Decision-making in the Campeche Octopus maya fishery in two fishing communities

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Abstract
Decision-making in fisheries, particularly those involving capture, is a vital moment for participants. Fishers weigh their options while considering factors such as the environment, economy, resource availability, sociocultural environment, ability, and preferred method/gear. Eventually, the decision will be to resort to illegal and/or undeclared practices, which can affect common-pool resources. Octopus maya is an immense common-pool resource off the coast of the state of Campeche, Mexico, which could become unsustainable if current illegal and undeclared practices continue. Synchronic and diachronic perspectives were applied with methods such as the following: revision of the legal and sociodemographic dimensions, design of an ethnographic questionnaire applied in 2006 and 2016, and recording of biological parameters for landed specimens. In response to constant and increasing market demand for marine products, decisions were made to employ illegal and undeclared practices to maximize profits. The practice of diving for O. maya capture boosted production by increasing the biomass landed per boat while requiring half the time investment and lower fuel costs. Catch biological data clearly indicated the use of illegal practices, with sizes below the authorized minimum size (mantle length, 110 mm) and the presence of spent females. Questionnaire data suggested that each community behaved in their own way and established its own local decision-making systems while considering socioeconomic risk and market demands. Sustainable management of the Campeche O. maya fishery will require greater data transparency and fluidity between government institutions and fishers, negotiation of compliance with current regulations, and more effective legal enforcement of them.

Keywords Fishing · Octopus · Illegal · Undeclared · Mexico

Introduction
Fishers have a toolkit of options they use in decision-making to optimize economic yields from the extraction of common-pool resources (CPRs). These resources represent a set of situations in which individuals are involved in decision-making that generates a sum of events (Ostrom et al. 1994).

When many social actors are implicated in economic activities linked to CPR extraction, those involved are collectively affected in the decision-making process and its consequences. It is essential to distinguish between the resource system, the resource unit flow produced by the system, and their interdependence (Ostrom 1990; Pascual 1996; Ostrom 2009; Kooiman et al. 2005).

Consensual collective actions are beneficial to CPR extraction-related economic activity, although to attain consensus communities’ socioeconomic surroundings must be known and understood (Ostrom et al. 1999; Degnbol and McCay 2006; Pomeroy 2011). Research addressing the behavior of CPR users is generally placed within the “tragedy of the commons” scheme (Acheson 2014; Acheson 2015) or applies game theory and the prisoner dilemma to model territorial changes and the presence/absence of cooperation among actors. As a social and economic group, fishers normally have their activity symbolized as a “tragedy of the commons,” frequently confused with the use of open-access resources.
On the Yucatan Peninsula, Mexico, the Octopus maya fishery is a very important fishery resource subject to the socioeconomic conditions of the regional fisher population. Many involved in the shore and small-scale fisheries opt to use illegal and undeclared practices, raising the questions of what decisions drive them to adopt these practices? How does social diversity in coastal communities affect these decisions? And do fishers consider immediate, short-term financial gain to be the most important factor when making these decisions? The present study objective was to identify the relationship between socioeconomic and biological variables, and how these affect the decisions that lead fishers to engage in illegal and undeclared capture.

Materials and methods

Very few studies have addressed O. maya biology in the Gulf of Mexico, and the socioeconomic and institutional elements that affect the fishery, including aspects of illegal and undeclared capture. Based on the CPR concept (Ostrom et al. 1999), analyses of legal and biological dimensions related to O. maya were included in the present study. Fishery, socioeconomic, and biological behavior associated with O. maya were studied in two communities in the state of Campeche, Mexico, using a combined synchronic/diachronic approach. A temporal axis was included in the selection of indicators in the years 2006 and 2016, comprising the synchronic aspect of the study, and responses and catches were compared between the two communities. The research is based on two ethnographic moments when questionnaires were applied based on measured variables and behavior in the O. maya fishery. To provide a broad panorama of the process, the etic (observation from the researcher’s perspective) and emic (observation from the interviewers or subjects’ perspective) were constantly monitored in both the synchronic and diachronic perspectives (Harris 1976). Questionnaire results were used to select two small-scale fishing communities: one was a highly committed no-risk community (Isla Arena) (Beck 2013; Huchim-Lara et al. 2016) while the other was under risk and included capitalization even when making risky decisions (Villa Madero) (FAO 2002; Berkes 2008). The categories of risky communities were derived after our fieldworks and it is a proxy exploration. The former (IA) takes advantages to conservation activities to sustain the daily lives, same we noticed the increasing illegal activities and the later, VM met more illegal fishing activities like a form to take advantage in decision-making.

Research design

Analysis was done of data collected from questionnaires applied to a sample of the population and from fishing records (Ponce-Díaz et al. 2013). As a qualitative method, the
questionnaire model was used to collect data on catch methods and changes over time. A total of 104 questionnaires were applied: 78 in 2006 and 26 in 2016 (all related to the 2006 questionnaire round). The size of the sample was selected by a non-probabilistic method (Pérez Tejada 2008). Items were organized by domains under a mixed questionnaire scheme, with some closed items (verbal protocol comparative scale) and some open items (García 2003). The social organization level is not relevant in our discussion because the main technique utilized (questionnaire) was applied selecting fishers individually in a horizon time (two fishing seasons, 2006 and 2016) and looking for the know-how techniques, and fishing methods. In the section of maturity and catch analysis was done with two season data (2005 and 2006).

**Legal and social dimensions of O. maya capture**

Octopus is one of the most significant fisheries in Mexico; it is 11th in terms of volume but fourth in terms of monetary value. On the country’s Gulf of Mexico and Caribbean Sea coasts, it is the most important fishery in terms of volume and the second in terms of value. It is among the largest octopod fisheries in the world. Fishing activity in the state of Campeche is diverse and complex, and involves large numbers of fishers. Normally, approximately 12,000 fishers work along the state’s coast. However, during octopus season, an additional 10,000 fishers join the activity, many from inland locations and even from other states (e.g., Tabasco, Chiapas, Yucatan, and Veracruz).

Regulation of the O. maya fishery began in 1993 with federal regulation NOM-008-PESC-1993 (SEPESCA 1993). Over time, this has been modified, and the current applicable regulation is NOM-008-SAG/PESC-2015 (SAGARPA 2016). This regulates fishing gear (gareteo), vessel type (small vessels along the Campeche coast, 10 m), minimum permissible organism size (mantle length, 110 mm), and permit holder administrative responsibilities (catch records, periodic submission to fisheries authorities, notice of arrival per trip, and providing data to monitors). It also includes clear prohibitions: use of stone crab *Menippe mercenaria* or terrestrial organisms as bait is not permitted; the same holds for use of unauthorized fishing gear and methods, use of explosives, and omitting/falsifying data. In this zone (Yucatan Peninsula and Caribbean Sea), closed season for O. maya normally extends from 16 December to 31 July (NOM-009-PESC-1993, SEPESCA 1994). The most widely used and only permitted fishing gear in the Campeche O. maya fishery is known as gareteo. It is unique to the region, selective and sustainable, resulting in no incidental capture. Fishers also use their knowledge of the species’ feeding habits. Illegal practices such as diving, closed season harvest, and taking of undersize individuals or spent females are increasingly used.

Six communities in Campeche have been reported as participating in commercial O. maya capture: Sabancuy, Champoton, Villa Madero, Seybaplaya, Lerma-Campeche, and Isla Arena (Solís et al. 1999; Arreguín et al. 2000; Markaida et al. 2017). The communities of Isla Arena and Villa Madero were included in the present study (Fig. 1). Isla Arena (IA) is located in the northern extreme of the state of Campeche and is inside the Ría Celestún Biosphere Reserve (a federal natural protected area administered from Celestún in the state of Yucatan). Its 754 inhabitants live in a moderate degree of marginalization. Villa Madero (VM) is in the municipality of Champoton, south of the capital city of Campeche, and is not officially considered a fishing port (SEDESOL 2010). Its 3954 inhabitants live in a high degree of marginalization (the degree of marginalization is based on SEDESOL (Social Development Ministry 2010) taking into account mainly the education proficiency, health access, salaries minimum, sanitary water, and lodging access).

**O. maya biology: maturity and catch size**

Endemic to the waters west and north of the Yucatan Peninsula (Voss and Solís 1966), O. maya has a reproductive period spanning from November to February, with peak reproductive activity in November and December (Solís et al. 1999; Arreguín et al. 2000). The open season (1 August–15 December) overlaps with a portion of this period, although most of it is nominally within the closed season (16 December–31 July) (Solís et al. 1999). During this period, female O. maya deposits fertilized eggs in a cave or other refuge, which they then guard to ventilate the nest and prevent predators from entering (Solís et al. 1999). The females do not feed during this period and are therefore not susceptible to capture with legal methods, although they are exposed to illegal methods.

For the purposes of the present study, O. maya capture was defined as furtive if it involved illegal methods and/or occurred during the closed season. Illegal capture was defined as the catching of individuals smaller than the legal minimum size based on mantle length (ML = 110 mm) or spent females. A total of 4269 organisms were sampled that had been collected from landings in the 2005 and 2006 seasons. Individuals were chosen randomly for the meristic sample, in an effort to include all sizes and maturity stages. Mantle length (ML) was measured, sex confirmed by visual identification of the gonads (S), and sexual maturity stage (SMS) indicated based on an established O. maya maturation scale (Guerra and Manriquez 1980; Arkhipkin 1992; Jiménez-Badillo et al. 2008). Furtive capture was quantified using the percentage of landed spent females as an indicator under the understanding that spent females can only be captured
using the illegal practice of diving. Illegal and furtive capture was also measured using a combination of SMS, ML, and percentage of spent females.

Statistics

Data were analyzed with confidence intervals (95%) for means with $Z$ and $F$, and a one-way ANOVA (Zar 2009). Analyses were run with the Excel ver. 1703 and IBM SPSS Statistics ver. 23 programs. The size of the sample of the questionnaire follows up a non probabilistic currently method known as snowball or chain of selecting informants (Pérez Tejada 2008). This method has the opportunity to collect information in the underground economy or informal activities that are impossible to collect in official institutions because are considered not habitual, same if the informants are in a collaborative networking with other groups. The approach is complicated when arrives the fieldwork, the veracity of the answers by the side of the users required a constant monitoring using qualitative methods. The researcher needs a good capacity for the techniques and to apply good questions.

Results

In an effort to interconnect the results with the synchronic and diachronic focuses used in the study, the results are presented by dimension, starting with official reports, and followed by social parameters, economic parameters, and finally biological catch data.

Fishing activity and O. maya catch in Campeche

To regulate O. maya catch in the waters of the Yucatan Peninsula, the Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación SAGARPA (2014) fixed permissible catch quotas at 10,500 t in 2005 (7206 t caught) and 11,270 t in 2006 (10,138 t caught). Campeche’s 523 km of coast experience intense fishing activity, with annual production ranging from 40,000 to 56,000 t annually. Relative to national fisheries production, the state is the eighth largest producer by volume and the sixth by value; octopus is the state’s largest fishery. The commercial value of Campeche’s fishing production has increased over time,
surpassing MXP$1,063,184 in 2012 (USD$70,879); *O. maya* accounted for 27% of this total. Annual volume of the *O. maya* fishery in Campeche between 1997 and 2013 fluctuated, with peaks in 2001, 2006, and 2012 (this was a historically high catch of 9614 t) (CONAPESCA 2013). Frequently, the researchers need to work in the absence of data transparency. Mexico improved this mechanism by law but there is not guarantee to have the corresponding statistical way.

**Demography and economy in decision-making in the *O. maya* fishery**

Octopus capture in Campeche is limited to *O. maya*. It can only be fished by small-scale vessel of which there were 3776 active and registered in 2013. The *O. maya* fishery is organized into production units in the form of fishing cooperatives (255) as well as other forms of social organization (144) (CONAPESCA 2013). Decision-making is vital within the organizational levels of the fishery (e.g., cooperatives, families, vessels) given the immense diversity of choices implied by the knowledge, skills, abilities, and other attributes, such as success and risk management, assumed by participating fishers. As part of this process, fishers function in one or more roles (at times switching between them). These roles follow an ascending hierarchy of approximately five levels: apprentice, loader (*alijero*; fisher on a personal, smaller boat), vessel captain (or one who accompanies a larger vessel), permit holder (financed fisher, company owner), and other (based on interviews, these include divers and intermediaries known as “coyotes”). In this hierarchy, the *alijero* and vessel captain obtained the same benefits from the catch, although the *alijero* had less responsibility. “Others” included those engaged in illegal and undeclared fishing, such as divers, off-season fishers, and coyotes.

During the two seasons included in the study, fisher age fell within a confidence interval of 38 to 43 years (*F* = 1.389, *p* = 0.241, nsd). Use of fishing methods changed over the 10 years between the first and second data collections, with increased use of diving and a mixed strategy (*gareteo/diving*) (Fig. 2). Those who used *gareteo* had an average of 21 years’ experience while those using diving had 11 years. At both study locations, the use of a mixed strategy was only reported in the 2016 season, and those who used it had an average of 27 years’ experience (Table 1). During the 2006 season, most of the interviewees (92%) in both communities stated they used *gareteo* and 2% decided not to respond. By 2016, the percentage stating they used only *gareteo* dropped to 73%, while 23% admitted to using a mixed strategy (*diving/gareteo*), and 4% used only diving. In 2006, only two *alijeros* (20 and 32 years of age) admitted to using diving. In 2016, fisher age ranged from 26 to 67, regardless of activity.

Different *O. maya* fishing strategies required varying investments in fuel and time. For example, diving used an average of 85 l/day of fuel while a mixed strategy used 71 l/day and *gareteo* 39 l/day (sd, *F* = 4.701, *p* = 0.004). The distance covered also changed according to strategy: diving, □ = 22 km (CI = 1–250, *p* = 0.05); *gareteo*, □ = 29 km (CI = 19–39, *p* = 0.05); and mixed, □ = 56 km (CI = 1–132, *p* = 0.05).

Bait species and costs were different at each community. The preferred bait species at IA were *Libinia emarginata* (spider crab) and *Rhithropanopeus harrisii* (mud crab), whereas at VM, *Callinectes sapidus* (blue crab) was preferred. At both locations, bait was supplied through the local market (50%), brought from other states (45%), and caught directly when possible (5%). Both bait costs and the required investment for the catch were higher at IA than VM (Table 1).

Investment in boats and motors was higher in 2016 than in 2006 at both communities. In contrast, the cost of poles at VM increased minimally because fishers planned ahead for losses from movement and speed by purchasing six to eight units per vessel (Table 1). In 2006, 60% of the interviewed fishers used

![Fig. 2](https://example.com/fig2.png) **Years of fisher experience in *O. maya* fishery, by community and catch season with the fishing method (mixed, *gareteo*, diving, and not answer (NR); source, data from fieldwork)**
GPS and radios, and in 2016, this had increased to 90%. Some fishers at IA had the additional expense of transport from nearby inland towns (e.g., Tancuche, Santa Cruz, San Antonio Siho, Pucnachen, and Halacho).

**Fisher perspectives about fishing activity**

Additional questionnaire items addressed organization of the fishing activity and its relationship with the authorities. On the permitting process, 50% of interviewed fishers stated that the process was slow and 60% observed corruption in the system. For 40% of the interviewees, the main problem in the *O. maya* fishery was predation, 30% did not respond, 20% believed it to be a lack of agreements, and 10% provided multiple answers blaming the authorities. When asked how well their community honored the closed season, 40% in IA said their community did so, while in VM only 10% said they did. Notably, 58% chose not to respond when asked about their personal honoring of the closed season. Items addressing resource management showed 79% thought not enough measures were implemented to protect the species and minimize the impact of illegal and furtive capture. Proposals for better management mainly (55%) focused on coordination with the authorities, 10% mentioned negotiation of applicable rules, 8% made more radical proposals, 5% proposed new prohibitions, and 22% did not respond. As far as how the resource would respond if barely sustainable practices were to continue, 40% believed it would become exhausted over the medium to long term, 23% thought it would remain unchanged, 19% were not sure what would happen over time, and 18% did not respond.

**Maturity and catch size analysis**

Taking into account two seasons (2005 and 2006) from an *O. Maya* sample analyzing maturity and catch size, the later showed 38% of the landed individuals to be immature (*n* = 1618; ML = 96–97 mm; *p* = 0.05), 24% to be maturing (*n* = 1011; ML = 105–107 mm; *p* = 0.05), 38% to be mature (*n* = 1615; ML = 112–113 mm; *p* = 0.05), and 1% to be spent (*n* = 25; ML = 109–120 mm; *p* = 0.05). Clearly, 39% of the catch consisted of individuals outside the official size range (i.e., immature individuals and spent females); the remaining 60% were of legal size (i.e., maturing and mature). In the 2005 and 2006 seasons, over 50% of the catch was not of legal size regarding the Official Mexican Rule (NOM-008-SAG/PESC-2015; SAGARPA 2016), meaning the fishers in both communities had made decisions to use illegal techniques (Fig. 3). Spent females were recorded only at VM. Only in the month of November did all catches fall within the official size range.

**Discussion**

Use of the diachronic dimension in the present results highlights the economic and sociocultural importance of the *O. maya* fishery. The synchronic dimension reflects the fishers’ decision-making process and the consequently greater pressure it has placed on fishery resources.

Official data for legal *O. maya* catch in the state of Campeche indicate that it has increased over time, with peaks approximately every 6 years. These data obviously do not reflect the reality of this fishery’s commercial chain, in which legal and illegal fishing practices are combined to produce a generally financially successful result. This in turn allows the country, the state, and even individuals to justify these economic riches while sidestepping the impacts this de facto overfishing will have on the resource’s sustainability and its associated consequences in the communities that depend on it. Combining legal and illegal practices makes sense to permit holders as an overall approach to maximizing profits. It is a clear decision for them to add additional fishers since the same strategy is applied by the other permit holders sharing the
As Larkin (1977:6) states: “...what prevails is the market of money as unlimited profit...”

A major challenge with illegal fishing is its complex, diffuse nature, and the lack of transparency in the markets for fishing-related inputs and resources (Bórquez et al. 2009; Ballesteros and Rodriguez-Rodriguez 2018). It also mobilizes immense amounts of money across the globe. Large markets like the USA, Russia, China, and Japan establish prices and demand in response to consumption levels; illegal fishing practices are also deeply rooted in their fisheries (Pramod et al. 2014). What portion illegal fishing constitutes of fisheries varies by country and fishery. For instance, overall illegal and undeclared fishing is over 40% of legal fishing levels (Agnew et al. 2009). In the USA, conservative statistics indicate that illegal and undeclared catch represented from 20 to 32% of fishery products in 2011 (Pramod et al. 2014). On the Pacific Coast of Mexico, illegally caught abalone represents 27% of the commercial catch, and the illegal lobster catch is 5% of the commercial catch (Ponce-Díaz et al. 2013). In the current results, interview responses were used to calculate the production of furtive practices at 8%, whereas the biological data (i.e., immature and below-minimum size individuals and spent females) showed illegal practices to produce 39% of the catch. This discrepancy between declared and actual illegal catch levels, and incomplete and/or untrustworthy fishery data, highlights the difficulties of applying any kind of participatory social action proposal.

To understand the environment that social agents in this fishery consider when making decisions, the factors identified as most relevant in this process were fisher and permit holder age, years of experience, role in the activity, and financial profit.

In Isla Arenas (IA), fishers entered the activity within a narrower age range, largely young adults of productive age, and a very few elderly people. Fishers in VM, in contrast were of a much broader age range, including many of parenting age.

Younger permit holders were more likely to promote unsustainable practices such as diving, illegal gear, and closed season harvest, and to focus on immediate financial gain. Boat captains in VM had more years of experience than those in IA, while permit holders in IA had more experience than their counterparts in VM. There was also a generation gap between fishers 25 to 39 years of age and those 60 to 64 years of age. This is important because the different generations expressed different perceptions of resource management and fishing gear; for example, divers were younger. Another example is that VM permit holders, who control the local market, have participated in this fishery for less time and are younger than those in IA, and they therefore tend to take more risks (Huchim-Lara et al. 2016). Accelerated, competitive, and neoliberal production practices have made fishing into a social risk production activity (Beck 2013; Vázquez 2006; Korstanje 2010). Fishers weigh economic, environmental, cultural, and social factors when deciding which fishing technique (and variations thereof) to apply. Decisions are made based on the known risk assumed with the use of illegal and/or controlled methods, and the goal of immediate economic gain.

Financial criteria were also included in decision-making. Prior investment and bait costs were higher in IA, whereas fuel costs and distance from the coast were higher at VM. Divers required investments less than a quarter of those made by those using gareto.

Diversification and intensification were adaptive strategies adopted by fishers in response to process intensity. Diversifying the ways to solve or confront an environmental problem was applied as a “diffusion of risk” that broadened the alternatives for facing the environmental process. Intensifying the use of new (albeit illegal) strategies helped to compensate for the risk effect through investment (Beck 2013; Korstanje 2010).

The fishers of each studied community expressed different visions of the CPR. A protectionist discourse including a self-monitoring agreement prevailed in IA, although they were unable to prevent illegal or furtive catch by other fishers.
especially those they subcontracted from nearby communities. In VM, the fishers approached the resource as a prospect for immediate financial gain.

Fisher perspectives of official corruption in the fisheries sector are at least partially justified given the absence of data transparency. In a recent study, the data produced by the National Fisheries Commission (Comisión Nacional de Pesca (CONAPESCA)) were found to be inadequate to evaluate its management of fishing rights, subsidies, and inspection/monitoring (Hayashida et al. 2016). Particularly in terms of inspection/monitoring the CONAPESCA does not have consolidated data on its activities.

The interviewed fishers were generally aware of the decline in the O. maya fishery. However, they opted to depersonalize it, deny responsibility for their actions and their consequences, and blame the authorities. As an economic activity, the O. maya fishery (legal + illegal + furtive + undeclared) functions within a scheme of communities at risk; that is, an activity can be carried out and continued without taking personal responsibility for it (Beck 2013; Huchim et al. 2016). This is exacerbated by the general perception of official corruption in the sector. In VM, the fishers acknowledged that they did not honor the closed season and had decided to give more weight to financial criteria than sustainable use criteria. Those at IA, in contrast, maintained that they tended to give more weight to following sustainable use criteria.

Federal fishing authorities have continued to use arbitrary annual catch limits. Illegal fishing practices result in real catch statistics that clearly differ from official numbers, making government studies and reports a flimsy baseline from which to try control the O. maya fishery. Since official data does not reflect reality and is thus untrustworthy, and because accurate information based on landings is not collected, establishing management plans and programs, for O. maya or any other species, becomes a very complex venture (Arbex 2006).

If the environmental problem or process is solved or improved, or conditions change for the better, use of the present strategies in this CPR will incur lower economic, social, and biological costs for the system. In contrast, if the negative processes in this environmental process remain unchanged or worsen, the strategies will become more exposed and could collapse the system, leaving a thin margin for resilience (Walker et al. 2004).

In communities, decision-making melds with individuals’ identification of the territory, which, in conjunction with time, allows reappropriation of CPRs and nature. Over time and in a given territory, tradition and modernity fuse within local structures, favoring the resilience of social groups (Leff 2005). Although the interweaving of social, cultural, and economic aspects in the O. maya fishery is extremely complex, social actors in both the studied communities expressed interest in co-management proposals for this vital CPR. This is important because, as stated in Ostrom’s (2009) collective action theory and social theory, CPRs are more likely to be better managed if certain conditions are present: user access to accurate, trustworthy opportune data; user acceptance of reciprocal responsibility; clear regulations and rules; and monitoring and fulfillment supervised by the social actors involved (García and Fonseca 2011). Research and community coastal resource management proposals are the best means towards a social-territorial governance that guarantees fisher well-being.

**Conclusions**

Current regulations in the Campeche O. maya fishery drive fishers to make decisions that intensify exploitation levels and thus temporarily increase profit margins for those who continue fishing. The intent of these regulations is to prevent overcapitalization in the sector, assuming savings in investment towards capital that would be surplus. However, this situation produces extraordinary profits, constantly increasing pressure for new actors to enter the sector and leading to continuous social and political pressure to ignore imposed limits. It also generates strong social, economic, and environmental pressure without improving the fishery and diminishes CPR availability. Illegal and furtive fishing practices are the logical response to this situation as is increasing corruption in regulatory institutions.

Illegal, furtive, and undeclared fishing will continue to be considered options in the O. maya fishery as long as massive extraction for financial gain is promoted, and no effort is made to begin negotiations to reach coastal management agreements in every affected community while legal instruments are reinforced. Agreements need to consider official regulations, species biology, and community sociocultural context. Fishing communities establish their own regulatory institutions and profits are managed by permit holders, who have been bypassed in co-management plans in Mexico. In the dynamic of illegal/furtive/undeclared fishing, fishers (as wage earners) require more attention than investors/capitalists (i.e., intermediaries/permit holders); the latter must manage the pressure for immediate financial gain generated by international markets.

Greater data flow at all levels of the fisheries sector is needed to promote empowerment of the involved social actors while also assigning them specific responsibilities and actions in their communities. This is increasingly important since these same social actors understand that prioritizing economic values over CPR sustainability over the medium term will lead to collapse of Campeche’s most significant fishery.

On an academic level, holistic research is needed in Mexico to better understand the fisheries sector and participate in the joint search for solutions. Further study is also needed.
on how the *O. maya* stock is affected by decisions to engage in illegal/furtive/undeclared fishing practices. The lens of implementation of SSF-FAO (Small-scale fisheries Food and Agriculture Organization) Guidelines will be needed in this kind of studies and we need for the future perspective about Campeche fishing communities a governance and governability analysis (Kooiman et al. 2005). This article keeps one dimension of the fisher behavior and decision-making, where they decided to go out to capture commercial species like the *O. Maya*. The fishers manage economic advantages searching better technologies that they buy sometime with money comes from illegal activities. They need to go far reaching target species. Market is the voice of the fishers, the state control remains in the last corner of the world, and fishing cooperatives are now fragmented and almost collapsing in a private sector that only profits are the main voices (Sommers González 2007). By the side of the profits from the captures are managed by the holders of fishing permits (target species). Sometimes, the fishing communities establish their own regulatory mechanisms as users with customs.

We need more ethnographic studies in the world like Ballesteros and Rodríguez-Rodríguez in Galicia, Spain (2018), Bórquez et al. (2009), and Ponce-Díaz et al. (2013). Finally, this article is an incentive for students and researchers looking for human-fishing interaction or ecosystem approach in fisheries.

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