioration of mussel stocks	–	Commercial request limits	–	–

limit, the landing time restriction has been an effective control rule that ensures group squid catches are of good quality at the time of landing.

Ilo's Hookah Divers and Crew Committee.—The committee's assembly, which is also the highest authority within the committee, has collectively identified that benthic resources have been declining mainly due to the race for fish among and within fisher groups in Ilo: hookah (*Buzos*), free divers (*Pulmoneros*), and shore gatherers (*Saltamocheros*). According to the interviewed representative of Ilo's committee, "they [the committee members] are not willing to invest in protecting [fishing] resources that others could freely enjoy." Reaching agreements with other users, however, is perceived as a complex challenge yet to be resolved (Table 3).

The assembly has self-devised and implemented a set of control rules for its mussel fisheries (Table 2). Unlike other benthic resources, mussels are not shared due to their difficult access (only by hookah diving). Therefore, neither free divers nor shore gatherers can freely enjoy the benefits of the committee's investment in protecting this benthic resource. Most of control rules are input control rules. In addition,

self-governing the extraction of mussel started in 2011, when the Lima mussels market turned its attention to Ilo's mussel stocks, as a result of the depletion of mussel stocks by closer fishing communities to the Lima market. Consequently, the self-governance experience of the mussel fisheries in Ilo began in conjunction with a commercial opportunity. All hookah divers in Ilo interested in extracting mussels are members of the committee, which must supply around 21 t of commercial sized, clean and fresh mussels once a week. This requires collective and coordinated actions. As a result, the assembly has agreed on a variety of control rules, such as memberships, catch limits, and size and cleanliness restrictions, to secure access to Lima's markets and maintain steady incomes (Table 2).

Any fisher desiring to fish mussels in Ilo's de facto fishing grounds must be a member of the committee. The only requisite to become a member is to follow the decisions agreed upon by the assembly. Membership is not an authorization to extract mussels per se, but a critical requisite to be included in the catch limit allocations. The assembly has arranged two allocation systems depending on the size of the commercial orders. Any commercial order fewer than 50 bags (equivalent to 3.5 t) is consider as a small commercial order, and all orders above that amount is considered as a large order, with a limit of 300 bags (21 t). For smaller orders, the order (total number of bags) is divided in catch limits of three bags each, and allocated to each boat according to a list on a rotating system every morning (Fig. 1F). If the total number of bags is not a multiple of three, the remaining bag is included in the next small extraction, or *saca*. Small extractions consist of around eight bags (70 kg per bag) with a frequency of two to four orders per week. For large commercial orders, the system consists of dividing the order (total number of bags) in equal parts among all members the previous day. To comply with large orders, the committee authorizes a total extraction limit of around 300 bags (70 kg each). Once boat representatives (e.g., a diver or crew) receive their catch limit (number of bags), that specific boat is automatically authorized to extract mussel for that given *saca*.

In addition, the buyers coordinated with the assembly to only land clean mussels that measure above the official size restriction established by Ministry of Production (65 mm in its longitudinal length). Such agreement helps buyers avoid sanctions at checkpoints on the road to Lima and at the seafood market controls, particularly at the Ventanilla market in Lima. Consequently, the assembly has incorporated the cleanliness and the official size limit as part of their own set of control rules to help secure access to markets.

Being one of the few big suppliers of mussels to one of the largest wholesale fish markets in Lima opened a window of opportunity for negotiating better prices. As a result, prices have steadily increased from USD$15 to USD$70 per bag of 70 kg between 2011 and 2015—four times more than at the very beginning. As prices and profits were getting higher, more local fishers were interested in extracting mussels. According to the committee constitutional rules, any fisher interested in being a member and willing to comply with the assembly's decisions must be accepted based on the "right to work." Consequently, the committee has been growing, but it has been keen to balance the number of members and price of mussels to maintain a minimum wage of about USD$45 per individual per saca (extraction). In other words, even though the catch limits per boat have decreased, incomes have remained almost the same with the added benefit of diving being less risky, as underwater times are reduced.

Table 3. Basic social aspects and fishers' attitudes toward local governance of coastal fisheries in Peru. For the attitudes toward local governance, data represent the mean responses (SD), where 1 = totally disagree, 2 = disagree, 3 = not sure, 4 = agree, 5 = totally agree.

	La Islilla	Ilo
Basic social aspects		
Population in area	1,400	59,000
Number of members	500	400
Current address	La Islilla	Ilo
Place of birth	La Islilla	Diverse (southern Peru)
Average number of generations as fishers ("Who is/was the first fisher in your family?")	2.9 (0.76)	1.8 (0.7)
Average age	51 (11.97)	49 (9.01)
Average time as fishers (yrs)	40 (13.43)	29 (10.7)
Cultural dependency	High	Low
Economic dependency	High	High
How often do peers return favors in good manner?	3.9 (often)	2.9 (sometimes)
How much do you trust in your leaders?	4.1 (75%)	3.4 (50%)
Attitudes toward aspects of their local governance		
Formal regulations implemented by PRODUCE have helped to manage fishing activity in your community	2.20 (1.01)	1.80 (0.94)
Decisions are fair when affect or benefit equally to all members	4.30 (0.65)	4.10 (0.35)
Peers only comply with the assembly's decisions due to the sanctions	2.01 (0.75)	4.01 (0.59)
The internal conflict resolution mechanisms have been successful in solving conflicts among	4.00 (0.28)	3.90 (0.88)
The assembly's meetings are important to achieve success in self-governing local fishing resources	4.90 (0.27)	4.00 (0.53)
It is easy to agree with other users or communities for managing shared fishing resources	4.00 (0.70)	2.08 (0.61)

In an attempt to sustain these favorable conditions, the assembly has also implemented an exhaustive monitoring system to ensure compliance with market conditions. It has recently, based on a precautionary approach, agreed on limiting small commercial orders up to 50 bags, and up to 300 bags for large orders. They have also established a rotating supply system for large orders to prevent the overexploitation of their stocks of mussels. If two or more buyers request large volumes, the assembly will work with only one buyer per week in a rotating system.

Promoting Compliance, Sustaining Collective Actions

Pathways promoting control rule compliance have been identified for each case. In both SES, the legitimacy of control rules is a contingent factor. In other words, legitimated rules are important for its compliance, but it might not determine its success. Therefore, some sort of control and sanctions have been needed and have been built around an effective deterrent factor, which depended on local settings. In La Islilla,

it has been built around members' reputations; while in Ilo, it has been around economic incentives (Table 3).

Legitimacy.—According to La Islilla and Ilo constitutional rules, the fishers assembly is recognized as the highest authority in their respective groups. All members (500 fishers in La Islilla and 400 fishers in Ilo) are invited to participate at their assembly's meetings with one voice and one vote to adopt or modify local rules. During these meetings, members deliberate about the nature and source of their common fishing issues, and propose potential solutions (i.e., control rules) based on their empirical and traditional knowledge. Collective-choice rules in both groups suggest that decisions are taken by a majority vote after deliberation. The heads of the La Islilla association and Ilo's committee play important roles in keeping order during the meetings and encouraging peers to embark on collective actions. Strong leadership skills and shared visions among members seem to have supported deliberation and decision-making processes in both cases.

The results of the questionnaire and informal conversations revealed that participation under equal conditions in the decision-making process has been essential to increase the perceived fairness and transparency of the processes, which ultimately improved the legitimacy of the control rules and sanctions agreed upon (Table 3). Furthermore, fishers suggested that rules are fair when they equally affect or benefit their peers. Perceived fairness is critical for legitimating decisions (Tyler 1990, Raakjær Nielsen 2003). In addition, being part of the decision-making process attaches a moral responsibility in complying with rules and sanctions.

Group Behavior.—In La Islilla, the representative of the association has observed that maintaining one's reputation drives compliance, whereas, the representative of Ilo's Hookah Diver and Crew Committee suggested that promoting compliance is mostly driven by a strict monitoring and sanctions system. Questionnaire responses support this finding (Table 3, Fig. 3). Respondents in La Islilla disagreed that peers comply with rules just because of sanctions (mean Likert scale value: 2.01, SD 0.75). In contrast, respondents in Ilo agreed that peers comply mostly because of the likelihood of being sanctioned (4.01, SD 0.59).

Social attributes might be playing an important role in developing pathways to compliance with assembly decisions (i.e., control rules and sanctions). La Islilla has been a traditional fishing community for centuries, and most members have been born there or immigrated from the same original locations (a homogenous place of birth). Fishing demersal finfish with balsillas and hook and lines is what characterizes small-scale coastal fisheries of La Islilla. Most respondents also said that the first generations of fishers in their families were their grandfathers (mean value of 2.9 generations ago). The mean fisher's age was around 59, and started using balsillas and helping at the port at an average age of 11 years old. In addition, their social networks expand beyond the fishing sector and integrate into the entire community. Therefore, most fishers in La Islilla perhaps comply with their control rules to maintain their reputation, which is a critical aspect for their personal development in such a lasting kinship.

Ilo's Hookah Divers and Crews Committee represents a small part of the population of Ilo (Table 3). They may not share the same traditional background like in La Islilla since most members or their parents have immigrated from different locations (a heterogeneous place of birth). Furthermore, there may not be a strong cultural

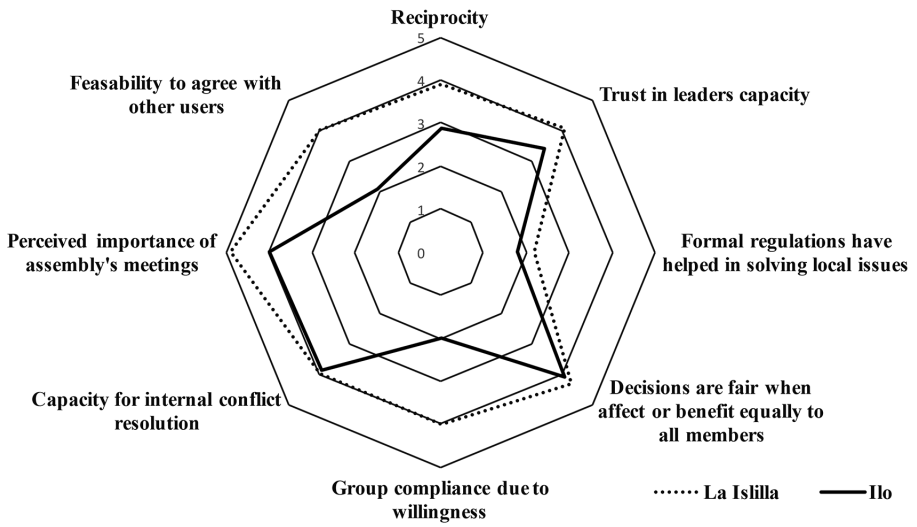

Figure 3. Attitudes toward aspects of self-governance efforts in Ilo (continuous line) and La Islilla (dashed line). Attitudes were measured through Likert-scaled responses, and values are shown in means of the sampled fishers' responses (13 respondents in Ilo and 15 respondents in La Islilla). Means and standard deviations can be found in Table 3.

dependency to fisheries, particularly with the mussel fisheries, since its commercial extraction started only in 2011. The results of the questionnaire show that the first generation of fishers in their families were their parents (mean value of 1.8 generations ago). The mean age was 49 yrs, similar to La Islilla; however, they reported less time as fishers (mean of 29 yrs as fishers). Social networks are mostly limited to the fishing sector; therefore, violating a rule may not have important repercussions on their social life beyond the fishing sector. Even when trust and reciprocity are growing, the relation among peers concerning compliance is still that of conditioned cooperation: "I comply with our commitment if you do the same." Informal conversations suggest that strict, fair, and effective monitoring and sanctions are needed to ensure compliance and minimize free-riding behaviors.

Monitoring and Sanctions.—Monitoring and sanctioning systems do exist in both cases, but they differ in their level of intensity. In Ilo, a trading representative has the explicit mandate to monitor compliance and sanction non-complying behaviors. He stays around the fishing port from 7:00 to 19:00 hrs to allocate the catch limits, monitor landings, and sanction unauthorized fishers. The trading representative is a paid position for at least 3 mo, which is filled only by members whose health condition is limiting their capacity to work at sea. According to the current trading representatives, the fact that it is a paid position encourages the individual to be held accountable by the committee because it is perceived that the committee is doing the individual a favor. The monitoring system in Ilo's committee is exhaustive and effective for reassuring members that rules are being enforced and complied with. The assembly also implemented a gradual sanctions system. Sanctions imply exclusion of a number of sacas, depending on the severity or frequency of the infraction. Being excluded from a saca has a significant repercussion on member's incomes.

The committee does not employ any direct patrolling activity in their fishing grounds. They have invested on the Ilo's fishing community to get their support, through: (1) giving away 60 bags of mussels to the local population in Saint Peter's day; (2) supporting non-member fishers in times of urgency (e.g., health accident, etc.); and (3) giving away confiscated volume to the community. The confiscated volumes are split into halves, one-half is given to the poachers to cover their fishing cost as a one-time benefit while the other half is given to the local community. In return, non-member fishers report to the trading representative when unauthorized fishers are seen extracting mussels from their fishing grounds. Once unauthorized fishers are reported, trading representative coordinate with all members present at the port to monitor poachers while fishing or landing.

In La Islilla, however, there is no exhaustive monitoring system like in Ilo, with the exception of the patrolling activities to monitor the intrusion of trawlers and purse seiners. Monitoring is based on peers during their fishing activities. If a gillnet fisher is seen fishing in a traditional hook and line spot, that fisher will be reported to the representative and the beach watcher (a position recognized by the maritime authority), and sanctioned by retaining his fishing gear for a number of days agreed upon by the representative and beach watcher, or, at most, offenders are shamed in the eyes of the community if violations are repeated. Being sanctioned may deteriorate one's reputation within the community, with important repercussion on other aspects of their social life.

Small-scale coastal fishers can self-organize in different ways despite opportunity and transaction costs as can be observed from the different factors that drive complying behaviors in both situations. The current collective-choice rules in each case have prompted the legitimacy of their control rules. Maintaining one's reputation in La Islilla and maintaining economic incentives and effective monitoring and sanction systems in Ilo have been decisive factors in promoting compliance in each respective fishing community.

Discussion

Identifying control rules devised and enforced by fisher groups is an opportunity to short list a whole universe of control rules that address specific local fishing issues in similar contexts (Gelcich et al. 2006, Cinner and Aswani 2007). This is of particular importance in unregulated fisheries and complex small-scale fishing settings (Christy 1982, Dahl 1989, Acheson and Wilson 1996), like the small-scale coastal fisheries in Peru. Self-governance experiences of La Islilla and Ilo provide evidence that control rules, such as catch limits, spatial partitioning of fishing gear, and landing time, can be effective and socially viable, if designed to address specific issues of small-scale coastal fisheries in Peru.

The set of informal control rules found in our study have shown to be more diverse and better tailored to local conditions than existing formal regulations (Table 2). The heterogeneity of informal rules is the result of the diversity of issues, which needed to be addressed in each SES setting. Importantly, self-governance systems of La Islilla and Ilo have been able to respond effectively to local common-pool resource management issues promptly. The responsiveness of both local systems has been key for avoiding the scaling of problems that, otherwise, may have deteriorated the governability of their SES (Jentoft 2007).

Fisher assemblies have been able to address issues associated with the extraction of some, but not all, their targeting resources. Acheson (2015) proposed the term "economical defendability" to explain such a situation. Acheson suggested that when the relative value (economic or cultural) of a fishery is sufficient to exclude foreign fishers from using a given stock or fishing ground, local fishers tend to establish a common property regime and manage their coastal resources.

The perceived high economic value of mussels in Ilo and the culturally important values of balsillas in the fishing practices of La Islilla seem to be sufficient for each group to defend their local fishing stocks and practices from foreign fishers unwilling to comply with local agreements. Establishing some sort of legal instrument to formalize these de facto rules may strengthen the resilience of self-governance and management efforts, reduce conflicts and costs of exclusion, and could promote fishers' active participation in the governance and management of their fisheries (Castilla and Fernandez 1998, Basurto 2005, Basurto et al. 2012, Defeo et al. 2016). While fishers' participation and support have been reported in the literature as key for fostering effective public policies and effective regulations, our study confirms that such an approach is likely to succeed in the context of small-scale coastal fisheries in Peru.

A critical challenge with devolving and sharing managerial responsibilities is whether or not fishers' organizational capacities are up to handling such power. Even though the risk of devolving management power to communities is an issue, La Islilla and Ilo cases suggest that fishers might be able to navigate that transition. Understanding the self-governance efforts of La Islilla and Ilo has provided insights into coping with the challenge of involving and sustaining fishers' participation in coastal fishing resource management. While social capital and leadership are key for the success of self-governance and cogovernance (Gutiérrez et al. 2011, Marín et al. 2012), results show that economic incentives may substitute for them at some stage of a self-governance effort. Results also suggest that sustaining La Islilla and Ilo efforts carry high transaction costs. Ensuring group compliance, participation, involvement, and support is essential to sustain self-management efforts (Ostrom 1990, Sundström 2012). Both case studies presented here have managed to provide the necessary incentives to self-sustain compliance over time.

In both situations, ensuring the legitimacy of assemblies' decisions has not been a major issue. Unlike some fishing communities in the Pacific Islands, Asia, and Africa (Harkes 1999, Cinner and Aswani 2007, Hauzer et al. 2013, Aburto et al. 2015), the decisions of the representative of La Islilla fishing community and Ilo committee are not backed-up by divine mandate or power, and compliance is not driven by social taboos, but by other factors. Decision-making processes at the La Islilla and Ilo assemblies are consistent with Raakjær Nielsen (2003), who noted that a participatory, transparent, and equitable decision-making process increases the likelihood of legitimate decisions (i.e., control rules and sanctions). The decision-making processes of the La Islilla association and Ilo committee challenge the current command-control approach of the formal governance of small-scale coastal fisheries in Peru. A study in central Peru suggested that compliance with formal regulations has been limited, to some extent, by their low legitimacy (Nakandakari 2014). Therefore, if compliance is to be improved, formal coastal fisheries governance should increase the legitimacy of their control rules and enforcement measures (Raakjær Nielsen 2003).

Furthermore, compliance with legitimate rules has been supported by either reputation and a lax monitoring system, or by economic incentives and exhaustive

monitoring systems depending on the fishery context. Sharing similar cultural backgrounds and complex social networks allows reputation to be highly valued for the personal development and sense of belonging of the fishers. As a result, maintaining one's reputation and legitimate rules drive compliance. Where reputation does not influence behavior, intensive monitoring and sanction systems have prompted compliance. It is important to take into consideration that the impact of strengthening enforcement on compliance would be higher if rules are perceived as legitimate (Jentoft 2000, Caddy and Cochrane 2001, Raakjær Nielsen 2003). Further quantitative evidence is needed to better understand the relations among social cohesion, incomes, costs of monitoring systems, and compliance.

The case of Ilo suggests that initiating and sustaining fishers' involvement in managing coastal resources may be incentivized by external factors (use rights and market incentives). While use rights may reduce exclusion costs (higher economic defendability), and market incentives may contribute to higher economic values (higher economic defendability), promoting compliance and implementing an exhaustive monitoring system requires a significant amount of resources to keep monitoring activities effective and accountable to its members. This might be an important barrier in less lucrative fisheries since low incomes may not favor compliance, and the costs of monitoring activities may represent an important portion of fishers' incomes.

In cases of La Islilla and Ilo, devolving managerial power to fishing communities may enhance the resilience of informal governance and management practices by providing legal support for their decisions (Gelcich 2014). Devolving such power implies some sort of cogovernance (comanagement), a mid-ground between self-governance (Ilo and La Islilla) and hierarchical governance (formal model). In cogovernance, fishers affected by the governing system (system-to-be-governed) and external institutions (e.g., authority, company, or both) participate in devising control rules for a given fishery (governance system) and among other managerial responsibilities (Raakjær Nielsen et al. 2004). Consequently, it "widens the source of knowledge" (empirical and scientific based knowledge) and promotes interactive learning among partners (Schumann 2010), increasing the likelihood of designing more effective and legitimate management systems (Kooiman et al. 2008). In addition, integrating formal and informal monitoring systems might enhance compliance by reducing the weakness of each. The challenge, however, is to create models to enable potential synergies between informal and formal governance systems of small-scale coastal fisheries through cogovernance schemes and use rights (Defeo and Castilla 2012, Finkbeiner and Basurto 2015).

Fishers of La Islilla and Ilo have become de facto proprietors (based on Schlager and Ostrom 1992), as they have been able to manage and exclude others (particularly poachers) from their fishing grounds through the implementation of their informal control rules and monitoring systems. Self-implemented and self-sustained local and informal control rules in La Islilla and Ilo has not been a one-time event. In fact, it has been a trial and error learning process leading to their institutional development. Both experiences provide important insights on the potential of understanding self-governance efforts to improve the effectiveness of public policies and regulations for small-scale coastal fisheries in Peru. In the best case scenario, understanding self-governance efforts might help build tool-boxes for control rules in a given ecoregion, ecosystem, or administrative context. Finally, it may help to develop strategies to promote compliance and sustain collective action in similar coastal fisheries. These

are critical issues to inform future formal management policies aimed at addressing small-scale fisheries sustainability in one of the most productive coastal ecosystems in the world.

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