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Fishery cooperatives in Cuba: Potential benefits, legal feasibility, and governance pre-conditions



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ABSTRACT

Currently there is a strong interest in Cuba in improving the performance of the fisheries sector with respect to social, biological, and economic outcomes. Many important fishery resources appear to be overexploited, and previous fishery regulations have had mixed success in restoring fishery stocks. The current fishing pressure could also have adverse impacts on other valuable ecosystem services that support economic activities such as dive tourism and recreational fishing. A new State policy to expand cooperative enterprises to non-agricultural sectors provides an opportunity for fishery cooperatives to be created for the first time since the early years of the Cuban Revolution. This paper explores the potential ecological, social, and economic benefits of adopting fishery cooperatives as a co-management scheme for Cuba's marine fisheries. It concludes that well-designed fishery cooperatives can offer substantial benefits to the management of the fishery sector. Based on an analysis of the relative success of fishing cooperatives worldwide, guidelines are provided for the design of fishery cooperatives in Cuba.

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1. Introduction

1.1. The current state of Cuban fisheries

The health of Caribbean fishery stocks varies by species and region, but most coastal Caribbean fisheries are considered over-exploited [1]. Reef fish populations in particular have suffered severe declines in recent years (see [2] for a meta-analysis), and overfishing has played a major role [3].

Cuba is an archipelago whose main island is the largest in the Caribbean (Fig. 1). Cuba's marine-fishery landings peaked in the 1970s and 1980s, increasing to a maximum of about 210,000 MT in 1986, mostly as a result of catch outside of the Cuban Exclusive Economic Zone (EEZ) [4]. Recent catches have been about 30,000 MT annually, almost all from domestic waters – an 86% drop from peak landings. Most industrial fishing takes place in the four areas (Fig. 1) considered of “great economic interest” [5].

There are indications that approximately one-third of Cuba's marine fishery stocks are overexploited, and one-half are being exploited at maximum sustainable levels [6,7]. Catches of smaller species have increased while those of larger species have decreased, suggesting that Cuban fisheries are “fishing down the food web” [8].

Some species could reportedly be exploited at higher sustainable rates, such as the turkey wing clam (*Arca zebra*), mojarra (*Gerres* spp.), sardine (*Clupeidae*), deep-water snappers (*Lutjanus vivanus*, *Lutjanus buccanella*, *Rhomboplites aurorubens*) and groupers (*Epinephelus mystacinus*, *Epinephelus flavolimbatus*), yellowtail snapper (*Ocyurus chrysurus*), mackerels (*Scomberomorus regalis*, *Scomberomorus maculatus*, *Scomberomorus cavalla*) and tunas (*Katsuwonus pelamis*, *Thunnus atlanticus*) [9]. Fish communities in the coral reefs of the Gardens of the Queen (*Jardines de la Reina*) – the largest marine protected area in the Caribbean – are among the healthiest in the Caribbean [10], and high densities of spiny lobster have been reported in protected areas off of Guanahacabibes Peninsula [11].

The two overarching policy objectives for Cuba's marine fisheries are achieving sustainable exploitation [4,12] and maintaining the fishing sector's workforce (Garcia, personal communication). Specific objectives for the sector include contributing to national food security by providing a dependable supply of high-quality and affordable seafood, and increasing revenues from the export of seafood ([13] cited in [4]). As a step towards these goals, in 2009 the Ministry of Fisheries was eliminated and its agencies, research institutions, and responsibilities were assumed by the Ministry of the Food Industry (MINAL). The renewed focus on marine fisheries as an economic driver is also reflected in Cuba's new national economic and social guidelines [14], which refer to fisheries as an important source of food and foreign currency.

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Fig. 1. Cuba and its main fishing zones (in light gray).

Despite efforts to manage fisheries for high fishery yields, fishery regulations have only been able to partially address the decrease in landings [15]. The spiny lobster fishery, which generates 75% of the industrial sector's revenues [16], reached peak annual landings in the 1980s. A substantial reduction in fishing effort occurred in the 1990s due to the Cuban economic crisis that followed the dissolution of the Soviet bloc. The reestablishment of fishing effort to pre-crisis levels and the introduction of stricter fishing regulations did not result in an increase in mean annual landings, which could be an indication that overexploitation combined with habitat degradation and climatic changes have affected the productive capacity of this fishery [16].

Shrimp landings declined sharply during the early 1980s despite the increased effort resulting in part from the return of Cuban fishing vessels to Cuban waters after their exclusion from Mexico's newly created EEZ [17]. This was addressed with a variety of regulatory actions in the late 1970s and early 1980s, including the protection of nursery areas, establishment of seasonal closures, reduction of allowable fishing days by 75%, and the removal of 40% of the vessels in the fleet, which was possible to achieve rapidly because the State owned the fleet [17]. These measures apparently contributed to the short-term stabilization of shrimp landings, but in the 1990s mean annual landings declined again. By 1995, landings were only 26% (1651 MT) of the mean landings from the period of maximum mean landings, 1976–1980 [7], and in 2001–2005 mean annual landings were only 1454 MT [18]. Recent decreases in shrimp landings seem to be related to a reduction in nutrient levels in estuarine waters caused by nutrient accumulation in a large number of new freshwater dams [19].

Given the failure of past management measures in tackling decreasing fishery yields, the currently stated policy goal of increasing fishery landings could exacerbate overexploitation. It could also have adverse effects on other valuable ecosystem services, such as those provided by coral reef ecosystems that support subsistence fishing, sports fishing, and dive tourism. Subsistence fishing contributes to the livelihoods and food security of coastal communities in parts of the country [20,21]. Recreational activities in marine protected areas such as *Jardines de la Reina* attract foreign visitors, and are sources of jobs and foreign currency.

1.2. The Cuban fisheries system, and recent policy changes

At the onset of the 1959 Cuban Revolution, the majority of Cuba's commercial fishing fleet consisted of small wind- and

oar-powered boats [21]. The new government took swift measures to improve the livelihoods of fishing communities and to transform the artisanal fishing fleets into a modern industrial fleet. This included the construction of shipyards and living facilities for fishermen, and the organization of fishermen into fishery cooperatives. In 1968, the government launched a program to nationalize small businesses not owned by the State [22], which led to the elimination of many small businesses run by private fishermen. At the same time, cooperatives were converted into State-controlled harvesting and processing enterprises called *combinados* [17]. New *combinados* with integrated fishing ports and shipyards were constructed. Presently, *combinados* and newer fishing enterprises that are also run by the State form the backbone of Cuba's industrial fisheries.

Species-specific fishing quotas are determined by MINAL on the basis of recommendations made by MINAL's Fisheries Research Center (based on MSY calculations) and the proposed production plans of the fishing enterprises. MINAL then assigns a fishing quota to the fishing enterprises, which are responsible for harvesting within the limit of their quota, although for some species of finfish overproduction beyond the quota is accepted.

Notwithstanding the intensive industrialization and nationalization of Cuba's fisheries over the past 50 years, there exists a private commercial sector that is comprised of fishermen who own and operate their own vessels. These fishermen are responsible for paying for fuel and other expenses, and receive no government subsidies. Boats in this sector are smaller than the industrial fishing vessels, varying from 2 to 9 m in length. Until 2009, licensed private fishermen were allowed to harvest fish for personal and domestic consumption. However, unlicensed fishing and a black market have existed for years, and there have been reports of coastal overfishing by the private subsector [20,21]. In 2009, with the aim of addressing food security and stemming seafood sales in the black market, the Cuban government began to authorize the sale of the private catch to State-owned enterprises, officially creating the private commercial fishing sector.

In 2011 Cuba began an unprecedented updating of its economic model, designed to increase economic productivity while achieving a number of social goals and adhering to the principles of the Cuban revolution. These profound reforms are detailed in the Guidelines of the Economic and Social Policy of the Party and the Revolution, adopted at the Sixth Congress of the Communist Party of Cuba in April 2011 and ratified by the Party Conference held in February 2013 [14]. One of the most fundamental reforms is aimed

at increasing opportunities for private economic activity, including the involvement of small private businesses and cooperatives in different sectors of the economy. Before the economic reforms, cooperatives existed almost exclusively in the agricultural sector. Regulations passed in December 2012 (Decree-Laws 305 and 306, Decree 309, Ministry of Economics and Planning Resolution 570/12, Ministry of Finance and Prices Resolution 427/12) provide guidelines for the creation of experimental non-agricultural cooperatives. These new cooperatives can be based on the following cooperative arrangements:

- the association of individuals who bequeath their privately-owned assets to a commonly-owned business,
- the association of individuals who maintain ownership of their assets but jointly undertake the purchase of inputs or services, the sale of products or services, or the pursuit of other economic activities,
- the lease of State-owned assets to a cooperative of individuals and
- a combination of the above, including associations between cooperatives to create “second-degree” cooperatives that produce value-added goods or services.

For the first time since the Cuban Revolution, the new regulations will make it possible for experimental cooperatives to emerge in Cuba's industrial and small-scale private fisheries. Members of the State production and processing enterprises (and the public in general) will be able to lease assets from State fishing enterprises to engage in fishery-related activities currently in the hands of the State. Private fishermen will also be able to associate to form cooperatives. The authorization of cooperatives in the fishery sector creates new possibilities for the collective management of the sector. The co-management of fishery resources by cooperatives in other parts of the world has often resulted not only in sustainable resource use and enhanced socioeconomic benefits, but also in ecosystem conservation and stewardship (reviewed in [23]).

The remaining sections of this paper will address the following questions:

- Could fishery cooperatives help achieve Cuba's fishery goals and avoid resource depletion?

- What role could fishery cooperatives play in achieving governance effectiveness in Cuban fisheries?
- Do the new regulations for cooperatives allow the establishment of well-designed cooperatives?
- What lessons from Cuban agricultural cooperatives can be applied for the benefit of the fisheries sector?

2. Cuba's fishery goals and performance

Under the overarching goals of sustainable harvests and jobs, specific goals for Cuba's fisheries include providing a constant supply of seafood with good quality and at an attainable price for the Cuban population; generating export revenues [12]; reducing production costs; and adding value to seafood products ([13] cited in [4]). The current performance of the fishery sector with respect to these goals is summarized in Table 1.

Several factors probably interact to explain the underperformance of the fishery sector relative to some of the goals, including natural fluctuations in stock productivity, reduction in productivity due to habitat degradation, and reduced yields due to overfishing. Of these, habitat degradation and overfishing could be reduced through co-management by cooperatives.

Fishery cooperatives around the world have acted as fishery co-managers, contributing to fishery performance by fulfilling key management needs and innovating to improve attainment of fishery goals [26]. Cooperatives often play a role in determining and enforcing harvest controls. They can also contribute to improvements in fishery science by gathering data, funding data collection, and advancing technological improvements for fishery monitoring. Cooperatives have also supported habitat protection by reducing bycatch through gear innovations, voluntary area closures, and other methods [27,28]. By coordinating fleet harvesting activities and implementing value-added opportunities in processing and marketing, cooperatives directly support economic goals by increasing revenues and reducing costs [27–29]. Furthermore, cooperatives have supported livelihoods by generating stable employment opportunities in the fisheries sector and, more broadly, by creating and maintaining coastal community infrastructure through joint resources [30].

Table 1

The performance of Cuba's marine fishery sector and the potential contribution of fishery cooperatives to achieving fishery goals.

| Goal | Performance | Potential contribution of fishery cooperatives |
|---|---|---|
| Generate livelihoods | <i>Underperforming</i> – Although the country has a large diversity of fishery resources, the number of Cubans employed directly and indirectly by fisheries is only 0.5% of the national workforce [24]. | Generate stable employment opportunities in the fisheries sector; support coastal community infrastructure |
| Contribute to national food security via steady supply and attainable prices for Cubans | <i>Underperforming</i> – Fishery yields have dropped sharply since the 1970s [24]. Per capita seafood consumption traditionally has been low despite subsidized prices and imports of inexpensive seafood [25]. | Support biological target setting through fisheries science contributions Promote sustainable harvest, including reduced habitat impacts and bycatch |
| Contribute to the national economy through export revenues | <i>Underperforming</i> – Export revenue has declined following the collapse of Cuba's industrial international fleet and declines in valuable domestic stocks. | Promote sustainable harvest Leverage value-added opportunities in processing and marketing |
| Sustain yields over time | <i>Underperforming</i> – Important stocks have declined. | Support biological target setting through fisheries science contributions Promote sustainable harvest, including reduced habitat impacts and bycatch |
| Produce high quality seafood | <i>Good performance</i> – Cuban lobster is regarded in international markets as a high-quality product. | Leverage additional value-added opportunities in processing and marketing |
| Reduce fishing costs | <i>Underperforming</i> – The fishing fleet is overcapitalized. | Coordination to minimize harvest inefficiencies |
| Add value to seafood products | <i>Moderate performance</i> – Cuban lobster is well marketed, but marketing of other products could be improved. | Leverage additional value-added opportunities in processing and marketing |

In Cuba, it is apparent that fishery cooperatives could help improve the performance of the fisheries sector (Table 1). By allowing the co-management of resources and by devolving many of the benefits of fishing to the communities that are most directly involved and dependent on fisheries, cooperatives would create incentives for better resource stewardship. The existence of access rights is a precondition for the co-management of fisheries by cooperatives [31]. Section 3 will discuss the current existence of access rights in Cuba's non-fishery cooperatives, and it will be argued below that this legal right will facilitate the emergence of co-management in Cuba's fisheries.

3. Enabling conditions for successful cooperative co-management

This section focuses on how well the existing governance structure for Cuba's marine fisheries can support fishery co-management by cooperatives. Governance is defined here as the process by which decisions are made and enforced to achieve resource management goals across all scales of government. In fisheries, the effectiveness of governance is related to the distribution of power, rights, roles, and responsibilities throughout the fisheries management system (producers, buyers, processors, managers, and other stakeholders), and in institutions that are not directly related to fisheries but have strong influences nevertheless (e.g., entities that manage coastal and watershed land use and pollution, economic and trade policy, and law enforcement).

The way that different institutions within the governance hierarchy are nested, or interact, with one another (e.g., the degree to which power is shared, and the degree to which institutions are formally recognized by other institutions) also has important impacts on the effectiveness of governance [32]. Theory and experience demonstrate that common pool resource management is most likely to be successful when harvesting and management rights are held by the same entity [33].

Fishery cooperatives have emerged as a means of decentralizing these rights from government institutions to localized, smaller scale entities. When groups of fishermen organized into cooperatives accept rights and responsibilities for managing their fishery, they then hold both harvesting and decision-making power. In many fisheries around the world, fishermen have access and withdrawal rights. The way that these and management, exclusion, and alienation rights¹ are distributed throughout the governance structure drives fishery outcomes [33]. When fishermen hold management rights, they have greater control over fishery outcomes and thus a greater incentive to invest time, effort, and resources to sustain the fishery over time. Exclusion rights strengthen this investment interest by giving fishermen assurance that they will receive the benefits of successful fishery management in the immediate future and long-term. In addition to the above, the right to seek the best prices for fishery products enhances governance by creating incentives for fishermen to manage the fishery in a way that generates long-term profits [34].

The distribution of rights and responsibilities in Cuba's lobster, shrimp, and finfish fisheries were compared with the distribution of rights and responsibilities in three cooperatively managed fisheries in order to discern how the observed differences could

be related to fishery performance. The cooperatively managed fisheries that were investigated were the cooperatives of the FEDECOOP cooperative federation in Baja California, Mexico; the Pescadores de Vigía Chico cooperative in Quintana Roo, Mexico; and the cooperatives that harvest coastal benthic species in Chile (Table 2). In these case studies, the distribution of rights and responsibilities to cooperatives has helped drive responsible fishing practices and management, stabilize or increase yields, drive increases in profits, and support community business opportunities and infrastructure [35–40].

3.1. Access and withdrawal rights

In the Mexican and Chilean examples, fishing cooperatives hold the right to fish in their coastal waters. These rights are conferred through licenses and area-based fishing rights. In the Mexican fisheries, the government has granted twenty-year concessions to the harvesting cooperatives. In the Chilean system, the right to harvest the high-value Chilean abalone, or *loco*, is granted to designated coastal cooperatives for a period of four years. Having a secure right to fish supports livelihoods and gives fishermen a direct interest in the future of their fisheries. In each of these systems, area-based withdrawal rights are granted (and renewed) in exchange for fulfillment of key management responsibilities. Having a secure, long-term right to fish has encouraged FEDECOOP and its members to invest in the future of the fishery by funding and participating in fishery research, enforcing fishery regulations, and improving processing and marketing [39,40]. The Vigía Chico cooperative's long-term concessions have enabled members to invest in fishing gear – thereby ensuring economic support for the community – while also encouraging sustainable fishing practices [35,37]. Tenure over marine space has provided a basis upon which cooperatives in Chile can build business opportunities [36], and they actively participate in managing and enforcing their fishing grounds in exchange for these rights. In Cuba, access and withdrawal rights are held by fishermen within the limits of their sector (industrial and private fisheries). In contrast to the Mexican and Chilean case studies, however, fishermen are not granted long-term withdrawal rights in exchange for co-management functions.

3.2. Management rights

In our case-study fisheries, management rights are decentralized. In all cases, the central government has the right to manage fisheries, but in the examples of the cooperatively-managed fisheries, those rights are extended to the fishery cooperatives in a co-management arrangement (the government is exercising alienation rights). Fishing cooperatives determine where and when to fish, how much to fish, and what resources they dedicate to fishing, which drives efficiency and greater economic returns. For example, FEDECOOP's cooperatives implement gear restrictions and size limits for target species in their concessions. They also coordinate harvest to meet biological and economic goals. FEDECOOP also participates in scientific monitoring and setting biological targets for the lobster fishery [40].

The responsibilities cooperatives accept in a co-management arrangement appear to be important determinants of success, and in the three examples of cooperatively-managed fisheries, the fishermen play a role in meeting fishery goals. The central government devolves management responsibilities to the cooperatives in exchange for the fishing rights they receive. These management responsibilities include regulation of cooperative harvesting activity, scientific monitoring and assessment, biological target-setting, catch accounting, and enforcement of regulations and boundaries. The government holds the cooperatives

¹ Access rights allow entering a defined physical property. Withdrawal rights allow extracting ("withdrawing") a resource (e.g., harvesting fish). Management rights allow regulating use patterns and making improvements to the resource. Exclusion rights allow determining who has an access right, and how that right may be transferred. Alienation rights allow the transfer of management rights from one entity to another (e.g., from the government to a co-management organization).

Table 2
Distribution of rights in Cuban finfish, lobster, and shrimp fisheries and in selected cooperatively-managed fisheries in Mexico and Chile.

| | Cuba, industrial finfish fisheries | Cuba, industrial lobster and shrimp fisheries | Cuba, private commercial fisheries | Mexico, FEDECOOP and Pescadores de Vigía Chico cooperatives | Chile, coastal cooperatives |
|-----------------------------|---|--|---|---|--|
| Access rights | Licensed fishermen have the right to access fishing areas of largest economic importance (i.e., to target lobster, shrimp, and other high-value resources). | Central government allocates exclusive lobster and shrimp fishing areas (delimited fishing territories) to licensed fishermen belonging to local production units of State fishing enterprises | Licensed fishermen have the right to access fishing areas of lesser economic importance. | Cooperatives have the right to access fishing areas. | Central government allocates exclusive fishing areas to cooperatives. |
| Withdrawal rights | Central government owns all fish stocks and fishing vessels. | Central government owns all fish stocks and fishing vessels. | Central government owns all fish stocks, and private fishermen own the fishing vessels. | Cooperatives have the right to harvest specific benthic species. | Cooperatives have the right to harvest specific benthic species. |
| Management rights | Central government maintains the right to set goals and manage fisheries, including setting fishing quotas. | Central government maintains the right to set goals and manage fisheries, including setting fishing quotas. | Central government maintains the right to set goals and manage fisheries, including setting fishing quotas. | Central government maintains the right to set goals and manage fisheries, including setting catch and effort limits; cooperatives have the right to apply additional management measures. | Central government maintains the right to set goals and manage fisheries; cooperatives have the right to apply additional management measures. |
| Exclusion rights | Central government maintains the right to control access. | Fishermen belonging to local production units have <i>de facto</i> exclusive fishing zones, but these are not protected by law. | Central government maintains the right to control access. | Cooperatives have legal rights to exclude non-members from their concession areas. | Cooperatives have legal rights to exclude non-members from their allocated areas. |
| Price-setting rights | Central government has the right to set prices, set quality standards, and control markets. | Central government has the right to set prices, set quality standards, and control markets. | Central government has the right to set prices, set quality standards, and control markets. | Cooperatives have the right to manage product marketing. | Cooperatives have the right to manage product marketing. |

accountable by making renewal contingent upon fulfillment of these duties.

In Mexico, FEDECOOP works closely with the National Fisheries Institute to assess stocks. The cooperatives are responsible for enforcing concession boundaries, ensuring compliance with regulations, and overseeing sustainable harvest of the resources, which includes investing in scientific research [39]. The Vigía Chico cooperative is also responsible for ensuring sustainable harvest within its concession. The cooperative oversees compliance with regulations – such as size limits, closed seasons, and protections for egg-bearing females – and also implements its own fishing rules [37]. In addition, the cooperative has divided the productive areas of its concession into harvesting plots that are assigned to individual members. The members are responsible for extraction and management within their plot.

In the Chilean coastal system, cooperatives formally accept most of the management responsibilities in their fishing area. Cooperatives must hire third party scientists to assess target stocks and set catch limits within the allocated area [36,41]. Cooperatives are responsible for ensuring compliance with catch limits and enforcing fishery regulations within their areas. By accepting these responsibilities, cooperatives have a greater connection to fishery management outcomes and the status of the resource they depend on. They hold themselves accountable for complying with fishery regulations and see the results of responsible management. In addition to productive stocks, they benefit directly from responsible management via industry certification from the Marine Stewardship Council (MSC), eco-tourism opportunities, and community-wide economic benefits [35,39]. By operating at the local level, cooperatives can plan and coordinate harvesting activities to optimize productivity and/or profits.

Fisheries governance in Cuba misses the opportunity to engage fishermen in the management process. Annual management plans inhibit flexibility that would otherwise allow fishermen to help determine when, where, and how to fish based on their knowledge of local conditions. Such prescriptive controls on production

can limit fishermen's ability to deliver a high-quality product and optimize revenue. Furthermore, the Cuban governance system does not make use of fishermen's capacity to participate in biological monitoring and assessment, as the cooperatives in the three case study fisheries have.

3.3. Exclusion rights

A key element of the cooperatively-managed case studies that differs from Cuban fisheries is the decentralization of exclusion rights. In Cuban fisheries, the State maintains the right to control access to fisheries. In the three cooperatively-managed fisheries, cooperatives have a right recognized by the law to exclude outsiders from accessing the resources in their defined fishing areas. These secure, exclusive rights allow them to have a clear stake in the future of their fishery, and conservation behavior is enhanced because of the benefits that it will bring in the future. In addition to leaving fish in the water to support future revenues, cooperatives often invest in the future of their fishery through enforcement and monitoring. They often drive mechanisms to boost fish stocks, such as no-take reserves. For instance, the Isla Natividad cooperative of FEDECOOP has voluntarily set aside 8% of its fishing grounds in no-take reserves [38]. Secure rights also create incentives to invest in community projects in transportation, electricity, and water [40]. Community improvements are also motivated by secure, exclusive rights through a sense of community empowerment [39,42].

Enterprises that target lobster and shrimp in Cuba have exclusive fishing zones allocated by the State. However, these zones were established *de facto* and not through the law; their location and extent were negotiated first among the conflicting fishing fleets that shared extensive fishing grounds, and then among the PFAs [7]. Cuban enterprises targeting finfish do not have exclusive access rights, resulting in a degree of conflict with fishermen from other enterprises fishing in overlapping areas and

increasing the difficulty of monitoring the spatial distribution of catch, assessing stocks, and enforcing regulations [9].

3.4. Price-setting rights

The right to market fishery products affects fishermen's incentives and thereby influences fishery sustainability and product quality [34]. The cooperatives in the case studies are rewarded in the marketplace for sustainable fishing practices. In the Mexican fisheries, cooperatives have worked to improve fishery sustainability to achieve MSC certification, which allows them to differentiate their product in the market. Flexibility in product distribution and marketing allows cooperatives to explore profit-maximizing opportunities; cooperatives have the flexibility to coordinate harvest to deliver products when price are highest and to exert market power by marketing their products collectively [42]. The day-to-day benefits fishermen receive in exchange for their fishing activity directly affect their incentives, and thus a well-designed payment structure can support fishery goals.

A payment system designed by cooperatives can also promote sustainable fishing practices. In the Buzos y Pescadores cooperative of FEDECOOP, for example, fishermen are paid a salary based on their catch, and at the end of the year, a portion of the profits is distributed evenly among cooperative members. This system rewards fishermen for their individual performance but also aligns their incentives with the overall benefit of the group. In Cuba, the central government owns all fish stocks and most of the fishing vessels (excluding the new private fishing sector), and hence retains all rights and responsibilities pertaining to fisheries [9,15,43]. These include the right to set goals and manage fisheries, including the right to control access, set prices, set volume quotas, set quality standards, enforce regulations, and control markets. The Ministry of the Food Industry (MINAL) manages all Cuban fisheries through State-owned enterprises that harvest, process and market fish both locally and internationally.

Because the central government sets production quotas and prices, fishermen have little incentive to reduce fishing costs or increase efficiency in other ways. In order to increase fishing efficiency and productivity, a new payment system was put in place at the end of the 1990s in Cuba. This system, referred to as the "Special Working Contract", is based on the socialist principle of remuneration according to each person's contribution (i.e. fishermen's monthly salaries depend on their productivity during the fishing season) [44]. There are two official currencies in Cuba. Under the Special Working Contract, fishermen receive 80% of the value of their catch in Cuban Pesos (CUP). The remaining 20% is paid in Cuban Convertible Pesos (CUC), which have approximately 25 times the value of CUPs. This payment system creates an incentive to maximize increase fishing landings, but it also reflects the intention to reward fishermen for the arduous and dangerous nature of fishing [45].

In Cuba, industrial fishermen must catch set volumes of fish (quotas set by the State) while complying with regulations (e.g., closed season and size limits), and sell all of their catch to the State enterprises at prices set by the State. Fixed annual per-unit price for the target species are established as an agreement between the fishery authorities and representatives of the enterprises [46]. Private commercial fishermen under contract with the State are required to sell their catch to the State-owned enterprise responsible for marketing seafood (but they can keep the catch that is beyond what is stipulated in contracts). Prices result from negotiations between the private fishermen and the State, often resulting in higher prices than those received by industrial fishermen. Nonetheless, private fishermen complain that prices are fixed and they can't sell their fish legally to other markets. This explains the continued robust black market. Private fishermen also lack

access to motors, boats, gear, and other capital required to maintain a healthy working fleet.

4. Legal feasibility of achieving well-designed cooperatives in Cuba

In a review of the performance of fishery cooperatives worldwide, [23] identified attributes of successful fishery cooperatives. Table 3 presents these attributes and reviews the presence of legal conditions in Cuba that would allow including them in the design of fishery cooperatives.

It can be seen that current Cuban law would facilitate the establishment of cooperatives that meet the majority of conditions for successful design. A notable exception is the lack of legally-sanctioned opportunities for fishermen to engage in the fisheries management, as was discussed above. Conditions related to the characteristics of fishing communities (Table 3), such as the presence of strong leaders and a history of abidance with regulations, varies from place to place in Cuba, as it does in other countries. The Cuban educational system offers a wide range of extension programs in courses related to management, such as accounting, which will benefit the managers of new cooperatives.

5. Lessons from Cuba's experience with agricultural cooperatives

Cooperatives were established as part of a widespread reform and a planned planting of the land immediately following the Cuban Revolution [47]. The first agricultural cooperatives that emerged (*asociaciones campesinas, cooperativas cañeras*) grouped farmers who had received land expropriated from large landholdings. The early days of the Revolution also saw the creation of "credit and service cooperatives" (*cooperativas de créditos y servicios, CCS*), which provided bank credits and joint access to new technologies to farmers who pooled their resources to increase their productive capacity but retained ownership of their land and other means of production. Farming associations received little government support until 1975, when the model of "agrarian production cooperatives" (*cooperativas de producción agropecuaria, CPA*) was created to support farmers who were working cooperatively. Farmers could voluntarily join these cooperatives by ceding the land and equipment that they owned, for which they received a payment and the right to become collectivized workers.

After the collapse of the Soviet bloc in the 1990s and the ensuing economic crisis in Cuba, measures were taken to improve productivity in the agricultural sector. In 1993, a new form of cooperative institution was constituted: the "basic unit of cooperative production" (*unidad básica de producción cooperativa, UBPC*). Large tracts of land owned by State agricultural enterprises were divided into parcels, which were given in indefinite usufruct to workers that began to work the land cooperatively. The new cooperatives were able to purchase agricultural equipment from the State with soft loans and long repayment periods.

Agricultural cooperatives of the types CCS, CPA, and UBPC still exist in Cuba today (approximately 3000, 1000, and 2000 of each type, respectively). The following are some of the main lessons learned from the Cuban experience with UBPCs [47]:

- The obligation to supply a high quota to the State (more than 70% of total production) at low prices (sometimes lower than production costs) has made many UBPCs fail economically.
- UBPCs lack decision-making autonomy; they are subordinated to State enterprises that ultimately decide what to produce,

Table 3

Attributes of successful fishery cooperatives (from [23]), and references to these attributes in Cuban legislation pertaining to non-agricultural cooperatives and fisheries.

| Theme | Attributes | References |
|------------------------|---|--|
| 1. Enabling conditions | <ul style="list-style-type: none"> Streamlined laws and bureaucracies enable the co-management of fisheries by fishing communities. Strong leadership exists in the fishing community. The fishing community holds, or is not legally impeded to hold, property rights or secure fishing privileges. Abidance with fishing regulations traditionally exists within the fishing community. | <p>DL 305 (25), R 427 (12): Cooperatives can set the prices of their products, except in special cases where prices will continue to be determined by the State. D 309 (66.1): Cooperatives can sell their products directly to markets, without intermediaries, after meeting their obligations to the State. DL 305 (7): Cooperatives can lease State property for renewable periods of 10 years. D 309 (51): Cooperatives that repair property leased from the State are exempt from the lease for one year. R 427 (11): New cooperatives are exempt from all taxes for the first three months. R 570 (Special Provision 4): State enterprises can provide assistance in accounting and other services to cooperatives that are established to assume their management. R 427 (2): Cooperatives that sell agricultural and animal food products are exempt from paying sales taxes. R 427 (13): Cooperatives are able to purchase goods from retail markets at discounted prices (but at higher prices than in wholesale markets).</p> <p>DL 164 (13, 15)^a A fishing concession is one form of fishing authorization that can be granted by the State to natural and legal persons.</p> |
| 2. Origins | <ul style="list-style-type: none"> A perceived common benefit from cooperation exists, which galvanizes cooperation. Fishermen are invested in the cooperative since its onset. | <p>DL 305 (4, 23), DL 309 (29): All members of cooperatives are required to contribute with labor. DL 306 (1): A special program of social security is established for members of non-agricultural cooperatives who do not receive benefits from the general social security system. DL 306 (3) Members of cooperatives are required to participate in, and contribute to, the social security program.</p> |
| 3. Goals | <ul style="list-style-type: none"> Cooperatives hold themselves accountable, or are held accountable by other parties, to science-based conservation and socioeconomic goals. Local knowledge is used to articulate appropriate conservation and management goals and to enhance the scientific understanding of resource status. | <p>DL 305 (4): Members of cooperatives are aware of, and comply with, regulations that regulate their economic activity.</p> |

| | | |
|-----------------------------------|--|---|
| 4. Membership | <ul style="list-style-type: none"> ● Cooperative members are closely tied to the fishery, and are willing and able to participate in decision-making. | <p>DL 305 (4): Decisions that impact the social and economic conditions of cooperatives are made democratically by their members.</p> <p>DL 305 (17.3): All members are part of cooperative's General Assembly, which elects the cooperative's managing body.</p> <p>DL 309 (28): All members of the cooperative have the right to run for an elected post in the managing body.</p> <p>DL 305 (10.1), DL 309 (23): Cooperatives created to assume the management of enterprises managed by the State will give preference to the enterprises' workers in becoming founding members of the cooperative.</p> |
| 5. Administration | <ul style="list-style-type: none"> ● Administration of cooperatives is based on traditional, successful models. ● Training in administration is available for cooperative members. | <p>DL 309 (20): Cooperative statutes can determine the minimum and maximum number of members and the guidelines for cooperative administration.</p> |
| 6. Sources of capital | <ul style="list-style-type: none"> ● Members contribute labor or capital to the cooperative. ● Cooperatives have access to external sources of capital. However, there is no financial dependence on government subsidies. | <p>DL 305 (4, 23): All members of cooperatives are required to contribute with labor.</p> <p>DL 305 (21.2): Initial working capital for cooperatives is established by contributions from members and bank credits.</p> <p>DL 305 (Final Provision 3), R 427 (24): The Ministry of Finance will create a fund to finance the initial working capital and the purchase of goods by cooperatives that are not able to procure bank credits.</p> |
| 7. Incentives for rule compliance | <ul style="list-style-type: none"> ● Cooperatives create incentives (profit-sharing and/or penalties) that enhance compliance with internal rules. | <p>DL 305 (4): Profits of cooperatives are distributed according to members' contribution to labor.</p> <p>DL 309 (21): Cooperative statutes can determine the scheme for profit sharing according to members' contribution to labor in relation to the quantity, quality, and complexity of work.</p> <p>DL 309 (29): Members must comply with the cooperative's disciplinary system.</p> <p>DL 309 (20, 68): Cooperative statutes determine the rights and obligations of members and establish causes for sanctions and expulsion from the cooperative.</p> |

DL=Decree-Law; D=Decree; R=Resolution. See text for details on the different regulations. Article numbers are in parenthesis. Attributes in bold type are characteristics of fishing communities that increase the likelihood of success of cooperatives, and their presence does not depend on existing legislation.

^a At the writing of this paper, MINAL was drafting a new policy to replace Decree-Law 164 of 1996, which is the current "Law of Fisheries".

whom to sell to and at what price, the types and quantities of agricultural inputs allocated to each UBPC, and what types of investments to make.

- There is limited access of UBPCs to the private agricultural market (*mercado libre agropecuario*).
- Production inputs are assigned by the State, and there are no markets for purchasing inputs directly.
- Profits from sales are not distributed to cooperative members (in contrast to CCSs and CPAs), which limits the incentives for production.

CCSs are the most productive type of cooperatives because they provide a sense of ownership to their members and have more autonomy for self-management than the other cooperative types [47]. Despite their relative success, excessive State control has encumbered the management of CCSs. Each cooperative is required to provide and manage the transportation and sale of products, and the purchase of inputs. The new regulations on cooperatives can in principle alleviate this financial and managerial burden; new transportation and commercialization cooperatives can be formed that offer their services to CCSs, which can focus their resources on production.

Using this model of specialization, State fishery enterprises could gradually convert to cooperatively-managed operations that could increase economic efficiency. *Combinado Pesquero Industrial La Coloma*, the largest fishing enterprise in Cuba, produces approximately 40% of the country's export earnings for seafood [48]. Its industrial complex comprises ports in the southwestern town of La Coloma (Fig. 1) and neighboring villages, and also contains a fish processing plant and a shipyard. In recent years, maintaining the aging fishing fleet has drawn excessively from the enterprise's resources, and a large number of boats are in need of repair and idle. A system of specialized cooperatives could manage the different industrial components in a more efficient manner. A cooperative of shipwrights, for example, could be formed to provide skilled services to La Coloma and other enterprises. At the same time, a harvesting cooperative made up of experienced fishermen could concentrate on sustainability and quality – two conditions for maintaining a stable flow of exports.

6. Conclusions

This analysis suggests that there may be a role for fishery cooperatives in achieving biological, economic, and social goals for Cuban fisheries. The central government holds almost all of the rights relevant to the fishery sector and hence is almost solely responsible for achieving all fishery objectives, defining the social contract between the central government and the people of Cuba. Although Cuba's current "Law of Fisheries" (Decree Law 164 of 1996) allows fishing concessions to be granted by the State to natural and legal persons, this paper suggests that the devolution of other rights and responsibilities to fishery cooperatives would likely improve the performance of Cuban fisheries with respect to national fishery objectives. This includes the right to set prices for fishery products based on demand. The specific design of cooperatives also will be critical to success [23,26], and it should include using local knowledge in co-management functions such as the setting of fishing quotas and defining fishery rebuilding areas.

The experience gained from cooperativism in the Cuban agricultural sector, where cooperatives have existed from prior to the Cuban Revolution, will be invaluable for extending cooperatives to marine fisheries. The importance that food security has in Cuba's new economic model is already being reflected in new regulations aimed at addressing the problems of agricultural cooperatives

discussed above. Decree 318, published by the Council of Ministers in November 2013, allows farmers, cooperatives, and state-run farms in three of the country's provinces (La Habana, Artemisa, and Mayabeque) to sell produce in any quantity and to any person after meeting State contracts, thus by-passing previous regulations on how much could be sold, and to whom. In addition, large consumers such as State enterprises and private restaurants will now be able to purchase wholesale produce directly from private farmers and cooperatives. Furthermore, State-run wholesale and retail markets can now be leased to cooperatives that are created for that purpose. The Decree is experimental in nature, and the expansion of its provisions to the rest of the country will be contingent on the results obtained in the three provinces.

This effort to improve the performance of cooperatives based on the country's experiences, including allowing cooperatively-managed sectors of the economy to gain more independence, will also be a crucial factor for the success of cooperatives in the fisheries sector. Especially important will be to continue awarding exclusive rights to the fisheries that have benefited from them (lobster and shrimp industrial fisheries), and to create exclusive rights in finfish fisheries, where the lack of these rights has resulted in conflicts. With the expectation that fisheries will play an important role in achieving the goals of Cuban economic policy; the government's concern in improving the efficiency of the food sector in general; and the renewed attention that non-traditional cooperatives are receiving in Cuba as potential economic drivers, it is anticipated that fishery cooperatives will be formed under the new regulations that allow the establishment of non-agricultural cooperatives. Considering the factors that have led to success of fishery cooperatives in other countries, it will be important to support especially the creation of fishery cooperatives in places that have a history of responsible fishing and strong local leadership.

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