El Colegio de la Frontera Sur

Relaciones entre actores sociales en espacios marinos compartidos pesca-petróleo: Costa de Tabasco

Tesis

presentada como requisito parcial para optar al grado de
Maestra en Ciencias en Ecología y Desarrollo Sustentable
Con orientación en Manejo y Conservación
de Recursos Naturales

Por

Carolina Citlali Salazar de la Cruz

2019

El Colegio de la Frontera Sur

Lerma, San Francisco de Campeche, 24 de junio de 2019.

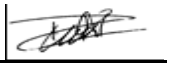
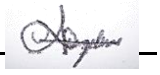
Las personas abajo firmantes, miembros del jurado examinador de:

Carolina Citlali Salazar de la Cruz

hacemos constar que hemos revisado y aprobado la tesis titulada

"Relaciones entre actores sociales en espacios marinos compartidos pesca-petróleo: Costa de Tabasco"

para obtener el grado de **Maestra en Ciencias en Recursos Naturales y Desarrollo Rural**

	Nombre	Firma
Director	Dr. Alejandro Espinoza Tenorio	
Codirector	Dr. José Alberto Zepeda Domínguez	
Asesora	Dra. Dora Elia Ramos Muñoz	
Sinodal adicional	Dr. Juan Carlos Pérez Jiménez	
Sinodal adicional	Dra. Claudia María Monzón Alvarado	
Sinodal adicional	Dra. Dolores Ofelia Molina Rosales	
Sinodal suplente	M. C. Angelina del Carmen Peña Puch	

Dedicatoria y agradecimientos

Al Colegio de la Frontera Sur (ECOSUR) por la oportunidad de formar parte de su programa de Maestría en Recursos Naturales y Desarrollo Rural y al Consejo Nacional de Ciencia y Tecnología (CONACYT) por el apoyo brindado en la realización de mis estudios de posgrado a través de una beca de maestría para CC. S-D y CONACYT- PN 2015-01-751.

Al Dr. Alejandro Espinoza Tenorio por su inestimable ayuda y su paciencia en estos primeros pasos. Gracias por la confianza depositada, sus consejos y tanto conocimiento compartido.

A Dr. José Alberto Zepeda Domínguez y a la Dra. Dora E. Ramos Muñoz por sus pertinentes comentarios y puntuales correcciones que hicieron a este trabajo, y sobre todo por las charlas que han contribuido a mi crecimiento personal.

Tabla de contenido

Capítulo I. Introducción.....1
Capítulo II. Artículo.....4
Capítulo III. Conclusión.....30
Literatura citada.....32

Resumen: Los Sistemas Socio-Ecológicos Acoplados (SSEA) son concurrentes en las zonas marinas, en las cuales coexisten diversas actividades humanas en un espacio en común; los SSEA tienen atributos individuales pero también emergen características inherentes a la coexistencia espacio-temporal. La gobernanza, busca minimizar los conflictos maximizando acuerdos entre los actores involucrados. Establecer una gobernanza efectiva es un desafío en el sur del Golfo de México, donde la Reforma Energética (2013) ha aumentado el frágil equilibrio entre la industria pesquera y petrolera. Este trabajo tuvo como objetivo identificar la red de gobernanza que está directamente involucrada en el proceso de toma de decisiones sobre el SSEA de pesca y petróleo de la costa de Tabasco. Mediante el análisis de redes sociales, se mapeó a 53 actores clave (clasificados en ocho grupos funcionales). La red presentó una cohesión baja (5.1%), en comparación con el número de relaciones máximas que podrían establecerse. La distribución de los actores se pudo apreciar en tres agendas políticas. La agenda energética, que está regida por la industria petrolera (PEMEX) y la Secretaría de Marina; la agenda de pesca que es un grupo más local (comunidad pesquera) y la agenda de intermediación ambiental (la agenda más pequeña) que se encuentra dirigida por la agencia estatal de protección ambiental.

Palabras Clave; Sistema Socio-Ecológico; Análisis de Redes Sociales, PEMEX, Reforma Energética, Gobernanza Ambiental.

CAPÍTULO I

Introducción

La gestión de los recursos naturales emerge de un sistema complejo, pues es objeto de una reapropiación de la sociedad que lo maneja (Leff 1995). Un sistema complejo tiene múltiples componentes (ambientales, sociales, económicas y culturales) que interactúan y dan paso a la formación de nuevos procesos o atributos (Ostrom 2009). Su unidad analítica son los Sistemas Socio Ecológicos (SSEs), los cuales se centran en las interacciones entre los componentes del sistema, así como en los procesos y/o atributos que van emergiendo de la dinámica de interacción entre ellos (Berkes et al. 2000; Ostrom 2009). La coexistencia de dos o más sistemas en un mismo espacio ha permitido el estudio de SSEs acoplados (SSEA), que se caracterizan por formar una estructura compleja con atributos y procesos adaptativos, producto de las interacciones de ambos sistemas de origen (Miller y Slicer 2014). Las interacciones de coexistencia en los SSEA se ven reflejadas en un proceso de gobernanza que busca la gestión de espacios y/o recursos comunes con el fin de contribuir a un objetivo compartido entre varios actores sociales (Kooiman 1993).

Los recursos marinos son proclives a crear SSEA dado que distintos procesos de aprovechamiento y gestión pueden aprovechar diferentes recursos en un espacio y tiempo en común (Hilborn 2007). A nivel mundial, la coexistencia de diversas actividades sobrepuestas en aguas marinas crea SSEA de relevante interés dado a las contribuciones que cada sector hace a los ejes económicos, sociales y ambientales a diversas escalas (local, estatal y federal). El ordenamiento de los mares contiene diversos puntos de flexiones teóricos y prácticos que conllevan a una debilidad estructural, entre ellas se encuentra:

a) la coherencia de adopción de las políticas públicas a diferentes escalas (Cabrero et al. 2000),

b) el reconocimiento de aspectos sociales que condicionan el aprovechamiento de los recursos naturales y la gobernanza que los regula (Sandström y Carlsson 2008; Bodin y Crona 2009); y

c) la identificación de actores involucrados en los procesos de gobernanza, entre los que se destacan los ajenos a procesos legales reconocidos (Zepeda-Domínguez et al. 2015).

Tener información que esclarezca los puntos de flexión anteriormente mencionados encamina a una gobernanza eficiente, apoyando a una mejor planeación y gestión de recursos con la identificación de los actores participantes, sus roles y procesos que ejecutan (Sandström y Carlsson 2008; Bodin y Crona 2009). Además, permite la identificación de las necesidades a diferentes escalas que permitan dar precisión de los problemas públicos en los que se sustentan las políticas públicas (Dente y Subirats 2014).

En México, el proceso de gobernanza de los espacios marinos entre diversos sectores que aprovechan recursos diferentes carece de un enfoque integral, implicando que la viabilidad del desarrollo en conjunto se vea cuestionada (Espinoza-Tenorio et al. 2014). Específicamente, en la costa tabasqueña hay un espacio en común para dos recursos: la pesca y el petróleo. Los sectores productivos que lo aprovechan han coexistido en un frágil equilibrio desde la década de los sesentas (Checa-Artasu 2014; Solano Palacios et al. 2015). Las restricciones de acceso a los recursos pesqueros por el sector petrolero han ocasionado, en su mayoría, interacciones conflictivas entre los diferentes actores sociales de este SSEA (Quist y Nygren 2015; Espinoza-Tenorio 2019)

Actualmente el SSEA pesca-petróleo (FOSES, por sus siglas en inglés) se encuentra en una etapa de transición ante la aprobación de la Reforma Energética (2013). La apertura jurídica a la inversión privada de hidrocarburos en aguas profundas presenta nuevos escenarios, en los que la disminución de la participación del Estado sobre los hidrocarburos y la participación de nuevos actores sociales (Gallardo, 2014; Gallardo y De la Mora, 2014), conllevan acciones que permearán tanto en la calidad de vida de los usuarios, como en el sistema de gobernanza del FOSES.

El presente trabajo se propuso identificar a los actores clave que operan en el sistema de gobernanza del FOSES de la costa de Tabasco, el cuál actualmente se encuentra en una etapa de transición dado la actual Reforma Energética de México. Se optó por un Análisis de Redes Sociales (ARS) para esclarecer los actores y tipificar sus roles en el sistema

de gobernanza que ha emergido a través del tiempo (1960-2018) de coexistencia de ambos sectores. El ARS se centra en las relaciones entre los actores sociales y puede revelar atributos clave de la estructura de la red de cualquier sistema social (Bodin y Crona, 2009). Los hallazgos de esta tesis podrían ser útiles para desarrollar una gobernanza más efectiva, favoreciendo la integración y coordinación de las interconexiones entre las áreas de política ecológica, económica y social (Nilsson et al., 2012).

CAPÍTULO II

Artículo
Revista: Industries Extractive and Society

Governance networks in marine spaces where fisheries and oil coexist: Tabasco, México

Carolina C Salazar-De la Cruz[a], José Alberto Zepeda-Domínguez[b], Alejandro Espinoza-Tenorio[a,*], Dora E Ramos-Muñoz[c]

[a] El Colegio de la Frontera Sur, Unidad Campeche. Av. Rancho Polígono 2-A, Col. Ciudad Industrial, Lerma, 24500, Campeche, Mexico
[b] Facultad de Ciencias Marinas, Carretera Ensenada-Tijuana No. 3917, Fraccionamiento Playitas, 22860, Ensenada, B.C.
[c] El Colegio de la Frontera Sur, Unidad Villahermosa. Carretera Villahermosa-Reforma km 15.5, Ra Guineo, 2a sección, 86280, Villahermosa, Tabasco, Mexico

*Corresponding author. E-mail address: aespinoza@ecosur.mx (A. Espinoza-Tenorio).

Highlights:

- Fifty-three stakeholders in eight groups form the fishing-oil SES in Mexico
- Three agendas in the governance network influencing fishing-oil SES
- The governance network in the coupled fishing-oil network has low cohesion
- The existence of different resources conditioned the participation of stakeholders
- The stakeholders' commitment influences the governance mechanism

Abstract

Coupled Socio-Ecological Systems (SES) are frequent in the sea where several human activities coexist in a common space, maintaining individual attributes, but also creating inherent characteristics of this spatiotemporal coupling. The governance system, which minimizes conflicts through maximizing the agreements, offers an opportunity to achieve balance between sectoral agendas. Establishing effective governance is challenging in the Southern Gulf of Mexico, where the Energetic Reform (2013) has stressed the historically fragile equilibrium between fisheries and oil industry. Through a Social Network Analysis (SNA), this work aims to identify the governance network directly involved in the decision-making process over the fishing-oil Socio-Ecological System (FOSES) of the coast of Tabasco. The mapping of 53 key actors (classified in eight functional groups) shows that the cohesion between them is low compared to the number of maximum relationships that could be established in the network. The distribution of the actors can be appreciated in three governance agendas. The energy agenda is ruled by the estate oil company (PEMEX) and the Mexican Navy, while the social-fishing and environmental-intermediary agendas are dominated by the fishing sector and the state environmental protection agency, respectively.

Keywords; Socio-Ecological Systems; Social Network Analysis, PEMEX, Energetic Reform

1. Introduction

In the Anthropocene era, natural resources are exploited in order to satisfy more than just fundamental human needs (Crutzen, 2002). Economic development and social wellbeing are critical goals for holistic management, which involves the interactions between the environment and its users (Folke et al., 2016; Hughes et al., 2005). The social dynamics of resource management is encompassed in entities called complex systems, which are a set of multiple components that interact with each other, producing new attributes from their interactions (Bodin and Crona, 2009). These complex systems can be studied through analytical units called Socio-Ecological Systems (SES) (Ostrom, 2009), whose internal dynamic create a collective identity undergoing constant change with the purpose of maintaining balance and avoiding crises and conflicts (Etkin and Schvarstein, 1995).

Coupled SES emerge where several human activities coexist in a common space, maintaining individual attributes, but also creating new characteristics associated to the spatiotemporal coupling (Gatzweiler, 2014). Marine spaces frequently conform coupled SES because several resources can be exploited in the same three-dimensional area, even when they involve multiple characteristics, such as seascape dynamic, socio-cultural practices, and international scenarios (Carr et al., 2003; Douvere, 2008). Given the cross-scale and multifunctional character of marine spaces, decisions affecting coupled SES involve a range of stakeholders related to each other through complex governance arrangements, which, nonetheless, represents the bridge of coexistence between users and the environment (Berkes et al., 1998; Bodin and Crona, 2009). Understanding these interactions will allow more informed decisions in a governance more efficient (Adams et al., 2003; Folke et al., 2005; Gibbs, 2008). Governance is understood as a mixture of social responses to an increasingly diverse, dynamic and complex context (Kooiman, 1993), it is a system that seeks to contribute to the achievement of societal objectives, promoting social stability through collective dialogues among various social actors, who manifest their differences and their socio-economic and political interests (Le Galés, 2009)

The Gulf of Mexico is an ocean basin shared by Mexico, the United States, and Cuba, and is one of the most productive and complex marine areas of the world (Tunnell y Earle 2004). This semi-enclosed sea attracts multiple users, and its sustainability depends upon the balance between social, environmental and stakeholders (Beck and Odaya, 2001). The Campeche Sound is where most of the Mexican offshore oil platforms are deployed, between 30 m and 200 m inshore, and represents a highly productive fishing area in the southern Gulf of Mexico (Soto et al., 2014). In this continental shelf, the two active users, fishing and oil industry, coexist in a fragile balance since the 1960s (Checa-Artasu 2014; Palacios 2015). Restricted access to fishing resources by the oil sector have caused adverse circumstances between the social actors of this coupled SES (Muñoz-Sánchez and Cruz-Burguete, 2013; Pinkus-Rendón and Contreras-Sánchez, 2012; Quist, 2016). Thus, decisions taken to protect the socioecological equilibrium of the Campeche Sound in the long term will be critical to sustaining current and potential uses (Vidal-Hernández et al., 2012).

Tabasco has the shortest coastal extension (200 km) of the Mexican states of Gulf of Mexico, however, its coastal plain interconnects the biggest basin and coastal wetland systems in the country, favoring agriculture, livestock, fisheries, and the oil industry (Espinoza-Tenorio et al., 2015). The relevance of the coast of Tabasco is increasing due to Mexico's Energetic Reform (2013), which identified this zone as the new crucial oil exploitation area which will complement the production of Campeche Sound. Before the Energetic Reform, the parastatal company *Petroleos Mexicanos* (PEMEX) was the sole company allowed to extract oil and gas, but afterwards , the entrance of new oil companies was permitted . This situation implies increasing interactions between new and traditional players, and the demand for new governance structures. Furthermore, the lack of previous economic and political interests and uneven influences and power are affecting the quality of life of the users, compromising the current and future of this coupled fishing-oil SES.

Managing fisheries and oil to meet or balance multiple, potentially incompatible, policy goals has become a fundamental problem encountered in marine management worldwide (Douvere, 2008; Osuagwu and Olaifa, 2018; Val et al., 1983). The present work identifies in the coast of Tabasco a coupled fishing-oil socio-ecological system (FOSES), which is

currently in a transitional stage on the advent of the approval of the Energetic Reform of Mexico. In order to develop governance structures for this FOSES, the understanding of new roles for new and traditional stakeholders is a key task. A needed step is the identification of this stakeholders, their interactions and their agendas.

Social Network Analysis (SNA) focuses on the relations between social actors, and it can reveal key attributes of the network structure of any social system (Bodin and Crona, 2009). This work aims to identify the social-network involved in the decision-making process for the management of this FOSES. The outcomes from the historical phase were back-solved to determine the underlying mechanisms operating in conflict situations and how it has built governance structures in the past. This work describes the FOSES network structure, the groups within it, the actors and their social roles, and thus identifies the stakeholders, based on their influence over the general structure. The findings could be useful to develop more effective governance, through favoring integration and coordination of interconnections between ecological, economic and social policy areas (Nilsson et al., 2012). A systemic view should lead managers guide their attention to certain groups, and even to sectoral representatives identified as key agents that may be functioning inefficiently (Prell et al., 2008).

1.1 Governance networks

Social networks theory considers society as a system where actors, and their relationships, are determined by moral values, beliefs, and behaviors (Latour, 2015; Lin, 2017). Natural resources management results from multiple interactions between social actors, so SNA is useful to analyze complex coordination in uncertain and competitive environments (Jones et al., 1997). SNA is applied to understand the effect of the presence/absence and interactions between actors over the system (Freeman, 2004; Prell, 2012; Vega-Redondo, 2007) and how their members respond to changes that alter the system (Thomas et al., 2013). It has also been used as a measure of social capital because it can show the capacity of a network to organize itself, create confidence and work collectively in the pursuit of common goals in the context of natural resources management (Bodin and Prell, 2011; Brondizio et al., 2009; Sandström and Carlsson, 2008)

Relational analysis involve organizational structure and its substantial dimensions. Thus, the interactions are formal practices of exchange, coordination, control and adoption of mechanisms for the resolution of needs generated between individuals creating patterns or structures (Bodin and Crona, 2009). However, in the governance networks, structures could be also characterized by informal social systems. For instance, social capital is also considered because it reveals the causes of relationships, where concepts such as reciprocity, implicit norms, decisions of power, exchange of knowledge, culture and socio-politic external pressure are involved (Kooiman, 2008). In this work, we will describe FOSES as a network structure (formal and informal) during conflicts.

Something important to take into account is that the limits of the analyzed FOSES can be artificial, defined by the goals of the research. Usually the criteria used is some mixture of social and ecological attributes. In governance networks, SNA shows social actors (nodes) and their relationships (links) in a matrix which represents a moment (Scott, 2000). Because of their spatiotemporal context their scope is limited to a specific moment and area (Putnam et al., 1994). Also as causal research, the specific findings cannot be extrapolated, but learning them is useful in strengthening body of knowledge at the field of collaborative governance of natural resources.

2. Method

To reconstruct the history of the–contemporary activities of FOSES (1960–2018), a bibliographic and hemerographic review of specialized literature was carried out. Federal information was of special interest because the Mexican Constitution establishes exclusive federal jurisdiction over the oceans and their fishing resources. Thus, spatial data were collected to create maps of changes in the exclusion areas to fisheries implanted by the federal government. Within each phase, data on fisheries and environmental policies were arranged according to both political (agencies, operational rules, and policies) and legal aspects (laws and instruments). This section is reflecten in the figure 1.

A Geographical Information System with QGIS software was elaborated to identify historical variations of the exclusion areas to fisheries on the Gulf of Mexico (1998 to 2017). Geospatial data of oil facilities provided by the National Hydrocarbons Information Center (CNIH) was used to identify buffer zones (500, 1,000, 2,500 and 5,500 m) decreed by federal government (SEMAR-SCT-SAGARPA, 2003; SEMAR, 2016) This section is reflected in the figure 2.

2.1 Governance actors

The primary data were collected through structured surveys to stakeholders and authorities in May 2017, and June 2018. Representatives of fishing units (n=4; e.g., leaders of fishing cooperatives and permit holders), government authorities (n=9; e.g., fisheries and environmental authorities, navy officers), oil company personnel (n=2) and scholars (n=2) were interviewed. They were questioned about the circumstances of the negotiations operating the system governance of the FOSES and the actors (institutions, organizations, persons, others) whom they considered key in the resolution of conflicts in the same SES.

The surveys were designed according to the methodological recommendations described by Fontana and Frey (2005) and Prell et al. (2011). Ethical procedures were followed in this research. The interviewed were selected according to Goodman's (1961) snowball sampling technique, with adjustment of a realistic approach based on the theoretical analysis of the FOSES (Zepeda Domínguez et al., 2017). The process was initiated with a seed informant from the fishery sector, which had more than 40 years of experience in oil-fisheries dynamics. Confidentiality was maintained by replacing names with code numbers.

Fifty-three social actors were identified as part of the decision making process on conflicts between fishing and oil. Said actors were grouped according to affinities between functions and professional approaches. These functional groups consist of actors from local to international hierarchy. Key governance actors mentioned as an indirect participant in the decision-making processes formed an unseen actors group. This section is reflecten in the figure 3.

2.2 Network analysis

Information about the relationships between actors acquired in the surveys was used to recognize the governance network. The most relevant actors in system, according to their connectivity, were identified. The structural properties of the network were calculated with the specialized free-access software Gephi®. Newman's algorithm (2006), was employed to observe substructures by modularity or communities. In network terms, a subgroup or cluster can be defined as having significantly more ties between its group members than between members and non-members (community structure, see Girvan and Newman, 2012). In the governance network, members of the same clusters form an agenda because they share information and resources to reach a common objective. The most important actors of each cluster were identified with a high number (i.e. 10) of degree of entry (DE), and the least representative with a smaller number (i.e. 1). The number of other nodes directly connected to that node (ties) gives DE.

For the network elaboration, an adjacency matrix was designed. To locate the actors according to their social role in the governance system, we used the visualization model "Force Directed Graph" proposed by Fruchterman and Reingold (1991) and own vector centrality analysis. Actors on the periphery represent actors who are away or have been removed from conflict resolutions, contrary to actors near the center of the network. Even so, a superior location of actors indicates a certain degree of control or influence over other actors. This section is reflected in the figure 4.

3. Oil-fishery system in Tabasco coast

The maritime history of Tabasco began in the late 60s (Fig. 1) when skilled sea fishers arrived from the neighboring state of Veracruz incentivized by federal programs promoting the accelerated development of economic activities (Muñoz-Sánchez and Cruz-Burguete, 2013). The first institutional programs, ‘‘Moving toward the Sea’’ and ‘‘Maritime progress’’ (1952-1958), were implemented for promoting settlement in the coastal zone and increasing the fishing effort in the maritime zone adjacent to Mexico (Espinoza-Tenorio et al., 2011). Fishers still identify this era as one of development and growth.

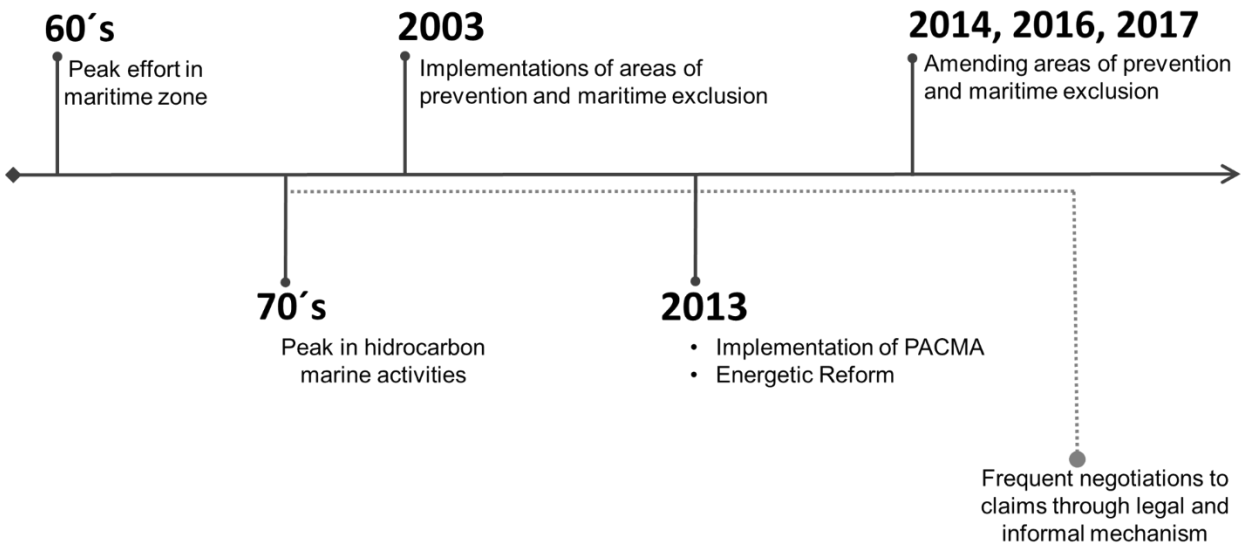


Figure 1. Time line of the main governance events

In 1938, Mexico reserved the right to exploit the oil and its derived products to the estate company (PEMEX). However, until 1970s the country reoriented its national policies cataloguing the oiling activities at sea as a priority (Uribe-Iniesta, 2011). Interest in the oil fields in the Southern Gulf of Mexico was stimulated by the success of the offshore production of the USA states of Louisiana and Texas, as well as the interest in the exploration of the Gold Belt in the Mexican marine space (Roux and Flores-Torres, 2015). Mexico became a major oil-producer country with the discovery of the mega offshore fields in the Campeche Sound in 1976. This boom placed Tabasco as the most important state in terms of oil production on land (Arias-Rodríguez and Ireta-Guzmán, 2009; Pinkus-Rendón and Contreras-Sánchez, 2012); however, a significant part of this development was sustained by the coastal zone (Botello et al., 1983), including the major fishing-area of the region, the Campeche Sound.

In the beginning, the co-development of the FOSES conditions at sea were favorable and, for example, fishers were hired as personnel of the energy sector (Muñoz-Sánchez and

Cruz-Burguete, 2013). However, the low profitability of fishing, compared to oil, and the environmental impacts (e.g., the blowout of the offshore oil well Ixtoc-I in 1979) caused adverse reactions in the local fishing sector (Soto et al., 2014). Oil industry exacerbated differences in social patterns, accentuating salary differences and decreasing the quality of life of several social sectors, including the fisheries (Lezama de la Torre, 1987; Negrete-Salas, 1984).

Lately, other stresses arrived from international sources, such as the pressure to protect the oil facilities from potential terrorist attacks (Arias-Rodríguez and Ireta-Guzmán, 2009). In Mexico, this threat caused the creation of *exclusion areas* imposed to fishers in 2003, to safeguard more than 200 maritime PEMEX platforms of extraction of crude oil and natural gas in the Campeche Sound (Intersecretarial Agreement 117 t.). Areas of prevention and maritime exclusion (17,463.91^2) (Figure 2, left side) were implemented to regulate the transit of Mexican fishing vessels, which limited the access to major capture areas (Zalik, 2009). All these events intensified the manifestations of disagreement and confrontation between fishers and their organizations, with the oil industry and government.

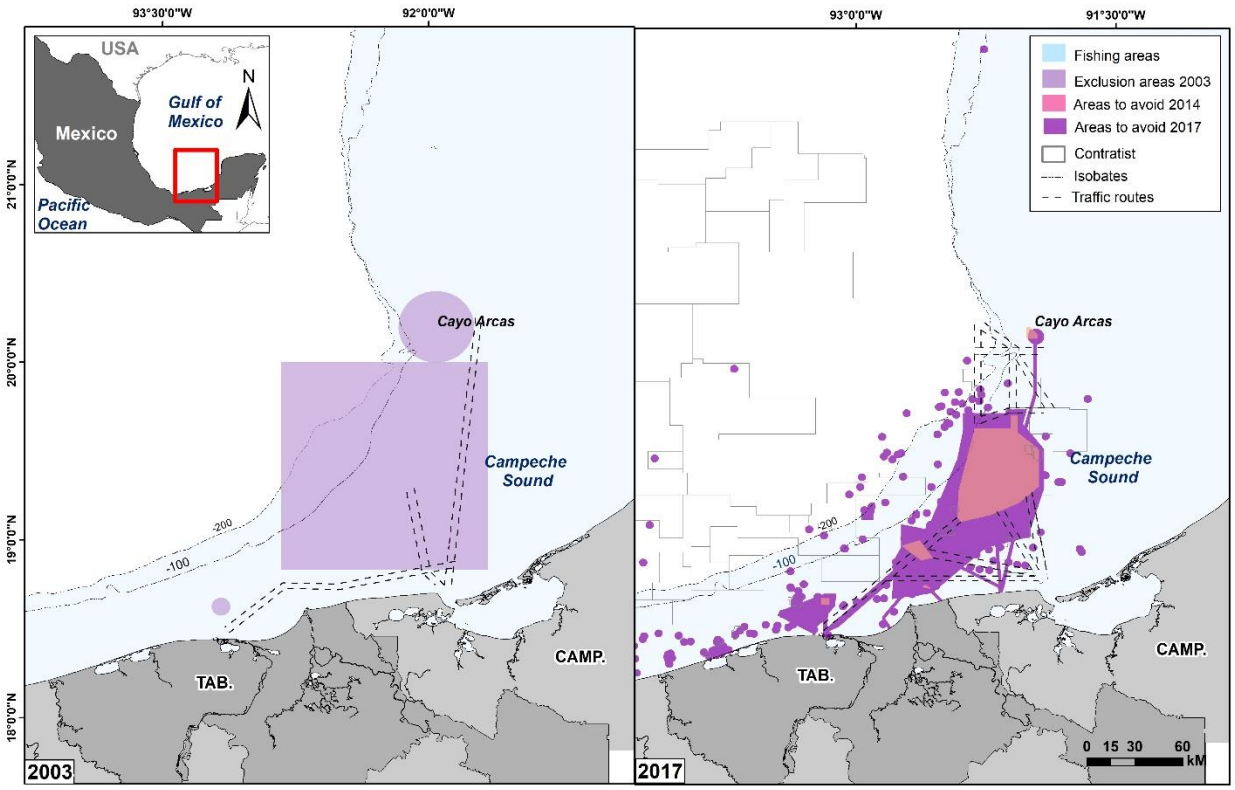


Fig. 2. Map of the exclusion areas imposed in 2003 (left) and those imposed in 2014 and 2017, (Just after the Energy Reform was decreed, 2013). (Sources: CNH, 2018; SEMAR-SCT-SAGARPA, 2003; SEMAR, 2016)

The fishing sector demanded compensation from PEMEX for the negative impacts caused by its activities and its social mobilizations, asking the intermediation of the State Government. Social demands were the integration of the fishing sector needs in political decisions (Zalik, 2006), as well as negotiation spaces between fisheries-oil sectors and the recognition and protection of their historical fishing zones (Palacios, 2015). Although PEMEX conducted compensation negotiations, it maintained an authoritarian and conflictive position, looking to avoid lawsuits (Arias-Rodríguez and Ireta-Guzmán, 2009). This political climate changed when international agreements to improve the reputation of mining companies were signed by PEMEX to boost comprehensive strategies to reach satisfactory resolutions of social tensions (e.g., United Nations Global Compact or the Environment). Thus, after continued negotiations, the Community and Environmental Support Program (PACMA, by its Spanish acronym) was created by the estate oil company in 2013 to promote human progress, productive opportunities, and sustainable development to attend social backwardness in the communities located within the

exploitation oil areas (PEMEX, 2018). In other words, in this new phase, a specific program was created to solve the social conflicts created by the industry, mainly because of their indirect effects on the fishing sector through environmental impacts.

3.1 New paradigm in energy

Due to the decline of hydrocarbon reservoirs in the last years, high international oil demand, and increasing export prices, Mexico's attention was focused on extracting oil in deep-sea basins at depths between 500 and 1000 m (Gallardo, 2014). The country faced the imminent need for investment. The purpose of the *Energetic Reform* of 2013 was to solve this need through the authorization of foreign private investment. This new policy represents a paradigm shift, with opportunities and challenges, of which training in technological innovation is one of the greatest opportunities (Coldwell, 2014). On the seas, the industry was open for selling blocks in shallow and terrestrial waters to private companies, favoring the opportunity for knowledge innovation in sophisticated technology.

To PEMEX, the Energy Reform meant the loss of its legal status of public corporation with social objectives, transforming it to an independent national oil company, subject like the others to the new regulatory bodies. In order to meet these challenges, constitutional changes were made to delegate responsibility. For instance, the control of nation's oil and gas reserves are now overseen by Secretary of Energy (SENER, by its Spanish acronym). The National Hydrocarbon Commission (CNH, by its Spanish acronym) is in charge of awarding contracts to oil companies through allocated entitlements. New government entities were also created, such as the National Agency for Safety, Energy and Environment (ASEA, by its Spanish acronym), designed to stress the industrial safety and environmental protection. ASEA and CNH form a regulatory technical system, operating autonomously from both the State and Industry.

In the case of the fishery, the areas of maritime exclusion from 2003 were abrogated, and governmental agreements for the economic reactivation of Campeche and Tabasco were signed. In 2014, 2016 and 2017. The exclusion areas were amended, and 10,000 Km^2 of the territorial sea were released to fishing again (figure 2, right side). The new dimensions remained as security-protection goals, but allowed the exploitation of fishing resources. The security and protection polygons became buffers to oil installations to 500 m, causing

the fishers to sail in a complex routes to access their fishing areas. In addition, the increase of private oil companies in the coast of Tabasco is gradually reducing fishing spaces. Also, an unexpected consequence for the domestic hydrocarbon sector is the loss of qualified personnel with experience in the FOSES governance mechanisms, as they are retiring or being recruited by international corporations.

4. Actors in coupled SSE

The social network operating the management of fisheries-oil coexistence on the coast of Tabasco is formed by 53 actors grouped in eight groups: Government agencies, fishing-community, hydrocarbons, scholars, civil society organizations (CSO´s), technical consultants, human communities and media (Fig. 3).

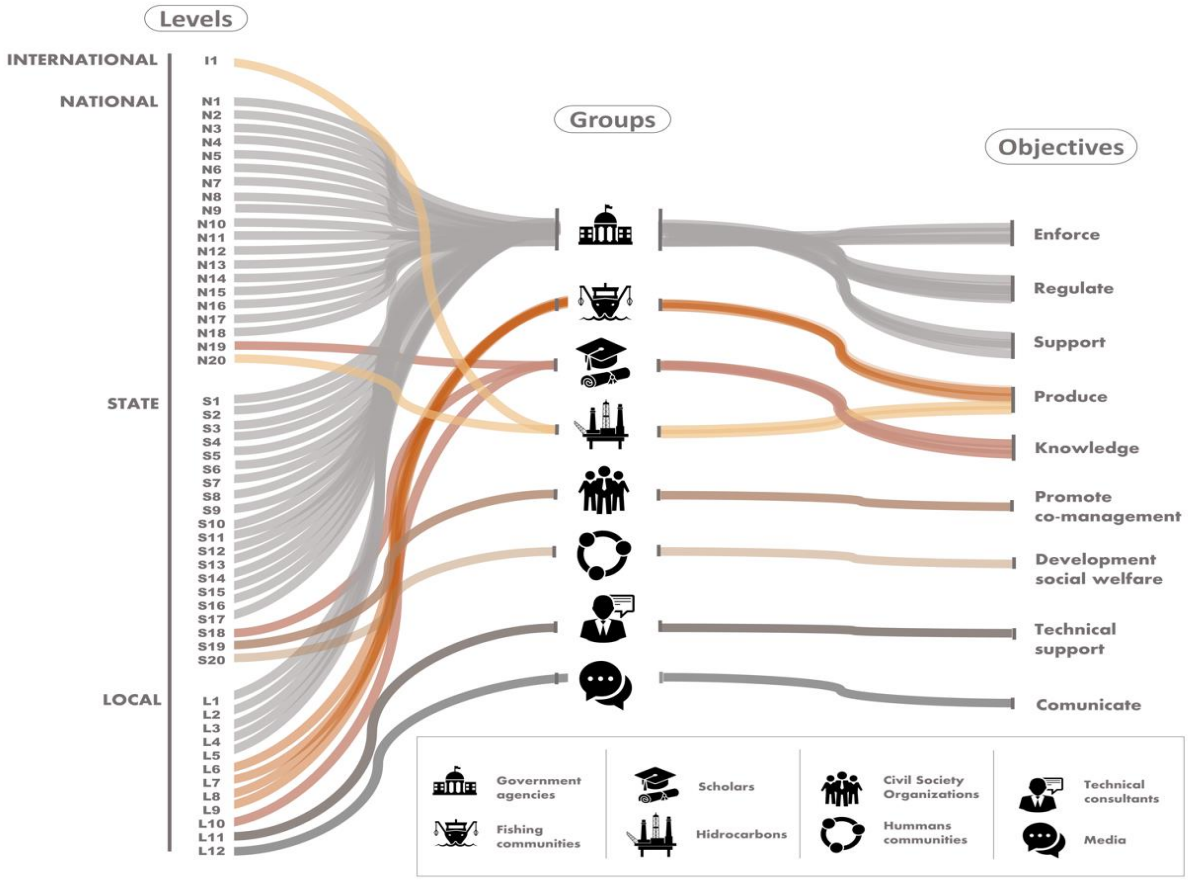


Fig. 3. Group of actors forming the social network operating the management of fisheries-oil.

Most of the actors come from the federal government (n=18) whose enforcement agencies are in charge of the protection offshore (SEMAR), but also of regulatory activities of fishing operations and the supervision of operational and environmental risks from hydrocarbons activities. Local actors (e.g., municipal delegate, municipal clerk) do not have constitutional responsibility; their main role is as mediators at the lobbying.

Although state government has no legal jurisdiction in seas, its institutions (n=17) play a role of conciliation at the environmental and social issues, as well as a source of economic and political support to fishers. These agencies are attempting to consolidate the informal sectoral-agreements between diverse and unorganized fishing organizations and hydrocarbon entrepreneurial groups, although it is not their formal task (because of scarce economic resources).

Fishing communities was the most locally represented group and involves four types of actors: divers, free fishers, cooperatives and permit holders. There are actors managing allocation of rights through permits (independent producers) or social groups such as fishing cooperatives. Other group outside the legal system, free fishers, is composed by non full-time fishers or outcasted fishers. This diversity makes it difficult to reach agreements in the sector to make proposals during the negotiation with Pemex and the authorities, so they lack the capacity for internal coordination so that what today is a difficulty can be part of the strategy in the future.

The hydrocarbons industry is present in the governance network through PEMEX. This is because the application of the Energetic Reform has only just begun, and by 2017-2018 (when interviews were conducted), other oil companies had not yet been established. PEMEX is operating through two actors: a) subsidiary organisms included in the organizational structures of the estate oil company, and b) national and international freelance contractors. The perception of contractors has two branches: a) PEMEX is related to contractors but is corporate image different and this should be confronted with their responsibility for the damage caused, or b) to the other actors the contractors are an extension of PEMEX companies and PEMEX is liable for damage caused. The role of PEMEX is key because the experience and coordination of its state and local office are resolving conflicts through alternative negotiation mechanisms.

Scholars are part of local institutions, but they were identified in the top three hierarchy levels, supporting mainly research on technical issues, as well as training professionals in oil and fisheries techniques. Their research work is also related to environmental and social impacts generated by the interaction of the activities in question. Although they could be knowledge-holders sharing information that should be taken into account in the governance processes (Luna and Velasco, 2009), their institutional values limit their role to “knowledge creation”, excluding them from more executive roles.

In the governance network, CSOs were the less represented sector, with only one actor at the local level. It was an actor identified but for security reasons the interview was not possible. Although they have a formal character, the social perception is conceived as informal actor’s defender of social justice and environment.

4.1 Unseen actors

Three groups (technical consultants, human communities and media) have an overlooked but crucial role. Technical professionals operate at the state level and their relationships with the fishing-aquaculture and hydrocarbon sectors are in terms of contracting service as freelancers, independent from any institutional restriction point of view. They are conceived as professionals who are in charge of interpreting technical information, also as information managers with an integrating and negotiating profile.

Communities are identified as the local entity that receives the impacts of the oil sector. Communities include all the people inhabiting the local territory involved in the interactions of the FOSES. Society is characterized with the arbitrary exclusion from the benefits resulting of the fishing-aquaculture sector, but mostly from the hydrocarbon sector. They should be consulted and taken into account, not only notified of the events that will impact their territories.

In the governance network, state level media was identified as an actor that collects, interprets, evaluates and transmits information on the conflict management processes between the hydrocarbon and fishing-aquaculture sectors. Others actors have a vision from media as responsible for reflecting the demands and manifestations of the sectors involved.

5. Network structure

The governance network has a density of 5.1%. This indicates that the cohesion between its actors is low, compared to the number of maximum relationships that could be established in the network. This low cohesion results from the high heterogeneity in the hierarchy of actors, particularly between state and national levels. The low density also reveals a high variation in communication channels between national and state actors that limits the capacity of information dissemination. The low density of the network also inhibits different types of actors maintained over time.

In the FOSES is reflected that their governance network requires intermediary actors and fewer hub actors (information hubs- actor to distribute information among the other actors within the same subgroup).. This intermediary cluster facilitates the homogenization of channels for decision making, since heterogeneity increase the available resources (information, different management capacities, economic resources and sources of legitimacy) bridging agents favors the management decision-making process (Bodin and Crona, 2009).

5.1 Governance agendas

The distribution of the actors can be appreciated in three agendas. Each cluster has at least one main actor (major DE) dominating its internal dynamic and objectives, and influencing the interaction with the others clusters (Figure 4).

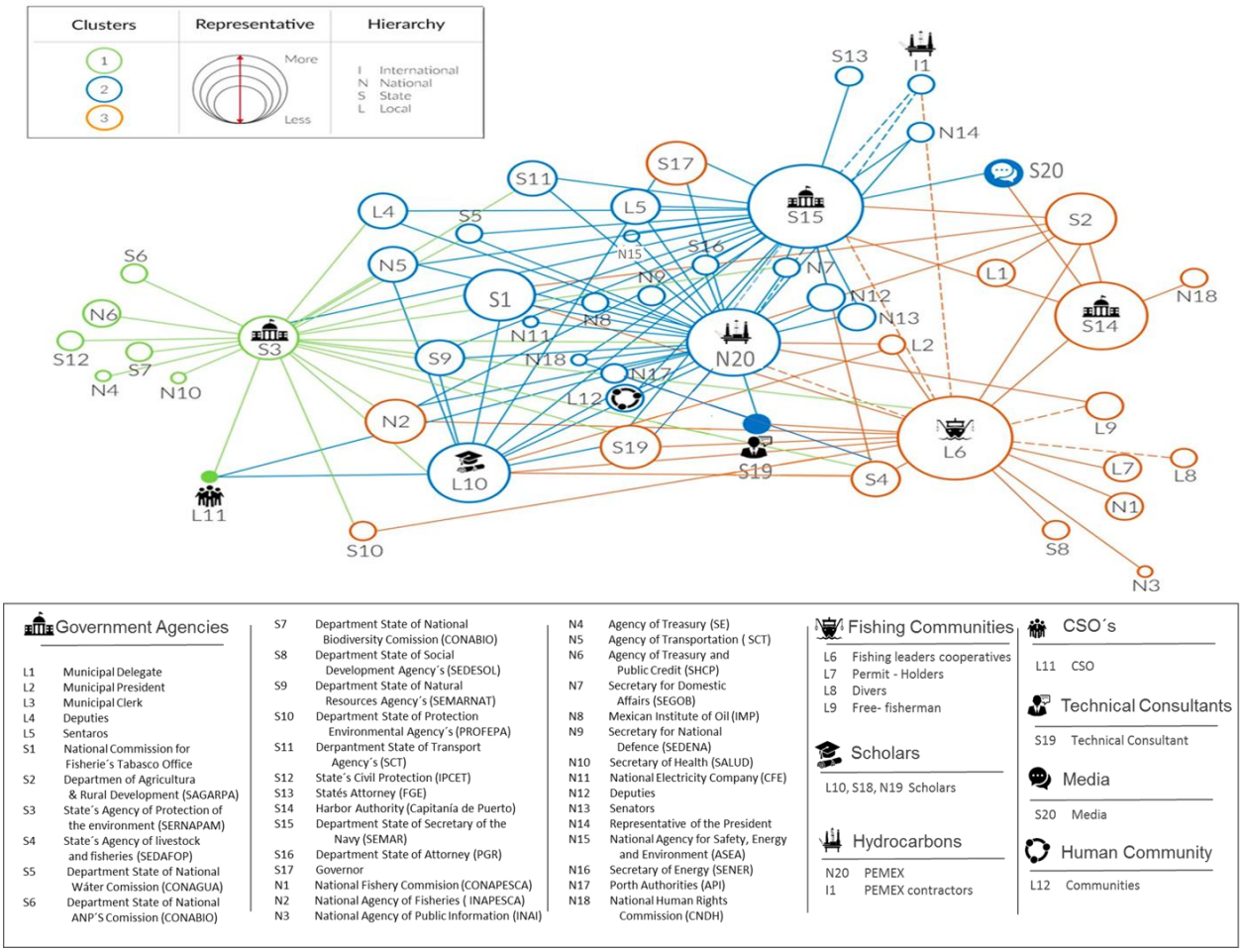


Figure 4. Governance network involved in the decision-making on the fishing-oil Socio-Ecological System (FOSES) of Tabasco's coast. Three political agendas were identified: energy (blue), social-fishing (orange) and environmental-intermediary (green).

The largest cluster (24 actors) shares the interest in energy agenda. It has a central position in the entire network and three central actors, coming from different categories and hierarchies: 1) oil National company (N20-PEMEX); 2) the enforcement agency (S15-SEMAR); and 3) scholars (L11: local research institutions). PEMEX stands out for its central position in the network with a DE (7), while actor S15 is one of the two actors in the entire network with the highest DE (10). Local academic institutions stand out for being closer to most of the actors in this cluster which includes the local academic institutions (7).

The central actors of the energy cluster have a high intermediation playing the role of connecting the different actors. However, there are distinctions between them. On one hand, PEMEX and scholars have roles of "hubs", although their proximity would suggest an influence between them. On the other hand, SEMAR acts as a regulatory actor, not only in the cluster, but throughout the network, given its high level of DE (10) and its superior position in the center of the network. SEMAR is not a hub or bridge, it is an entity in charge of safeguarding oil installations from intruders and, occasionally, supporting fishers during extreme weather events. The other actors in this cluster have different DE hierarchies from 1 to 7, and most of them are federal entities (e.g., N7-Secretary for Domestic Affairs, N9-Secretary for National Defense, N12-deputies, N13-Senators) supporting the political and social viability of PEMEX activities, and even dealing with its environmental concerns (e.g., S9- Department State of Natural Resources Agency´s).

PEMEX appropriated the central position in FOSES through its institutional system of conflict management and dispute resolution of social conflicts. With a low network density, this central actor uses its influences to coordinate the closest actors, allowing to set agendas and issues management mechanism in the short term (Bodin and Crona, 2009). These situations, according to Janssen et al. (Janssen et al., 2006), generate distrust and decrease the disposition of the less favored, making difficult the mechanisms to face management challenges in the medium and long term (such as the management of problems of coexistence).

The social-fishing cluster has 20 actors. It has two central actors, one local (L6-fishing leaders cooperatives) and another federal (S14-Harbor Authority). The fishing leaders stands out for having one of the two largest DE (10), and its central position in the cluster gives it the role of "hub". However, the low position in the network is indicative of the low capacity of influence on other members. Most of these actors understand that working together is the only way to get press on oil industry and authorities. Inside this cluster, the fishing leaders act as an obliged actor that filters information to other cluster members, this could have a negative impact where the parties involved are very unevenly matched (e.g., L7-Permit holders *vs* L9-Free fishers).

Harbor Authority is an agency that has historically suffered many jurisdictional losses. Nevertheless, it continues positioned as central and local actor in the cluster, given the combination of its high DE (8) and its approach and superior position in relation to the fishing cooperatives (L6). This combination can give it the role of supporting actor given the higher level of hierarchy in relation to actor L6, and its position in decision making given his category of actor (government agency). The actors that compose this subgroup are diverse in their hierarchies as well as their respective categories; they have a DE range of 1 to 4 and together they position themselves in the periphery of the network but close to the central actor of the network.

The cluster environmental-intermediary is the smallest subgroup (10 actors). Its central actor is a governmental state agency (S3-SERNAPAM), dedicated to the protection of the environment and, because its DE (5), and its position in the network, acts as bridge between other two clusters. However, its function as cluster is more related to a "hub", distributing information among the other actors within the same subgroup. SERNAPAM historically had the bureaucracy support and served as the main PEMEX contact with the people complaining about the hydrocarbons industry pollution; despite this formal role, its network positioning suggests opt-out of principal conflict resolution. Most of these actors have DE ranging from 1 to 4 and they are mainly government agencies, at state and national levels, dealing with environmental and economic concerns. However, an actor at the local level that is the SCOs category, which is the least representative in the lower peripheral part.

6. Final remarks

The study of the interactions between fishing and oil sectors as a coupled SSE provided a promising approach to map out the social complexity that underpins coexistence in a shared marine space. The governance network was a useful mechanism to achieve information-based in social dynamics, not just identified the key stakeholders but also their role players. This coupled SES involved a higher number of stakeholders than anticipated. In FOSES, 54 stakeholders showed different positions, interests, and degrees of unequal

power and influence, aspects that compromise the current governance system. This high social presence could be related with the economic and political relevance of oil industry, activity that attracts a variety of actors involved in the process to address social issues, but above all for tackling political and economical issues carried by the oil-environmental problems.

It was observed that the existence of different types of pressures (from legal obstacles, close periods of political movements and even preventions to ensure physical protection) conditioned the level of participation of different actors. Thus, in governance systems in oil-producing developing countries fragmentation is common between different levels of government, causing a tense relationship between federal and state actors and frequently communication gaps in both vertical and horizontal dimensions among government actors (Fox, 2004; Jenkins, 2005). There is a range of execution of vertical governance activities which is related by the spatial dimension (onshore, coast line, offshore) in which the conflict needs to be managed, as well as the hierarchical and trust level of the actors involved. Although the present work does not contemplate social capital resources and relationship intensities, it is recognized that all the actors involved have resources at their disposal to influence the process.

6.1 Political agendas

FOSES is a governance network where the coexistence of diverse actors exchanging knowledge, supports networks for impacts and socio-political control, and mutual natural resource management. Because fisheries management is a contested, competitive management context among stakeholders, governance structures in fishing areas face particular characteristics; they are horizontally and vertically integrated across levels of government and public-private-nonprofit sectors (Hartley, 2010). The distribution of the network makes evident the existence of three agendas in the governance network, that their objectives or interests influencing management mechanisms for decision making. The energy agenda is related to the hydrocarbons agenda, where PEMEX plays an important role in the governance system. In the fishing communities, the division tactics applied by the oil agencies agencies (e.g. Agreements without the intervention of intermediaries or conciliators agency) are reported among the government institutions and

community actors, deteriorating the trust management systems of the actors (Luning, 2012). Mayorga- alba, 2009, reports that relations between the oil industry and human communities are limited by corporate social responsibility, so it is important that government agencies link environmental sustainability with the ecological and political planning of the resident country.

In the social-fishing agenda are key actors that incorporate a cultural perspective, reflected in the way they allow interaction with other actors and incorporate them into their networks (Fraga et al., 2009; Zepeda-Domínguez et al., 2015). The local perspective is present (e.g., Harbor Authority), but its role not are in change.

The actors of the smallest cluster had a low representation with the environment coordination. The increase in knowledge and awareness of the conservation state of fisheries has had the effect of increasing the number of stakeholders in management processes (Gibbs, 2008). The limited role of CSOs, medias and scholars in FOSES is a character of oil economies (Ross, 2001). Thus, although centralized fisheries management agencies are facing social pressure from a wide range of well-informed stakeholder, CSO´s and scholars (Fraga et al., 2009), these weakened agencies remained as central actors because its political influence built through several years (Aguilar, 2010). In other studies it has been reported the emergence of CSO´s, on fisheries matters, had broadened the definition of public affairs, playing a critical role of bridge connecting different subgroups thereby contributing the information sharing across the network (Hartley, 2010).In this research we have identified the addition of media, community and technical consultant groups in the governance network, whose presence isn't directly linked to the conflict and even with decision-making but increase the complexity of management. These groups may have also played a role in explaining the decisions of the stakeholders local identification, like a local office permitting close contact with stakeholdersHuman communities and media are unseen actors playing as clusters to press for economic compensations to environmental or social impacts, but they are vulnerable to lawfully basis and willingness of key political actors. Besides, find media actor´s questioning that of government policies to address environmental problems for the oil companies (Onwuka, 2005).

The newer institutions (e.g. ASEA, SENER) are still small in this governance system and need support it they are to become stronger stranger. Their further development and centrality linked would enhance oil companies' ability to cover risk of major social and environmental disasters. Sandström (2008) demonstrated that the presence of bridging ties enhanced the different natural resource managers' collective ability to mobilize various different kinds of know-how for lacustrine-lake fisheries management, as long as if actors connecting subgroups have the willingness, capacity and motivations to coordinate subgroup activities towards a common goal

6.2 Governance arrangements

Looking at governance arrangements in this shared marine space from a network perspective may be even more useful in the future as the number of public and private sector actors involved in, or concerned with marine resources management increases and increasingly diverse stakeholders and worldviews need to be integrated. Any transformation towards more sustainable and equitable marine ordinance and management will need to work through these complex webs of social relations. This study has gained some systematic insights into these relations. The low structuration of the network reflects the lower connections between actors. According to other studies (Beilin et al., 2013; Janssen et al., 2006), the low density of the network (5.1%) affects access to information because there is a high variety of social actors and hindering joint actions. However, unwittingly promoting and exaggerating such links may diminish the capacity to handle conflict.

Governance networks are truly dynamic, the networks changing that adapt continuously, it is therefore recommended that monitoring approaches be adopted. An assessment of the levels and effects of links and measures to improve these links, with the aim of obtaining positive impacts and reduce unintended consequences for sustainable development. Institutional framework evaluation is also important, whose interrelationships serving to give effect to the communications channels and the social capital. According to Teubner (2016), the network coordination increased organizational capacity; thereby mitigating external factors by enlarging interactions with other actors provides opportunities of dialogue are a key to successfully integrating different aims and actors.

Acknowledgments

This study was funded by CONACYT-México (National Council of Science and Technology) under a master's scholarship to CC.S-D, and CONACYT-PN 2015-01-751.

Literature

Adams, W.M., Brockington, D., Dyson, J., Vira, B., 2003. Managing Tragedies: Understanding Conflict over Common Pool Resources. Science (80-.). 302, 1915–1916. https://doi.org/10.1126/science.1087771

Aguilar, L.F., 2010. Gobernanza: El nuevo proceso de gobernar. Mexico city: Fundación Friedrich Naumann para la Libertad, Mexico.

Arias-Rodríguez, J.M., Ireta-Guzmán, H., 2009. Pesca y petróleo en el Golfo de México. Asociación Ecológica Santo Tomás A.C., Villahermosa, Tabasco.

Beck, M.W., Odaya, M., 2001. Ecoregional planning in marine environments: Identifying priority sites for conservation in the northern Gulf of Mexico, in: Aquatic Conservation: Marine and Freshwater Ecosystems. pp. 235–242. https://doi.org/10.1002/aqc.449

Beilin, R., Reichelt, N., King, B., Long, A., Cam, S., 2013. Transition landscapes and social networks: examining on-gound community resilience and its implications for policy settings in multiscalar systems. Ecol. Soc. 18, 15.

Berkes, F., Folke, C., Colding, J., 1998. Linking social and ecological systems : management practices and social mechanisms for building resilience. Cambridge University Press, Cambridge.

Bodin, Ö., Crona, B.I., 2009. The role of social networks in natural resource governance: What relational patterns make a difference? Glob. Environ. Chang. https://doi.org/10.1016/j.gloenvcha.2009.05.002

Bodin, Ö., Prell, C., 2011. Social Networks and Natural Resource Management. Cambridge University Press, Cambridge. https://doi.org/10.1017/cbo9780511894985

Botello, A., Goñi, J., Castro, S., 1983. Levels of Organic Pollution in Coastal Lagoons of Tabasco State, México; I: Petroleum Hydrocarbons. Bull. Environ. Contam. Toxicol. 31, 271–277.

Brondizio, E.S., Ostrom, E., Young, O.R., 2009. Connectivity and the Governance of Multilevel Social-Ecological Systems: The Role of Social Capital. Annu. Rev. ofEnvironment Resour. 34, 253–278. https://doi.org/10.1146/annurev.environ.020708.100707

Carr, M.H., Neigel.E.J., Stes, J.A., Andelman, S., Warner, R.R., Largier, L.J., 2003. Comparing marine and terrestrial ecosystems: Implications for the design of coastal marine reserves. Ecol. Appl. 13, 90–107.

CNH, 2018. Centro Nacional de Información de Hidrocarburos.

Coldwell, P.J., 2014. El cambio del paradigma energético, in: Gallardo, A., De la Mora, L.M. (Eds.), Colección de Análisis y Debate de Las Reformas Del Pacto Por México Reforma Energética. Fundación Colosio, Distrito Federal, pp. 451–454.

Crutzen, P.J., 2002. Geology of mankind. Nature 415, 23. https://doi.org/10.1038/415023a

Douvere, F., 2008. The importance of marine spatial planning in advancing ecosystem-based sea use management. Mar. Policy 32, 762–771. https://doi.org/10.1016/j.marpol.2008.03.021

Espinoza-Tenorio, A., Espejel, I., Wolff, M., Zepeda-Domínguez, J.A., 2011. Contextual factors influencing sustainable fisheries in Mexico. Mar. Policy 35, 343–350. https://doi.org/10.1016/j.marpol.2010.10.014

Espinoza-Tenorio, A., Zepeda-Domínguez, J.A., Núñez Gómez, J.C., Mendoza Carranza, M., Barba-Macías, E., 2015. ¿De la intuición al conocimiento lagunas costeras de Tabasco, México. Interciencia 40, 446–456.

Etkin, J., Schvarstein, L., 1995. Identidad de las organizaciones; Invarancia y cambio, Paidós. ed. Prentice Hall, Buenos Aires.

Folke, C., Biggs, R., Norström, A. V., Reyers, B., Rockström, J., 2016. Social-ecological resilience and biosphere-based sustainability science. Ecol. Soc. 21, art41. https://doi.org/10.5751/ES-08748-210341

Folke, C., Hahn, T., Olsson, P., Norberg, J., 2005. Adaptive Governance of Social-Ecological Systems. Annu. Rev. Environ. Resour. 30, 441–473. https://doi.org/10.1146/annurev.energy.30.050504.144511

Fontana, A., Frey, J., 2005. The interview, in: Denzin, N., Lincoln, Y. (Eds.), The Sage Handbook of Qualitative Research. Sage Publications Inc., pp. 695–727.

Fox, T., 2004. Corporate social responsibility and development: In quest of an agenda. Development 47,

29–36. https://doi.org/10.1057/palgrave.development.1100064
Fraga, J., Villalobos, G.J., Doyon, S., García, A., 2009. Descentralización y manejo ambiental Gobernanza Costera en México, Descentralización y Manejo Ambiental.
Freeman, L.C., 2004. The Development of Social Network Analysis: A Study in the Sociology of Science. Empirical Press, Vancouver. https://doi.org/10.2189/asqu.2005.50.1.148
Fruchterman, T.M.J., Reingold, E.M., 1991. Graph Drawing by Force-directed Placement. Software-Practice Exp. 21, 1129–1164.
Gallardo, A., 2014. Una reforma para el crecimiento económico y el bienestar, in: Gallardo, A., De la Mora, L.M. (Eds.), Reforma Energética; Motor de Crecimiento Económico y Bienestar. Fundación Colosio, Distrito Federal, pp. 21–32.
Gatzweiler, F.W., 2014. Value, institutional complementarity and variety in coupled socio-ecological systems. Ecosyst. Serv. 10, 137–143. https://doi.org/10.1016/j.ecoser.2014.08.004
Gibbs, M.T., 2008. Network governance in fisheries. Mar. Policy 32, 113–119. https://doi.org/10.1016/j.marpol.2007.05.002
Girvan, M., Newman, M.E.J., 2012. Community structure in social and biological networks. PNAS 99, 7821–7826. https://doi.org/10.1079/pavsnnr20116044
Hartley, T.W., 2010. Fishery management as a governance network: Examples from the Gulf of Maine and the potential for communication network analysis research in fisheries. Mar. Policy 34, 1060–1067. https://doi.org/10.1016/j.marpol.2010.03.005
Hughes, T.P., Bellwood, D.R., Folke, C., Steneck, R.S., Wilson, J., 2005. New paradigms for supporting the resilience of marine ecosystems. Trends Ecol. Evol. 20, 380–386. https://doi.org/10.1016/j.tree.2005.03.022
Janssen, M.A., Bodin, Ö., Anderires, J., Elmqvist, T., Ernstson, H., McAllister, R., Olsson, P., Ryan, P., 2006. Toward a network perspective of the study of resilience in socialecological systems. Ecol. Soc. 11, 15.
Jenkins, R., 2005. Social Corporate Responsibility and poverty. Int. Aff. 81, 525–540.
Jones, C., Hesterly, W.S., Borgatti, S.P., 1997. A general theory of network governance: Exchange conditions and social mechanisms. Acad. Manag. Rev. 22, 911–945. https://doi.org/10.5465/AMR.1997.9711022109
Kooiman, J., 2008. Exploring the Concept of Governability. J. Comp. Policy Anal. Res. Pract.
Latour, B., 2015. Reassembling the Social. An Introduction to Actor-Network-Theory (translated by Irina Polonskaya). J. Econ. Sociol. 14, 73–87. https://doi.org/10.17323/1726-3247-2013-2-73-87
Lezama de la Torre, J.L., 1987. Migración y petróleo en Tabasco. Estud. Demogr. Urbanos Col. Mex. 2, 231–256.
Lin, N., 2017. Building a Network Theory of Social Capital, in: Social Capital. Routledge, pp. 3–28. https://doi.org/10.4324/9781315129457-1
Luna, M., Velasco, J.L., 2009. Las redes de acción pública como sistemas asociativos complejos: Problemas y mecanismos de integración. Redes. Rev. Hisp. para el análisis redes Soc. 17, 76–99. https://doi.org/10.5565/rev/redes.376
Luning, S., 2012. Corporate Social Responsibility (CSR) for exploration: Consultants, companies and communities in processes of engagements. Resour. Policy 37, 205–211. https://doi.org/10.1016/j.resourpol.2011.02.004
Mayorga-Alba, E., 2009. Extractive Industries Value Chain A Comprehensive Integrated Approach to Developing Extractive Industries (No. 3), Extractive industries and development series, 125. Washington, DC.
Muñoz-Sánchez, P., Cruz-Burguete, J.L., 2013. Identidades y tendencias migratorias desde la pesca en Chiapas y Tabasco. Convergencia 20, 231–257.
Negrete-Salas, M.E., 1984. Petróleo y desarrollo regional: el caso de Tabasco. Demogr. Econ. 18, 86–109.
Newman, M.E.J., 2006. Modularity and community structure in networks. Proc. Natl. Acad. Sci. 103, 8577–8582. https://doi.org/10.1073/pnas.0601602103
Nilsson, M., Zamparutti, T., Petersen, J.E., Nykvist, B., Rudberg, P., Mcguinn, J., 2012. Understanding Policy Coherence: Analytical Framework and Examples of Sector-Environment Policy Interactions in the EU. Environ. Policy Gov. 22, 395–423. https://doi.org/10.1002/eet.1589
Onwuka, E.C., 2005. Oil extraction, environmental degradation and poverty in the Niger Delta region of Nigeria: A viewpoint. Int. J. Environ. Stud. https://doi.org/10.1080/00207230500040823
Ostrom, E., 2009. A general framework for analyzing sustainability of social-ecological systems. Science

325, 419–422. https://doi.org/10.1126/science.1172133
Osuagwu, E.S., Olaifa, E., 2018. Effects of Oil Spill on Fish Production in the Niger Delta, SSRN. https://doi.org/10.2139/ssrn.3120396
Palacios, E.S., 2015. Sectores productivos y espacios de conflicto: pesca y petróleo en la sonda de Campeche, in: 20° Encuentro Nacional Sobre Desarrollo Regional En México. pp. 1–23. https://doi.org/10.1007/s13398-014-0173-7.2
PEMEX, 2018. Programa de Apoyo a la Comunidad y Medio Ambiente.
Pinkus-Rendón, M.J., Contreras-Sánchez, A., 2012. Impacto socioambiental de la industria petrolera en Tabasco: el caso de la Chontalpa. LiminaR X, 122–144.
Prell, C., 2012. Social network analysis: History, theory and methodology, SAGE.
Prell, C., Hubacek, K., Quinn, C., Reed, M., 2008. "Who's in the network?" When stakeholders influence data analysis. Syst. Pract. Action Res. 21, 443–458. https://doi.org/10.1007/s11213-008-9105-9
Prell, C., Reed, M., Hubacek, K., 2011. Social network analysis for stakeholder selection and the links to social learning and adaptive co-management, in: Bodin, Ö., Prell, C. (Eds.), Social Networks and Natural Resource Management: Uncovering the Social Fabric of Environmental Governance. Cambridge University Press, Cambridge, pp. 95–118.
Putnam, R.D., Leonardi, R., Nonetti, R.Y., 1994. Making Democracy Work. Princeton University Press. https://doi.org/10.2307/j.ctt7s8r7
Quist, L., 2016. in álvaro's house: fisher leaders , family life and the ethnographer at mexico's oil frontier. Suom. Antropol. 41, 21–43.
Ross, M.L., 2001. Does Oil Hinder Democracy? World Polit. 53160180, 325–361. https://doi.org/10.1353/wp.2001.0011
Roux, R., Flores-Torres, O., 2015. Los hidrocarburos en el Noreste de México. Universidad Autónoma de Tamaulipas, El Colegio de Tamaulipas.
Sandström, A., Carlsson, L., 2008. The performance of policy networks: The relation between network structure and network performance. Policy Stud. J. 36, 497–524. https://doi.org/10.1111/j.1541-0072.2008.00281.x
Scott, J., 2000. Social network analysis : a handbook. SAGE Publications.
SEMAR-SCT-SAGARPA, 2003. Acuerdo mediante el cual las secretarías de Marina, de Comunicaciones y Transportes, y de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación, establecen medidas de seguridad en la Sonda de Campeche. Acuerdo secretarial No. 117. D. Of. la Fed. 1–2.
SEMAR, 2016. Acuerdo por el que se establecen zonas de seguridad para la navegación y sobrevuelo en las inmediaciones de las instalaciones petroleras y para el aprovechamiento integral y sustentable de los recursos pesqueros y acuícolas en zonas marinas mexicanas. DOF 11–12.
Soto, L.A., Botello, A. V., Licea-DurÃ¡n, S., LizÃ¡rraga-Partida, M.L., YÃ¡Ã±ez-Arancibia, A., 2014. The environmental legacy of the Ixtoc-I oil spill in Campeche Sound, southwestern Gulf of Mexico. Front. Mar. Sci. 1, 1–9. https://doi.org/10.3389/fmars.2014.00057
Teubner, G., 2016. "And if I by Beelzebub Cast Out Devils, …": An Essay on the Diabolics of Network Failure.
Thomas, D.S., Hyde, I., Meyer, M.A., 2013. Measuring and conveying social vulnerability, in: Thomas, D.S.K., Phillips, B.D., Lovekamp, W.E., Fothergill, A. (Eds.), Social Vulnerability to Disasters. CRC Press, Florida, USA, pp. 415–445.
Uribe-Iniesta, R., 2011. Panorama y desarrollo de las ciencias sociales en el estado de Tabasco. Secuencia 113–135.
Val, M., Erik, M., Nelson, J., 1983. Offshore Petroleum and Commercial Fishery Interactions: The Case of Long Point, Port Dover, Lake Erie. GeoJournal 7, 247–260.
Vega-Redondo, F., 2007. Complex social networks, Complex Social Networks. https://doi.org/10.1017/CBO9780511804052
Vidal-Hernández, L.E., Páramo-Romero, I., Soto, L.A., Rivera-Arriaga, E., 2012. Legal framework for the offshore operations of the Mexican Oil Industry from a systemic environmental perspective. Ocean Coast. Manag. 58, 9–16. https://doi.org/10.1016/j.ocecoaman.2011.12.006
Zalik, A., 2009. Zones of exclusion: Offshore extraction, the contestation of space and physical displacement in the Nigerian delta and the Mexican Gulf. Antipode 41, 557–582. https://doi.org/10.1111/j.1467-8330.2009.00687.x
Zalik, A., 2006. Re-Regulating the Mexican Gulf, Center for Latin American Studies. Berkeley.
Zepeda-Domínguez, J.A., Zetina-Rejón, M., Espinoza-Tenorio, A., Ponce-Díaz, G., Lluch-Belda, D.,

Espinosa-Romero, M.J., Torre-Cosío, J., Cisneros-Mata****, y M.Á., 2015. Mapeo topológico de los actores involucrados en el manejo de la pesquería de jaiba café Callinectes bellicosus en Sonora, México. Cienc. Pesq. 23, 81–19.

Zepeda Domínguez, J.A., Vergara Solana, F.J., Ponce Díaz, G., 2017. El mapeo de actores y conformación de cuerpos de participación pesquera. Región Y Soc. 29. https://doi.org/10.22198/rys.2017.68.a221

CAPÍTULO III

Conclusión

El sistema de gobernanza del FOSES de la costa de Tabasco está constituido por 54 actores, que en esta investigación se agrupan en ocho grupos funcionales (agencias gubernamentales, pesquero, academia, hidrocarburos, sociedad organizada, comunidad, asistencia técnica y medios de comunicación) definidos por su afinidad profesional y objetivos institucionales. En la red de gobernanza se logró identificar la existencia de una baja cohesión entre los actores y disparidades de poder e influencia (mediante análisis de densidad y grados de entrada, respectivamente). Mediante el análisis de modularidad se logró identificar la distribución de los actores con tres agendas: agencias ambientales intermediarias-, energética y social-pesquera. Cada una, con objetivos e intereses comunes que influyen en los mecanismos para la toma de decisiones. Entre los actores involucrados existen grupos que son poco percibidos por actores más influyentes (comunidad, medios de comunicación y asistencia técnica), sin embargo ejercen una presión en las compensaciones económicas a los impactos ambientales o sociales. Se halló que son vulnerables a la base legal y la voluntad de los actores políticos clave.

La información hallada podría ser útil para transparentar la participación de actores relevantes en la planeación de sistemas acoplados, aunque es importante recalcar que cada SSEA responde a un contexto espacial y temporal especifico y el análisis del FOSES no debe ser la excepción. La metodología y análisis que se empleada puede seguirse nutriendo con la posibilidad de profundizar en algunos aspectos con los entrevistados, el aumento de entrevistas a otros actores clave, otros análisis a la red de gobernanza que reconozcan la importancia de pequeñas subestructuras u otras metodologías que permitan seguir mapeando la existencia de otros grupos funcionales, presente . Entre los pendientes que se pueden abarcar para el reconocimiento de los actores clave en FOSES son: i) el reconocimiento administrativo de los roles de gobernanza que ejercen; ii) explorar con detalle los roles sociales de cada uno de los involucrados; esto es, porqué están ahí y los motivos sociales y iii) incentivos y barreras individuales que hacen que la red actualmente funcione con una baja cohesividad.

A medida de recomendación se sugiere llevar a cabo una aproximación al potencial de la presencia y formas de capital social que pudieran estar circulando en la red de gobernanza del FOSES; en concreto, relacionado con la confianza, camaradería. La idea del capital social como recurso en un análisis de redes permitiría indagar como cada uno de los individuos o grupos de actores invertirían más en aquellas relaciones que les proporcionan acceso a los recursos de su interés, lo que conlleva a un mantenimiento de la red. En términos de tiempo se puede explorar la frecuencia con la que los actores se relacionan; la cual podría estar asociada con datos espaciales (cercanía y lejanía entre actores) y permitiría explicar mejor las dinámicas de gobernanza, y si estás tienen una relación con la cercanía y lejanía entre los actores.

La implementación de cada reforma tiene que afrontar desafíos que escapan del control de las autoridades estatales, tales como actores y colectivos con poder para obstaculizar los cambios aprobados, o bien, procesos globales de distinta índole. El éxito o el fracaso de las reformas dependen en buena medida de la capacidad para sortear esos factores externos con los recursos materiales e institucionales disponibles en el país. México sigue presentando la oportunidad para el aprovechamiento de sus mares a través de la Reforma Energética, en este escenario se requiere de investigaciones que analicen los desafíos del desarrollo sostenible y que a su vez le permita desarrollar modelos de sistemas de gobernanza más eficientes. Se espera que la identificación de los actores clave en el sistema de gobernanza de dos grandes sectores que comparten el Golfo de México sea un componente base para identificar y crear estructuras relacionales que aporten al desarrollo sostenible de este espacio marino.

Literatura citada

Berkes F, Folke C, Colding. J. 2000. Linking social and ecological systems: management practices and social mechanisms for building resilience. Cambridge University Press, 2000.

Bodin Ö, Crona BI. 2009. The role of social networks in natural resource governance: What relational patterns make a difference? Glob. Environ. Chang. 19:366–374.

Cabrero, Enrique, David Arellano y Ma. de Lourdes Amaya(2000), "Cambio en organizaciones gubernamentales: innovación y complejidad", en David Arellano, EnriqueCabrero y Arturo del Castillo (coords.), Reformando algobierno. Una visión organizacional del cambio gubernamental, Miguel Ángel Porrúa Editores-CIDE, México.

Checa-Artasu MM. 2014. Geografía, poder y petróleo en México. Algunos ejemplos. Barcelona.

Dente, B. y Subirats, J. 2014. Decisiones públicas: análisis y estudio de los procesos de decisión en políticas públicas. Barcelona: Ariel

Espinoza-Tenorio A. 2019. Pesca y petróleo: Línea base para el uso compartido de los espacios marinos en la costa de Tabasco. Villahermosa, Tabasco.

Moreno-Báez M, Pech D, Villalobos-Zapata J, Vidal-Hernández L, Ramos-Miranda J, Mendoza-Carranza M, Zepeda-Domínguez J, Alcalá-Moya MG, Juan Carlos Pérez-Jiménez4, Fernando Rosete7 CL& IE. 2014. El ordenamiento ecológico marino en México: un reto y una invitación al quehacer científico. Lat. Am. J. Aquat. Res. 42:386–400.

Gallardo, A., 2014. Una reforma para el crecimiento económico y el bienestar, in: Gallardo, A., De la Mora, L.M. (Eds.), Reforma Energética; Motor de Crecimiento Económico y Bienestar. Fundación Colosio, Distrito Federal, pp. 21–32.

Gallardo, A., De la Mora, L.M., 2014. Reforma Energética; Motor de crecimiento económico y bienestar, Colección de Análisis y Debate de las Reformas del Pacto por México Reforma Energética. Fundación Colosio, Distrito Federal.

Hilborn R. 2007. Managing fisheries is managing people: what has been learned? Fish Fish. 8:285–296.

Kooiman J. 1993. Modern governance : new government-society interactions. Sage. Leff, E. 1995. ¿De quién es la naturaleza? Sobre la reapropiación social de los recursos naturales. Gac. Ecológica 37:28–35.

Miller y Slicer, 2014. Miller, D., N. Slicer, and E. Sabourenkov. 2010. IUU fishing in Antarctic waters:CCAMLRactions and regulations. Pages 175–196 in D. Vidas, editor. Law, technology and science for oceans in globalisation. Martinus Nijhoff Publishers, Leiden, the Netherlands.

Ostrom E. 2009. A general framework for analyzing sustainability of social-ecological systems. Science 325:419–422.

Poteete AR, Janssen M, Ostrom E. 2010. Working together : Collective action, the commons, and multiple methods in practice. Princeton University Press. Quist L-M, Nygren A. 2015. Contested claims over space and identity between fishers and the oil industry in Mexico. Geoforum 63:44–54.

Sandström A, Carlsson L. 2008. The performance of policy networks: The relation between network structure and network performance. Policy Stud. J. 36:497–524. Solano Palacios E, Frutos Cortés M, Martínez Beberaje RJ. 2015. Sectores productivos y espacios de conflicto: pesca y petróleo en la sonda de Campeche. En: Pasado, presente

y futuro de las regiones en México y su estudio. Asociación Mexicana de Ciencias para el Desarrollo Regional A.C. p. 23.
Zepeda-Domínguez JA, Zetina-Rejón MJ, Espinoza-Tenorio A, Ponce-Díaz G, Lluch-Belda D, Espinosa-Romero MJ, Torre-Cosío J, Cisneros-Mata MÁ. 2015. Mapeo topológico de los actores involucrados en el manejo de la pesquería de jaiba café Callinectes bellicosus en Sonora, México. Cienc. Pesq. 23:81–90.