A Characterization of the Shark Fisheries in Campeche, Mexico

by

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ABSTRACT

Since the early 1990s, shark landings in the Mexican state of Campeche have declined drastically, mirroring an overall decrease in shark populations across the Gulf of Mexico. Historically, most research on the Campeche shark fisheries has focused on assessing the health of shark populations, with little emphasis placed on understanding the human dimension of these artisanal fisheries. This study begins to fill that knowledge gap through participant observation and informal interviews with fishery participants. Results clarify the organizational structure and the rules-in-use of the fisheries, as well as the attitudes of fishery participants towards government regulations. The characterization will ultimately inform Environmental Defense Fund’s future work to rebuild shark populations in the region.
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INTRODUCTION: A fishery in decline

The Mexican state of Campeche is situated on the Yucatan Peninsula along the Bay of Campeche in the southern Gulf of Mexico (see Figure 1). The warm, nutrient-rich waters of Campeche’s continental shelf have supported productive fisheries in the region for centuries (Zavala-Hidalgo, Gallegos-García et al. 2006).

Figure 1: Map of Campeche, Mexico

Sharks in particular are a resource of economic, social, and cultural importance in Campeche. A subsistence shark fishery has existed since the time of the ancient Mayan civilizations, and in fact many fishermen in the region continue to use Mayan names for certain shark species. It wasn’t until the 1970s that international demand for shark meat and fins resulted in an exponential increase in landings of elasmobranch species in the Campeche region (Pérez-Jiménez 2012).

In the period from 1992 to 2008, however, elasmobranch landings declined in the Mexican Gulf states from 13,976 tons to 6,280 tons (see Figure 2), mirroring an overall decline in shark populations across the Gulf of Mexico (Baum and Myers 2004; Ferretti, Worm et al. 2010). This decline occurred despite a 1993 moratorium on the issuance of new shark fishing permits, and is attributed in large part to overfishing of the resource and excessive catch of juveniles and gravid females (Castillo-Géniz, Marquez-Farias et al. 1998; Ordaz, Torcuato et al. 2009).
Mexican fisheries authorities are taking additional steps to ensure the sustainability of the shark fishery, including a closed season for shark fishing that was published in 2012 (SAGARPA 2012). However, the artisanal and multispecies nature of the fishery, along with lack of government resources, makes monitoring and enforcement of regulations difficult. In addition, because sharks in Mexico were historically classified and reported only by size and not by species, there is a severe lack of reliable species-specific data for monitoring shark populations and informing management decisions (Castillo-Géniz, Marquez-Farias et al. 1998).

In the past two decades, there have been a number of studies that have attempted to quantify Gulf of Mexico shark catches by species, gear-type and Mexican state of landing (Castillo, Márquez et al. 1996; Bonfil 1997; Castillo-Geniz, Marquez-Farias et al. 1998; Pérez-Jiménez 2012; Pérez-Jiménez, Mendez-Loeza et al. 2012b). However, less is understood about the human component of the fisheries, such as the rules-in-use\(^1\), the organizational structure and the beliefs and attitudes of the fishermen themselves.

This study begins to help fill that knowledge gap through a characterization that emphasizes the social dimensions of the fishery. Chapter 1 provides important fishery

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\(^1\) Rules-in-use refer to the working rules, or practices that are actually used by the people on the ground. They may be distinct from the formal rules expressed in laws or regulations (Cinti et al 2010).
background and a fishery system overview. In Chapter 2, differences between communities are noted and each distinct fishing community is described in greater detail. Fishery participant perspectives are incorporated in Chapter 3 to further enrich the illustration of fishing cultures in Campeche. Finally, with this complete characterization in mind, overarching themes are discussed and next steps for the fishery and its management are recommended.

Because many shark species are highly migratory, any effort to protect them must be international in scope to truly be effective. To address this concern, project client Environmental Defense Fund (EDF) has teamed up with Mote Marine Laboratory of Sarasota, FL, to coordinate a tri-national effort between the United States, Cuba and Mexico to rebuild shark populations in the Gulf of Mexico. The project is in its initial phase, with researchers working to understand the current status of the shark fisheries in each country and identify the gaps in information (Baker and Muñoz-Nuñez 2010). My study is part of this larger effort, intended to improve EDF’s understanding of the Campeche shark fisheries so that they may more successfully engage in work in this region.

METHODS

I began my research with a literature review, collecting existing information on Campeche’s fisheries. I also undertook a limited literature review of small scale fisheries worldwide, with the objective of identifying management approaches that have proven effective in other multispecies, data-poor artisanal fisheries around the globe. I utilized a Small Scale Fisheries Database developed by Duke University’s Dr. Xavier Basurto to complete this search. This Endnote database was created to store primary and secondary literature on small scale fisheries, and to provide a mechanism for organizing and searching these studies based upon their content. This database was compiled by searching the ISI Web of Knowledge database aggregate (Web of Science, BIOSIS Previews, MEDLINE, Zoological Record, and Journal Citation Reports) for “small scale fisher” and “artisanal fisher” (Basurto 2012).

The terms “elasmobranch”, “shark”, “multispecies”, “Campeche”, and “Mexico” were used to search the Endnote database for this project. Studies of potential interest
were logged in a spreadsheet and shared directly with client Environmental Defense Fund. Some studies may also be referenced throughout this report.

The majority of information in this report was derived from observations and interviews that I collected in Campeche, Mexico from January 19-29th, 2013. My research was conducted in partnership with Dr. Juan Carlos Pérez Jiménez from El Colegio de la Frontera Sur (ECOSUR), and his team including Iván Méndez Loeza, Nicte-Ha Salazar, and Fátima Bravo.

Interviews were informal and unstructured. I worked with Environmental Defense Fund and ECOSUR to develop an interview guide (see Appendix). In the field, we selected and adapted questions as appropriate from this interview guide. I did not ask all subjects the same questions or every question. Priority was given to questions about fishery organizational structure and regulations and enforcement. I was as interested in contextual meaning and interpretation as statistical representation. Interviews varied from 5 to 30 minutes in length. With the exception of a few individuals that the ECOSUR team knew personally, interview subjects were selected at random and included fishermen, buyers, boat owners, permisionarios (permit-holders) and government officials. Interviews were not recorded and personal information was not collected in order to protect the privacy of the interview subjects. For the purposes of this paper, each interview is identified by community and subject role (fisherman, permisionario, etc), and assigned a number. Some interviews were conversations with multiple fishery participants simultaneously.

I collected additional information through participant observation and personal communication with Dr. Pérez-Jiménez, my principal informant, and the rest of the ECOSUR team. Detailed field notes and interview summaries were submitted to the client organization separately.

Communities visited included Campeche City (which served as a home base), Champotón, Sabancuy, Ciudad del Carmen, Emiliano Zapata and San Pedro (which is technically in Tabasco, right on the border of Campeche and Tabasco). Bad weather hindered fishing activity in Sabancuy and Ciudad del Carmen, and as a result few individuals were available in these locations for interviews.
CHAPTER 1: FISHERY BASICS

All natural resource management issues have multiple components – the biophysical, the human, and the institutional (Orbach 2009). This characterization is broken down in terms of these three elements, which interact and overlap to produce the complex fishery system that I observed in Campeche. An understanding of all three of these pieces is necessary to make informed management decisions.

1.1 Biophysical Ecology

1.1.1 About the Bay of Campeche ecosystem

The Bay of Campeche (BOC) is a semi-enclosed region surrounded by the Mexican states of Veracruz, Tabasco, and Campeche, known for its productive fisheries and lucrative oil and gas resources. The continental shelves in the BOC range from a mere 30 m wide in Veracruz to a whopping 200 m wide on the Bank of Campeche (Zavala-Hidalgo, Gallegos-García et al. 2006). The Bank of Campeche is a wide, relatively flat carbonate region with depths ranging from 20-200m, flanked on the right by the Yucatan Straits (Gomez 2002). Beyond the shallow continental shelves in the BOC, depths increase rapidly to over 1000m, and reach 3000m at the deepest point of the Bay (see Figure 3) (León, Monreal et al. 2007).

Figure 3: Bay of Campeche with Bathymetry Contours shown for isobaths in meters

Source: (León, Monreal et al. 2007)
A number of rivers empty into the BOC, including the Grijalva-Usumacinta (G-U) system and the Coatzaolcos River, which together account for one third of all fluvial discharges in Mexico (Gomez 2002). Lagoonal systems that line the coast, most notably the Terminos Lagoon, serve as important nursery areas for juvenile fish and shark species (Sanvicente, orve et al. 1998).

The southern Gulf of Mexico has three characteristic seasons that drive many of the ecological processes: the ‘dry’ season from March-July, the ‘rainy’ season from August-October, and the winter storm or ‘northers’ season from November through February (Signoret, Monreal-Gómez et al. 2006). The northerns season is known for the formation of cold fronts that generate strong winds (up to 20-30 cm/s) (Leon, Monreal-Gomex et al. 1992) and vertical mixing of the water column up to 175 m of depth (Vidal, Vidal et al. 1994). Although these winds stir up nutrients that increase ecosystem productivity, they can disrupt fishing activities.

1.1.2 Shark species prevalence and biology

Around 40 shark species have been recorded in commercial landings on the Atlantic coast of Mexico, but less than a dozen are commonly caught in Campeche (Federal 2007a; Pérez-Jiménez, Mendez-Loeza et al. 2012b). As with many small-scale fisheries in developing nations, data on the shark fishery in Campeche is very limited (Espinoza-Tenorio, Espejel et al. 2011). Official elasmobranch fishery statistics in Mexico are divided into three main groups: smaller sharks called “cazones” (length < 1.5 m), larger sharks called “tiburones” (length > 1.5m), and rays. Because of this classification scheme, there are no official records that show historical catch by species. Even the grouping of sharks into size categories is somewhat arbitrary, as fishermen often count juvenile individuals of larger species as “cazones” (Pérez-Jiménez, Méndez-Loeza et al. 2012a). Additionally, the lack of reliable data makes it difficult to determine whether fluctuations in catch volume are due to changes in shark populations or changes in fishing effort (Bonfil 1997).

Despite these deficiencies in official catch data, researchers have managed to quantify landings of different shark species through extensive survey work (see Figure 4).
The bonnethead shark (*Sphyrna tiburo*) and the Atlantic sharpnose shark (*Rhizoprionodon terraenovae*), considered “cazones”, are the two most commonly caught shark species in Campeche. Less common but still present is the blacknose shark (*Carcharhinus acronotus*). These species typically don’t grow to surpass 4-5 feet in length, and they are very biologically productive (Bright 2011; Pérez-Jiménez, Mendez-Loeza et al. 2012b). The Atlantic sharpnose reaches maturity at 3.5 years of age, and the bonnethead at only 2.5 years (Frisk, Miller et al. 2001). Embryonic development of the Atlantic sharpnose lasts nine to twelve months and ends with a litter of three to seven individuals in May or June right before the mating period starts anew (Márquez-Farias and Castillo-Géniz 1998a). The bonnethead, on the other hand, has a gestation period of only four to five months and an average litter size of 10 individuals. Bonnethead mating occurs in April or May and the pups are born in August or September (Márquez-Farias, Castillo-Géniz et al. 1998b). Both the bonnethead and the Atlantic sharpnose shark inhabit coastal waters and are therefore accessible to fishermen throughout the year, but they form large spawning aggregations in late spring off of Campeche’s shores (Márquez-Farias and Castillo-Géniz 1998a; Márquez-Farias, Castillo-Géniz et al. 1998b).

Bull sharks (*Carcharhinus leucas*) and blacktip sharks (*Carcharhinus limbatus*) are the most frequently caught “tiburones”, reaching 6-10 feet at maturity (Camhi, Pikitch et al. 2008). Hammerhead sharks, (*Sphyrna mokarran*), are also caught. These larger sharks are caught much less frequency than the “cazones”. They have lower biological productivity, and are thus more susceptible to fishing pressure than their smaller relatives (Pérez-Jiménez, Mendez-Loeza et al. 2012b). Blacktip sharks don’t reach maturity until seven years, and bull sharks not until fifteen years of age (Frisk, Miller et al. 2001). Blacktip sharks migrate together in groups, further increasing the vulnerability of these sharks to overfishing (Harry, Tobin et al. 2011). Their movements are difficult to predict but are influenced by temperature change (Castillo, Márquez et al. 1996). Bull sharks travel alone and do not aggregate (PC with Pérez-Jiménez).
Sometimes elasmobranch species are found in close association with other species. Along the Campeche Bank, mackerel and cazones are often caught together. Bull sharks and eagle rays are often landed together, especially in Champotón. In San Pedro, stingrays, catfish and cazones are closely associated (PC with Pérez-Jiménez). These species associations are important to recognize, as they may have management implications. For example, it may be impossible to catch catfish without also landing some cazones; thus, to ensure the sustainability of one species, fishing authorities may also need to restrict fishing of associated species.

1.2: The Fishery on the Ground: Human Dimensions

1.2.1 Industry landscape and changes

The state of Campeche has undergone notable economic transitions over the past thirty years. What started as a remote, rural region in Mexico evolved to support large-scale cattle ranches and enormous tropical plantations. Then exploration and exploitation of petroleum began, and Mexico’s oil monopoly, Petróleos Mexicanos (PEMEX), moved into the area. Today, Campeche and neighboring state Tabasco host the highest oil and gas production in Mexico (Sánchez-Gil, Yáñez-Arancibia et al. 2004). The presence of

<table>
<thead>
<tr>
<th>Species</th>
<th>Sharks</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sphyrna tiburo</em></td>
<td>1578</td>
</tr>
<tr>
<td><em>Rhizoprionodon terraenovae</em></td>
<td>1224</td>
</tr>
<tr>
<td><em>Carcharhinus acronotus</em></td>
<td>113</td>
</tr>
<tr>
<td><em>Sphyrna lewini</em></td>
<td>36</td>
</tr>
<tr>
<td><em>Carcharhinus leucas</em></td>
<td>16</td>
</tr>
<tr>
<td><em>Carcharhinus limbatus</em></td>
<td>12</td>
</tr>
<tr>
<td><em>Ginglymostoma cirratum</em></td>
<td>9</td>
</tr>
<tr>
<td><em>Sphynx mokarran</em></td>
<td>4</td>
</tr>
<tr>
<td><em>Carcharhinus falciformis</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Carcharhinus perezii</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Carcharhinus plumbeus</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Carcharhinus porosus</em></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,997</strong></td>
</tr>
</tbody>
</table>

Source: (Pérez-Jiménez, Mendez-Loeza et al. 2012b)
this industrial giant has changed the landscape of the area considerably, and prompted a lot of concern for natural resources such as fisheries.

Nevertheless, the people in the Mexican Gulf States (Tamaulipas, Veracruz, Tabasco, Campeche, Yucatán and Quintana Roo) continue to take advantage of their access to elasmobranch and other marine resources. Mexico ranks 7th globally for shark production, bringing in between 20,000 and 29,000 tons of shark annually over the last ten years (Baker, Hueter et al. 2011). Although approximately 90% of sharks are landed on Mexico’s Pacific coast, shark production in the Gulf of Mexico is still significant, involving an estimated 1,813 fishing vessels and 7,378 artisanal fishermen (Baker and Muñoz-Nuñez 2010). Landings vary in each state by year. Veracruz and Tamaulipas have traditionally reported the highest landings of tiburones, but Campeche typically weighs in at first or second place for total elasmobranch catch (Soriano 2011). For many fishermen in Campeche, sharks serve as an important source of income in between seasons for more lucrative species such as octopus (Soriano 2010).

While Mexico’s artisanal fishing fleet has grown more than 500% nationwide in the last three decades, the average annual catch per boat is declining (Fernández-Méndez 2006). Increased restrictions on fishing effort are intended to achieve long-term sustainability of the resources, but those same restrictions cause immediate financial hardship for fishermen, most of who have little education and low socioeconomic status (Mata 2012). For many fishermen in Campeche, the only realistic alternative to fishing is work in agriculture or aquaculture, both of which have significant barriers to entry (Interview Champotón #4).

1.2.2 Types of shark fisheries

The shark fisheries operating out of Campeche are extremely heterogeneous in nature. Sharks are caught in target shark fisheries, in multispecies fisheries targeting both sharks and teleost fishes (the “escama” fishery), and as bycatch in other fisheries (Pérez-Jiménez, Mendez-Loeza et al. 2012b). In multispecies fisheries, sharks are typically caught alongside escama species like grouper, snapper, snook, mackerel or other scaly fish. Sharks can also be caught as bycatch in fisheries specifically targeting shrimp or tuna (Baker and Muñoz-Nuñez 2010).
Surveys conducted in 2011 showed that a vast majority of sharks were landed in multispecies fisheries or as bycatch in other fisheries (see Figure 5). When fishermen carry multiple types of gear for a single trip, it can be difficult to determine whether or not the shark catch was incidental. These scenarios are categorized as “M-B” in the table below.

**Figure 5: Sharks by species and type of fisheries in the state of Campeche in 2011 based upon field surveys of 2,997 landed sharks. (M-B = could not distinguish whether shark catch was multi-species or bycatch.)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Target</th>
<th>Multispecies</th>
<th>By-catch</th>
<th>M - B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sphyrna tiburo</td>
<td>25</td>
<td>927</td>
<td>290</td>
<td>336</td>
<td>1578</td>
</tr>
<tr>
<td>Rhizoprionodon terraenovae</td>
<td>495</td>
<td>314</td>
<td>388</td>
<td>27</td>
<td>1224</td>
</tr>
<tr>
<td>Carcharhinus acronotus</td>
<td>4</td>
<td>8</td>
<td>80</td>
<td>21</td>
<td>113</td>
</tr>
<tr>
<td>Sphyrna lewini</td>
<td>35</td>
<td>1</td>
<td>1</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Carcharhinus leucas</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Carcharhinus limbatus</td>
<td>1</td>
<td>10</td>
<td>2</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Ginglymostoma cirrata</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Sphyrna mokarran</td>
<td>1</td>
<td>3</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Carcharhinus falciformis</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Carcharhinus perezii</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Carcharhinus plumbeus</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Carcharhinus porosus</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>542</td>
<td>1255</td>
<td>808</td>
<td>392</td>
<td>2997</td>
</tr>
</tbody>
</table>

Source: (Pérez-Jíménez, Mendez-Loeza et al. 2012b)

The target fishery for cazón traditionally takes place during the dry season from April to July, with most of the activity in May and June when the adult sharks (principally the Atlantic sharpnose) aggregate to spawn. Catches of bonnethead sharks remain high from June into September (PC with Pérez-Jíménez). Most of the year, cazones are targeted mainly in the vicinities of Scorpion Reef (“Arrecife Alacranes”) and Cayo Arcas, both around 130km from shore (Pérez-Jíménez, Mendez-Loeza et al. 2012b). However, the spawning aggregations in May and June occur within 40km of shore. Juvenile cazones are also caught closer to shore in the multispecies teleost fishery (PC with Pérez-Jíménez). As cazón populations decline, though, fishing activities are being pushed farther and farther offshore (Pérez-Jíménez, Méndez-Loeza et al. 2012a).
Although historically the cazón target fishery operated as described above, a recently instituted closed season (“veda”) now prohibits shark fishing in May and June in the Gulf of Mexico, and also in August on the Bank of Campeche. This closure is intended to protect the spawning aggregations and avoid the capture of pregnant or gravid females, and is discussed in greater detail in section 1.3.2.

Tiburones are targeted during the winter cold front season from October to February or March, less than 35 km from shore (Pérez-Jiménez, Mendez-Loeza et al. 2012b). The target fishery for tiburones has declined significantly in the last decades, and now it exists only in the communities of Champotón and Ciudad del Carmen.

1.2.3 Fishing gear

The majority of sharks in Campeche’s artisanal fisheries are caught in 7-10m-long fiberglass and wood boats called “lanchas” (also known as “pangas”) (Castillo-Géniz, Marquez-Farias et al. 1998). These tiny boats have outboard motors ranging from 60-85 horsepower depending on the distance that they travel from shore. Because many of the lanchas remain out at sea overnight, they each carry long wooden poles (usually simple tree branches) with small lights attached at the top to help them avoid collisions on the water. On board, the anchor, rope and fishing gear take up most of the space in the lanchas. There are also small, removable coolers on board where catch is stored on ice. Fishermen typically carry extra gas, and those that fish many kilometers from shore also carry a radio (PC with Pérez-Jiménez). Most of the lanchas (and the fishing gear more generally) are quite old, and many have peeling paint and weathered sides that make the vessel identification numbers nearly impossible to read.

Lanchas targeting tiburones will usually only leave for a day at a time; however, cazón fishermen can spend anywhere between 2 and 15 nights at sea per fishing trip (Pérez-Jiménez, Mendez-Loeza et al. 2012b). Lanchas that are used for longer trips are sometimes modified to include small cabins on board that provide some limited shelter. They may also have larger, built in coolers to store a greater quantity of product.

Fishing crews vary in size from one to three people, with two being standard. Preference of the boat owner, length of the trip and value of the species being targeted may all factor in to determine crew size (PC with Pérez-Jiménez).
Fishing gear use varies with season and region, but small bottom longlines and gillnets are most common (Castillo-Géniz, Marquez-Farias et al. 1998; Soriano 2010).

Gillnets (“redes”) can be made of nylon (monofilament) or silk. Nylon gillnets have smaller holes (less than 20cm) and are the most common nets used for the teleost and cazón fisheries. Silky gillnets have larger holes (30cm or greater) and are used to catch tiburones, rays and snook (PC with Pérez-Jiménez).

Sharks are also caught on various types of longlines. The standard longline (“palangre”) can stretch for 6-7 miles with up to 3,000 hooks, and is used to catch escama and cazones. A different type of fishing line called a “cimbra” is used to target tiburones specifically. It involves a long, horizontal line reinforced with metal and containing only 100-150 hooks, which are larger than the hooks on a traditional longline (PC with Pérez-Jiménez).

Many fishermen alternate between two or three different types of gear, depending upon factors like the species in season, daily weather conditions and even the lunar cycle. One fisherman explained that on the days surrounding the full moon, catches of tiburones and rays are notably low; therefore, on these occasions he trades out his silky gillnet for a nylon gillnet and targets teleost fishes, instead. This variability in gear use allows the fishermen to adapt to changing circumstances, but it also makes them difficult to categorize.

When a lancha leaves for a fishing trip, it can carry up to $20,000 pesos worth of ice, bait and gasoline on board depending on trip length (Interview Sabancuy #1). There is a lot of money invested upfront to make the fishery function, and a lot at risk if the fishermen are unsuccessful.

1.2.4 Shark products and commercialization

Although international demand has certainly been a driving force in shark exploitation, up to 90% of the shark caught in Mexico is consumed domestically (Castillo-Géniz, Marquez-Farias et al. 1998). Large sharks are coveted for their fins and skin which are typically shipped to international markets, but the lower-value cazones are pursued for their meat and often consumed locally (Federal 2007a; Soriano 2010). Shark consumption in Campeche is particularly high, and many families eat a traditional shark
dish called “pan de cazón” regularly (PC with Julio Sanchez). When possible, other parts of the shark are also utilized. The shark liver is processed to extract the oil for medicinal purposes, shark cartilage can be used for biopharmaceuticals and the bones are sometimes saved for decoration (Soriano 2010; Betancourt, Flores et al. 2011).

The price of sharks varies with available supply. In January, because cazones were out of season and therefore scarce, they sold at the Champotón market for 70 pesos/kg; however, in April and June when landings increase, retail prices may drop to 30-40 pesos/kg (PC Pérez-Jiménez). There is usually at least a 15 peso/kg difference between what the fishermen are paid for the fish and what the consumer pays for it. The buyer adds about $3-4 pesos/kg for his services, and the rest of the difference is added by other intermediaries and the final retailer (Interview Campeche #5). Fishermen aren’t paid more per kilogram for shark fins, even though the fins have a much higher commercial value than the rest of the shark (Pérez-Jiménez, Méndez-Loeza et al. 2012a). Only the buyers and retailers, not the fishermen themselves, benefit from the high international prices for shark fins.

The sharks that are not sold in local markets are often shipped to Mexico City where they are either exported internationally or sold in Mexico’s largest seafood market, the capital’s Nueva Viga Market (Soriano 2010). Some seafood products are also sent to processing plants in Puerto Progreso in the Yucatán, from where they are shipped to Europe and the U.S (PC with Pérez-Jiménez).

A special invoice (“factura”) is required to legally commercialize seafood in Mexico. The Mexican government distributes these invoices only to individuals or cooperatives that have valid fishing permits. Fishing permits can be distributed for individual species or for groups of species. In Mexico, there is one general fishing permit for the capture of sharks and rays. Many permit-holders possess multiple kinds of permits. The most common permits in Campeche are for octopus, shrimp, teleost fish and sharks and rays. See Figure 6 below for a list of licenses by permit-type in the state of Campeche in 2011. Notice that although shark licenses account for only a small percentage of the overall total number, because sharks are also caught regularly by teleost fishermen, they may actually be landed by around 50% of all lanchas operating out of Campeche.
The permit-holders write an invoice to legalize their catch. The invoice is expected to remain with the product as it changes hands through the market chain until it reaches its final retail or export destination (PC with Pérez-Jiménez). The responsibilities of permit-holders will be discussed in greater detail in Section 1.2.5.

### 1.2.5 Fishery structure and organization

Artisanal fishermen in Mexico are often broadly categorized as cooperative members, employed fishermen or “free fishermen” (Cinti, Shaw et al. 2010; Pérez-Jiménez, Mendez-Loeza et al. 2012b). A cooperative is a type of fishermen’s association within which permits and equipment are shared among members. Employed fishermen work for individual-permit holders called permisionarios. Free fishermen, or “pescadores libres,” are traditionally understood to be completely unaffiliated with any cooperative or permisionario.

While these three broader groups certainly do exist in Campeche (and are described in detail below), the organizational structure operating on the ground in the fisheries is much more complex. Fisheries in adjacent communities may function entirely differently, and there are a multitude of possible variations in roles and functions. This section will describe the roles and interactions of five different groups of fishery participants – cooperatives, permisionarios, boat owners, buyers and fishermen - that are prevalent in the Campeche target and multispecies shark fisheries. It is important to note

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**Figure 6: Licenses and number of vessels by permit type, Campeche 2011**

<table>
<thead>
<tr>
<th>Species</th>
<th>Licenses</th>
<th>Boats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crabs</td>
<td>81</td>
<td>391</td>
</tr>
<tr>
<td>Octopus</td>
<td>526</td>
<td>1398</td>
</tr>
<tr>
<td>Oyster</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Seashell</td>
<td>101</td>
<td>243</td>
</tr>
<tr>
<td>Sharks</td>
<td>48 (3.2%)</td>
<td>170 (3.7%)</td>
</tr>
<tr>
<td>Shrimp</td>
<td>47</td>
<td>193</td>
</tr>
<tr>
<td>Teleost fishes</td>
<td>679</td>
<td>2136</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1,483</td>
<td>4,534</td>
</tr>
</tbody>
</table>

Source: (Pérez-Jiménez, Mendez-Loeza et al. 2012b)
that these groups are not, nor are they intended to be, mutually exclusive. For instance, a fisherman might also be a cooperative member, and therefore fall into two different categories. Figure 7 outlines the variety of possible positions that a fisherman may occupy in Campeche’s fisheries. The various fishery participant roles are described in detail in this section.

**Figure 7: Campeche Fishery Organizational Structure**

![Organizational Structure Diagram]

**Cooperatives**

As discussed briefly above, cooperatives are associations of fishermen fishing under a shared permit and sometimes sharing equipment. Cooperatives are required to have a president, treasurer, and other functionaries, and oftentimes the members are expected to pay dues. The cooperative members receive aid from the government to subsidize the cost of supplies like ice and gas, and to purchase and repair lanchas and fishing gear (PC with Pérez-Jiménez). Cooperatives may or may not have a bodega (a seafood storage plant) or means of transporting their product to market.

Many cooperatives in Mexico were formed in the 1970s during a time of rapid growth for Mexican fisheries and markets (Espinoza-Tenorio, Espejel et al. 2011). The cooperatives were granted exclusive concessions to species of high value, including abalone, lobster, and sea turtle (Young 2001). However, the Federal Fishery Law of 1986
eliminated the cooperative’s exclusive access to most marine resources (Espinoza-Tenorio, Espejel et al. 2011). In Campeche today, some cooperatives continue to function as intended, with the fishermen themselves listed as members and receiving the government benefits directly. However, in many cases the modern cooperatives appear to function essentially as permisionarios do, and instead of fishing themselves the cooperative members hire others to fish on their lanchas. These cooperative members continue to receive government subsidies, but some choose to keep the benefits for themselves rather than using that aid as it was intended (Interview Sabancuy #1). Another subset of cooperatives in Campeche continues to exist on paper (and thus the members continue receiving benefits), but the cooperatives have sold their lanchas and gear and no longer actively participate in the fishery (Interviews Sabancuy #1, Campeche #2). The fishery participants call these cooperatives “ghost cooperatives”.

There was some confusion among interviewed fishermen, buyers and permisionarios as to the number of cooperatives operating in their communities. On more than one occasion, I received remarkably different responses about cooperatives in the same exact community. The uncertainty surrounding the extent of their involvement suggests that cooperatives are not the predominant organization for fishermen in Campeche.

With the exception of one community (Emiliano Zapata), it appeared that there were few or no direct benefits for fishermen who joined or worked for a cooperative in Campeche (Interviews Sabancuy #1, San Pedro #1, Champotón #3). Corruption in cooperatives is very high, and even when fishermen are active members there is a tendency for government aid to remain among the leadership and not filter down as intended to help all those in the organization. When cooperatives are further organized into Cooperative Federations (local or regional associations of cooperatives), the opportunities for corruption increase further. Typically, the Federations decide how government support gets distributed among the cooperatives, and inequitable distribution may occur as a result of bribery or favoritism (PC with Pérez-Jiménez).
Permisionarios

These are individuals that hold permits for the fishery but are not affiliated with a cooperative. The vast majority of permisionarios do not actually fish; they are businessmen who hire others to fish on their lanchas. Permisionarios tend to own at least several lanchas and a bodega where seafood, ice, fishing gear and gas can be stored. Sometimes they also own trucks to transport the product to market. The bodegas supply the fishermen with ice and gas for their work. In return, the fishermen are supposed to sell their catch exclusively to that bodega. However, it is common practice for fishermen to sell some of the product to other buyers who will give them a higher price, before returning with the remaining product to their bodega (Interview Champotón #2).

The permisionarios themselves do not actually spend much time at the bodega, instead hiring a bodega manager (“encargado de bodega”). This bodega manager does not hold a fishing permit, but he still has some level of influence in how the business is run and what decisions are made. He is the person interacting daily with the fishermen and other buyers.

One bodega owner stressed the point that there are no formal contracts between fishermen and permisionarios, so the fishermen can switch between bodegas at will (although most chose to stay with one permisionario for many years). When a bodega owner gives a fisherman a lancha and gas and ice to go fishing, he’s doing so on faith that the fisherman will return with the gear and with their whole catch. If a fisherman’s catch doesn’t cover the cost of supplies invested in the trip, he will not be paid for the catch, but he is not legally required to repay the money lost (Interview San Pedro #2).

Another subset of permisionarios do not own a bodega but do own lanchas and fishing gear. These permisionarios typically have relationships established with certain buyers and their product goes straight from the lanchas into the buyers’ trucks.

A much smaller but still existent group of permit holders are actually what one might consider truly “free fishermen” – they own their boats, equipment and fishing permit. They can sell their catch wherever they choose. These fishermen still need gas and ice, so they may establish relationships with certain bodegas or buyers who can provide those supplies.
One of the benefits of working for a permisionario is secure access to a greater diversity and higher quality of fishing gear. Permisionarios typically repair and replace fishing gear and motors when they break. A free fisherman with his own permit and gear lacks the security in knowing that someone will replace his boat motor if it is stolen or his net if it is torn (Interview Champotón #2, #4). Fishing independently, rather than for a permisionario or boat owner, is in some ways much riskier, even though it affords a fisherman some freedom in choosing a buyer and may allow him to sell his product for a higher price.

**Boat owners**

These individuals own lanchas and fishing gear, but do not have fishing permits. They hire fishermen to work on their boats and receive some fraction of the overall earnings of each trip. The boat owners must establish relationships with a permisionario, so that the seafood landed by their lanchas can be sheltered under a permit and commercialized with an invoice. In interviews, the fishermen referred to the boat owners as their bosses. These individuals are significant and often-overlooked players in the fishery.

**Buyers**

Seafood buyers (or dealers), called “compradores” or “coyotes”, are individuals that transport the seafood landed from the docks or bodegas to market. Some buyers purchase smaller amounts of product for sale in a local market or store, while others purchase large quantities for transport via truck to other parts of Mexico, or even for international markets. It’s common for seafood to pass through the possession of multiple buyers before it arrives at a retail market. When a cooperative or permisionario has a method of transporting the product, they function as the buyer. If not, they must work with other buyers to get their product to market.

Most buyers do not have fishing permits, and must receive the proper invoice from a permit-holder to legally commercialize the catch. This invoice is supposed to accompany the product from the time it is first sold until it reaches the retail market.
Fishermen

Fishermen in Campeche can be fit into the three traditional categories described at the beginning of this section, but with some important nuances. Some fishermen are cooperative members that receive benefits and actively participate in the fishery. Perhaps the majority of fishermen are employed, either by a permisionario, a boat owner or a cooperative in which they are not members. A smaller percentage may be “free fishermen”, in possession of their own fishing permit, lancha and fishing gear, and able to sell their catch to whatever bodega or buyer that they choose. This is uncommon, however, because when they have a permit and boats and gear, fishermen usually stop fishing altogether and switch over to the role of permisionario, essentially employing others to fish for them.

A clear theme that emerged from the interviews was that the term “free fishermen” means different things to different people. Fishermen with their own boat and gear but no permit consider themselves to be free fishermen because they depend on no one to go out and fish, even though they are fishing illegally and rely on someone else to shelter and commercialize their catch. Many employed fishermen also self-identified as free fishermen, explaining that they are “free” in the sense that they can, at their will, go and fish for a different employer (Interviews Campeche #1, #5). Although most fishermen choose to work for the same permisionario or boat owner for an extended period of time, they are not obligated under any formal contract to do so.

In Campeche’s communities, fishermen register with organizations called “Frentes Comunes de Pescadores” to obtain their official fishing credential. Depending on the community, fishermen may have to take a safety course to be registered, or pay a monthly fee ($20 pesos/month in Champotón) (Interview Champotón #4). Fishermen must register with the Frente Común in order to obtain the monetary benefits (around $1,400 pesos/year, depending on the specific community) allotted to them by PEMEX (Petróleo Mexicano) as compensation for oil industry’s disruption to fishing activity in the region (Interview Campeche #1). The Frentes are intended to serve as organizations that represent the fishermen’s interests; however, in some communities it seemed that Frente leaders are aspiring politicians, not actual fishermen (Interview Champotón #4).
1.3 The Fishery on Paper: Institutional Environment

1.3.1 Fishery management Agencies

The fisheries management structure in Mexico typically changes every six years with the election of a new president (Espinoza-Tenorio, Espejel et al. 2011). The structure described here is functional as of January 2013; however, reorganization may occur under new President Enrique Peña Nieto.

Fisheries regulation in Mexico is shared by two federal agencies: the Secretary of the Environment and Natural Resources (with Spanish acronym SEMARNAT) and the Secretary of Fisheries and Agriculture (with Spanish acronym SAGARPA).

SEMARNAT has jurisdiction over species under protection. Shark species protected in Mexico’s waters include the great white shark (C. carcharias), the whale shark (R. typus) and the basking shark (C. maximus) (Federal 2007a). SEMARNAT is also responsible for the establishment and management of marine protected areas throughout Mexico via its National Commission of Natural Protected Areas (CONANP).

The Federal Agency for the Protection of the Environment (PROFEPA) is SEMARNAT’s enforcement body (Cinti, Shaw et al. 2010).

The other relevant federal Agency, SAGARPA, regulates fisheries through its National Fisheries Commission (CONAPESCA). CONAPESCA is the entity that issues fishing permits, enforces regulations, and collects data on fishing effort and landings (Cinti, Shaw et al. 2010). Fishing permits are distributed by CONAPESCA for specific species or broad groups of species, such as the general teleost fish “escama” permit. Permit holders are responsible for keeping fishery logbooks (called “bitácores”) and catch data forms called “avisos de arribo,” and submitting these records to CONAPESCA on a monthly basis (Federal 2007a). CONAPESCA derives all landings data from these avisos de arribo, and if permit holders fail to submit them accordingly, their permits are not renewed. CONAPESCA has eight legislative offices nationwide and smaller offices in all of the principal fishing communities (Interview INAPESCA #1).

The National Institute of Fisheries (INAPESCA) is the research arm of SAGARPA. INAPESCA does biological surveys of fisheries to determine stock status. Based upon their research, INAPESCA recommends particular management actions to CONAPESCA; however, CONAPESCA retains all authority to adopt or dismiss
INAPECSA’s recommendations (Interview INAPESCA #1). There are fourteen regional centers of INAPESCA called the “Centros Regionales Pequeras” (CRPs). In addition, INAPESCA has a number of laboratories or science centers (Interview INAPESCA #1).

In state of Campeche, there is one office of SAGARPA, two offices of INAPESCA, and eight offices of CONAPESCA (about one per every two fishing localities). Permit holders report their landings and receive the invoices necessary to commercialize their catch from these local CONAPESCA offices (PC with Pérez-Jiménez).

See Figure 8 for a depiction of the current organizational structure.

**Figure 8: Federal agencies involved in fisheries regulation in Mexico**

Figure adapted from: (Cinti, Shaw et al. 2010)

1.3.2 Rules and regulations

A number of laws and regulations apply to the shark fishery in Mexico. The 2007 General Law of Sustainable Fishing and Aquaculture emphasizes sustainable fishing practices, reversing the Fisheries Law of 1992’s emphasis on competition and productivity in the fishing sector (Ponce-Díaz, Arregín-Sánchez et al. 2009). This overarching fishery law also establishes that fishing permits should be distributed “by vessel or unit of fishing effort” (Federal 2007b). However, in official CONAPESCA permit records, most permits are associated with more than one vessel, suggesting that
the vessel is not actually the functioning unit of fishing effort in Mexico (CONAPESCA 2012).

The National Fishing Charter (“Carta Nacional Pesquera”) is Mexico’s official report on the status of all fisheries and serves as a guidance document for fishery managers. It includes an inventory of fishery resources, guidance for the conservation of those resources and the maximum allowable fishing effort for each fishery. The National Fishing Charter is published by the National Institute of Fisheries and by law must be consulted in the process of decision-making by management authorities (Hernandez and Kempton 2003). It also grants CONAPESCA the authority to implement fishery management plans and regulations (Baker, Hueter et al. 2011). The National Fishing Charter states that the tiburón and cazón fisheries in the Gulf of Mexico are currently exploited at the maximum sustainable level, and asserts that annual production should not exceed 8,444 tons (INAPESCA 2010).

In 1993, CONAPESCA declared a moratorium on the distribution of shark fishery permits for small vessels (less than 10.5 meters in length), followed in 1998 by a moratorium on permits for medium-sized vessels (10.5-27 meters in length) (CONAPESCA 2004; Pérez-Jiménez, Méndez-Loeza et al. 2009). Since 1993, no new permits have been issued for the artisanal shark fishery, and if existing permits are not renewed appropriately, they are cancelled (PC with De Anda Fuentes). Official CONAPESCA records currently show 48 shark permits in the state of Campeche (CONAPESCA 2012).

In 2004, Mexico released a Plan of Action for the Conservation and Management of Sharks, Rays, and Related Species which offered general guidelines and a vision for the shark fishery (CONAPESCA 2004). The plan acknowledges the high catch of neonatal and juvenile sharks and gravid females, and the lack of adequate catch data by species. It promotes the development of tagging and observer coverage programs for the fishery, along with a database system to organize fishery statistics. It also calls for the establishment of programs for education and outreach, inspection and vigilance and institutional collaboration (CONAPESCA 2004). A new Plan of Action for sharks and rays was due out in November of 2012, but as of February 2013 no new plan has been released.
The Plan of Action for the Conservation and Management of Sharks, Rays and Related Species was followed in 2006 with Mexican Official Standard NOM 029-PESC-2006 - “Responsible Fishing of Sharks and Rays: specifications for use” – which establishes more detailed regulations, authorizing gears, requiring submission of fishery logbook data, specifying fishing zones and seasons, designating protected species and prohibiting shark finning (Federal 2007a). NOM 029-PESC-2006 also prohibits any sort of gillnet fishing in Terminos Lagoon in June of each year because the lagoon serves as a nursery ground for various species of shark at this time (Pérez-Jiménez, Méndez-Loeza et al. 2009).

A 2012 amendment to the Mexican Official Standard instituted a shark fishery closure (called a “veda”) in the Gulf of Mexico from May 1st through June 30th of each year, and additionally from August 1-31st on the Bank of Campeche (SAGARPA 2012). This closure was unpopular among fishery participants, and will be discussed further in Chapter 3.

1.3.3 Vigilance and enforcement

CONAPESCA is the Agency responsible for enforcement of fisheries regulations. There are eight CONAPESCA inspectors assigned to the state of Campeche. These inspectors allegedly work in many different capacities, involved in everything from routine boat inspections to intelligence operations that identify and prosecute rule-breakers (Interview INAPESCA #1). However, the actual influence of these inspectors is unclear. After several years of extensive fieldwork, the ECOSUR team had never once encountered an inspector at landing sites or bodegas (PC with Pérez-Jiménez). Bodega managers in Sabancuy and San Pedro commented that inspectors do occasionally come through the communities and into the bodegas, but typically only to drop of notices or to purchase seafood for themselves, not to conduct inspections (Interview with Sabancuy #1, San Pedro #2).

The Mexican Navy (La Secretaría de Marina) provides enforcement support to CONAPESCA. However, the Navy doesn’t actually have the authority to take enforcement actions against illegal fishing activity without a fisheries authority present (Interview INAPESCA #1). This was surprising, as almost every instance of enforcement
action that was described by fishery participants in the interviews was on the part of the Navy, especially around the PEMEX facilities.

Overall, compliance with regulations is low because vigilance is inadequate to enforce fishery rules. Illegal fishing activity will be discussed in detail in Chapter 3.

CHAPTER 2: COMMUNITY SUMMARIES

2.1 Overview of geographical patterns

There are 13 fishing communities in the state of Campeche: Isla Arena, Campeche City, Lerma, Sebaplaya, Villa Madero, Champotón, Sabancuy, Isla Aguada, Ciudad del Carmen, Atasta, San Antonio Cárdenas, Emiliano Zapata and Nuevo Campechito (Pérez-Jiménez, Mendez-Loeza et al. 2012b). My research was focused on Campeche City, Champotón, Sabancuy and Emiliano Zapata, as well as San Pedro, a small fishing community in Tabasco right over the Campeche state boundary (see Figure 9). I will also describe Isla Aguada and Ciudad del Carmen briefly, although no primary data was collected in these locations.

Figure 9: Location of fishing communities in the state of Campeche

Before exploring the rich diversity of Campeche’s fishing communities, it is helpful to discuss some regional geographical trends for context.
Campeche’s coastline can be split into two major sections based upon primary target species (see Figure 10). From Isla de Aguada west along the coast into Tabasco, shrimp is the dominant fishery. In these regions, there are two primary fishing seasons – shrimp season and “everything else season”. From Sabancuy northeast up to Yucatán state, octopus is the dominant fishery product. Snook is caught from Sabancuy west toward Tabasco using special gillnets that also capture tiburones and rays (PC with Pérez-Jiménez).

**Figure 10: Map of Campeche’s major cities and towns**

The fishing infrastructure on land changes along the length of Mexico’s Gulf coast, with the most rustic facilities (bodegas, docks, etc) in San Pedro, Tabasco and western Campeche. This section of the coastline has no seafood processing facilities, so any product that needs to be processed or packaged is shipped elsewhere. The facilities are more modern and sophisticated in Yucatán state, where big processing plants in Progreso export product to Europe and the United States (PC with Pérez-Jiménez).

As infrastructure varies along the spatial spectrum, so too does product handling. In San Pedro and even Champotón, it’s common practice to throw the fish directly onto the wet cement floor or wooden dock while unloading the catch, which results in scrapes and nicks in the skin of the animal and exposes it to bacteria. Because of the poor
handling practices, the seafood in these communities is worth less. Conversely, in Yucatán more vigilance and organization has allowed for better landing and processing conditions for the fishermen (PC with Pérez-Jiménez).

This order in Yucatán translates also to the fishing cooperatives, which are better organized than those in Campeche and Tabasco. There is more incentive in Yucatán for fishermen to join cooperatives because they can usually become members (as opposed to being treated as employees of the cooperative as often occurs in Campeche). In Yucatán, registered fishermen who are credentialed by the state actually receive some benefits like temporal employment during closed seasons from the state government (PC with Pérez-Jiménez). Campeche does not appear to have any such programs in place.

In Campeche, the fisheries targeting cazón are located in Campeche City and Isla Arena. Next door in Yucatán, cazón is targeted in Celestún and El Cuyo. Target fisheries operate out of these particular communities because they are closest to the sites of the offshore spawning aggregations in early summer. Further west along the coastline, Champotón and Ciudad del Carmen are the sites of target tiburón fisheries.

Researchers at ECOSUR have worked to identify all the communities in Campeche with target or multispecies shark fisheries. Figures 11 and 12 describe these fisheries based upon their research. In the following sections, supplementary details about certain communities are provided based upon my participant observations and interviews.

**Figure 11: Shark target fisheries in Campeche**

<table>
<thead>
<tr>
<th>Community</th>
<th>Species</th>
<th>Months</th>
<th>Boats</th>
<th>Fishing gear</th>
<th>Fishing areas (distance from shore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isla Arena</td>
<td><em>R. ternaenae</em>, <em>S. tiburo</em>, <em>C. acronotus</em></td>
<td>Apr-Jul</td>
<td>21</td>
<td>Nylong gill-nets</td>
<td>18-45 km</td>
</tr>
<tr>
<td>Campeche</td>
<td><em>R. ternaenae</em>, <em>C. acronotus</em>, <em>S. tiburo</em></td>
<td>Mar-Jun, Oct-Nov</td>
<td>10</td>
<td>Nylon and silky gill-nets</td>
<td>15-150 km</td>
</tr>
<tr>
<td>Champotón</td>
<td><em>R. ternaenae</em>, <em>C. leucas</em></td>
<td>Apr-Jun, Nov-Feb</td>
<td>15</td>
<td>Nylong gill-nets</td>
<td>10-35 km</td>
</tr>
<tr>
<td>Sabancuy</td>
<td><em>R. ternaenae</em>, <em>C. acronotus</em></td>
<td>May-Jun, Oct-Feb</td>
<td>19</td>
<td>Silky gill-nets</td>
<td>65-150 km</td>
</tr>
<tr>
<td>Isla Aguada</td>
<td><em>R. ternaenae</em>, <em>C. acronotus</em></td>
<td>May-Jun, Oct-Feb</td>
<td>10</td>
<td>Longline</td>
<td>30-100 km</td>
</tr>
<tr>
<td>Cd. del Carmen</td>
<td><em>C. limbatus</em>, <em>C. leucas</em></td>
<td>Nov-Feb</td>
<td>10</td>
<td>Silky gill-nets</td>
<td>10-20 km</td>
</tr>
<tr>
<td>Nvo Campechito</td>
<td><em>R. ternaenae</em>, <em>S. tiburo</em>, <em>S. lewini</em></td>
<td>Oct-Mar</td>
<td>10</td>
<td>Longline</td>
<td>5-45 km</td>
</tr>
</tbody>
</table>

30
2.2 Campeche City

Campeche City is the capitol of the State of Campeche. The city’s fisheries are divided into different spatial zones of docks and lanchas. Each zone has certain bodegas, permisionarios, cooperatives and buyers associated with it. People tend to work exclusively out of one particular fishing zone, and the people in each zone come to know each other quite well (PC with Méndez-Loeza). There seem to be well-established routines and a lot of respect for tradition in Campeche City’s fisheries.

Campeche City’s artisanal fleet consists of hundreds of lanchas (our best estimate was 600 lanchas) (PC with Méndez-Loeza). The majority of fishermen target octopus from August to December, and then switch to finfish or sharks when octopus season ends. The target fishery for cazón runs in May and June when the spawning aggregations draw close to the shore and are easily accessed from Campeche City. The cazón fishery is not as economically important as the octopus fishery, but it is very important culturally. Fishermen in Campeche have been catching cazón for many generations, and it is a valued tradition. Some fishermen stay at sea for up to 15 nights in pursuit of cazón, although 4-5 day trips are more common. These fishermen most commonly use nylon gillnets to target cazón.

Most of our interviews were conducted in San Román, one particular fishing zone. Through interviews, we discerned that fifteen permisionarios and approximately five different buyers worked out of San Román (Interview Campeche #2, #5). There was some confusion, however, as to the number of cooperatives active in this zone. One
fisherman said that there were two active cooperatives, another counted three, and a
permisionario and buyer both claimed that the cooperatives existed only on paper and no
longer owned lanchas to fish (Interview Campeche #1, #2, #5).

2.3 Champotón

Arriving in Champotón from Campeche, one can see the hundreds of lanchas that
line the Champotón river as it snakes through the bustling town before emptying out into
the ocean. Similarly to Campeche, most of the 500-600 lanchas in Champotón target
octopus from August to December, and then switch to teleost and other species at
different times of the year. There are around five lanchas that target tiburones and rays
using silky gillnets between October and March, and some of these boats carry nylon
gillnets to catch finfish simultaneously (PC with Pérez-Jiménez). There is no target
fishery for cazón in Champotón because the community is too far from the spawning
aggregations to make that fishery worthwhile, but cazones are regularly caught in the
multispecies finfish fishery.

There are around 40 lanchas that operate in the multispecies escama fishery year-
round because they lack permits to fish octopus. They elect not to fish octopus illegally
because the market for octopus is so highly saturated that these fishermen find that they
make more money from teleost species (PC with Pérez-Jiménez). There is a very unusual
dynamic between these particular fishermen and the local buyers. Unlike most artisanal
fishermen, these Champotón escama fishermen are not obligated to sell to a particular
buyer. The fishermen arrive each morning, with the highlights of their catch displayed
atop their gillnets, to a zone right across the road from the Champotón seafood market.
The buyers await them, with their scales and crates in tow. The fishermen themselves
announce their asking price, and then proceed to barter with the buyers until an
agreement is reached. The successful buyer then loads up his or her crates and carries the
seafood to a truck or, more commonly, across the street to a market stand. Very few of
the fishermen involved in these transactions have fishing permits that would allow them
to legally catch and commercialize the fish; however, since the seafood remains almost
exclusively in the local community and vigilance in Champotón is extremely low, this is
a low-risk practice (PC with Pérez-Jiménez).
This subset of fishermen in Champotón have more autonomy than most fishermen in the state of Campeche. Some of them own their own lanchas, others work for a boat owner, but they are all “free fishermen” in a way that many others are not because they have the power to negotiate (to at least some degree) their earnings.

There are around 9-10 bodegas in Champotón, and probably a similar number of permisionarios (Interview Champotón #1). As in Campeche City, there was some confusion as to the number of cooperatives – one buyer said that there were around 20 cooperatives of all different sizes, while a fisherman knew only of a few cooperatives (Interview Champotón #1, #2). A family group of fishermen reported that there were ghost cooperatives, existing on paper but no longer out on the water (Interview Champotón #3).

2.4 Sabancuy

Sabancuy is located on an arm of Terminos Lagoon, set back from the open ocean. There are no formal docks, and lanchas are instead pulled up onto the rocky shorelines when they are not in use. Sabancuy is different from Champotón in that there is a greater diversity of equipment in use. The fishermen in Sabancuy use both gillnets and longlines regularly. They fish for octopus and various teleost species. Their lanchas are modified to be about 50cm taller, allowing them to go out deeper at sea. Very few fishermen target sharks in Sabancuy, but there is frequent bycatch of cazón in the mackerel fishery. The longlines used to target catfish and snapper also catch cazones and tiburones occasionally (Interview INAPESCA #2).

In January in Sabancuy, lanchas lined the shoreline and there seemed to be little fishing activity. Many of the bodegas were boarded up, unable to stay in business year-round. One of the few open bodegas was co-owned by a permisionario and a cooperative. The cooperative owned 20 lanchas and the permisionario owned an additional five, and the bodega always received the catches of these 25 lanchas (Interview Sabancuy #1).

The bodega manager estimated that there are around 50 to 60 cooperatives that exist in Sabancuy on paper, but only 20 that are still operational. The cooperatives are spread between five different Cooperative Federations. Usually the cooperative members themselves don’t actually fish, employing others to do so instead. In the case of the
cooperative that co-owned this bodega, some of the fishermen were actual cooperative members but others were only hired to work on the cooperative’s boats. The bodega manger explained that the two types of fishermen were indistinguishable, and for all practical purposes there were no functional differences in the ways that the groups worked (Interview Sabancuy #1).

2.5 Isla Aguada

There are no fishermen in Isla Aguada that land sharks with any regularity (PC with Pérez-Jiménez). Most of the fishermen in Isla Aguada fish shrimp, crab, croaker and mackerel, along with other assorted finfish. Oddly, according to CONAPESCA statistics, there are a lot of cazones caught in Isla Aguada. It’s possible that the sharks are brought in from another community and simply registered at the CONAPESCA office in Isla Aguada (PC with Pérez-Jiménez).

2.6 Ciudad del Carmen

Bustling Ciudad del Carmen is a stronghold for Pétroleo Mexicano (PEMEX), whose drill sites are offshore. The presence of PEMEX profoundly changed the fishing industry in Ciudad del Carmen. Fishing is prohibited in large areas around each offshore station (ironically, these tend to be areas rich in fishery resources as the PEMEX structures provide artificial reef habitat for marine life), and vigilance in the area is some of the highest in the state of Campeche (PC with Pérez-Jiménez).

There are around 10-15 lanchas in Ciudad del Carmen that target tiburones with silky gillnets, catching primarily bull and blacktip sharks on overnight trips. The fishery runs from November to March, but on a very irregular basis due to the unpredictable movement of the sharks. If a few tiburón fishermen come back empty-handed one week, the others will usually elect to target snook for a few days before attempting again to catch tiburón. Sometimes these fishermen will catch bonnethead and blacktip sharks as bycatch in the snook gillnets. During the rest of the year, the tiburón fishermen capture more snook, Atlantic tripletail and shrimp (PC with Pérez-Jiménez).

Ciudad del Carmen used to host a tiburón processing plant that was government-subsidized, but in the mid-80s that was shut down. Today, small houses used to store ice
and gasoline remain but no large bodegas. Because they lack adequate storage facilities, the fishermen and permisionarios rely on the buyers (coyotes) to transport their product. One particular buyer purchases tiburones in Ciudad del Carmen and transports them to Puerto Progreso in the Yucatán (PC with Pérez-Jiménez).

Cooperatives, permisionarios, and free fishermen all work out of Ciudad del Carmen. As we were unable to collect interviews in Ciudad del Carmen, future research is needed to better understand the dynamic of these different groups.

2.7 Emiliano Zapata

In this tiny, agricultural community of Campeche there are no bodegas, no docks, only beach and lanchas tucked away in the sand. Buyers drive their trucks onto the beach to pick up the seafood as it is landed and transport it to market.

Shrimp is the economic staple of this fishery, and it is caught using small closed-ended nets that are dragged through the water like small trawls. When it’s off-season for shrimp, the fishermen use gillnets to target teleost fishes and sometimes capture cazón as bycatch.

Although there are fishermen employed by permisionarios in Emiliano Zapata, the structure of the fishery revolves around the cooperatives. These organizations were formed back in the 1980s when shrimp concessions were granted exclusively to cooperatives. Today there are eight cooperatives remaining in Emiliano Zapata, and they all belong to a central Cooperative Federation. There is a lot of communication between the different cooperatives, and all of the members live in the community and know each other well. One fisherman interviewed was part of a 25-member cooperative that owned six lanchas. The cooperative members all took turns working on the lanchas. Some members also worked at the cooperative’s aquaculture farm, which served as another source of income. This fisherman preferred working as a cooperative member to working with a permisionario, because he was able to receive government benefits directly (Interview Emiliano Zapata #1). Emiliano Zapata was the only community I visited where there was an apparent advantage for fishermen affiliated with a cooperative. The success of the cooperatives in this small community may be due to frequent communication and familiarity between members.
The fishermen in Emiliano Zapata are highly reliant on the buyers. Sometimes the permisionarios themselves have trucks and act as buyers, but often there are separate buyers that have no fishing permit and thus must receive an invoice for the product from a cooperative or permisionario. Some cooperatives have an agreement with one particular buyer and always sell to that person, while others will sell wherever they can get the highest price. Nevertheless, the buyers maintain considerable control over the market (Interview Emiliano Zapata #1).

2.8 San Pedro

The tiny village of San Pedro, Tabasco is situated on a river, right over the Campeche state border. Before the bridge was built, San Pedro was the site of the ferry that transported vehicles across the river between Campeche and Tabasco. Today, the economy of this impoverished community is based entirely on fishing. The local permisionarios even own the town’s saloon and restaurants, in addition to the bodegas (PC with Pérez-Jiménez).

Longlines are the most common equipment used on the 60-70 lanchas that operate out of San Pedro. Some fishermen carry the cimbra, which is a type of longline used to target tiburón. Others still use special gillnets designed to catch snook, which often capture tiburones and rays as bycatch. Some fishermen in San Pedro target snapper or catfish, which is often caught in association with the southern stingray. Nylon gillnets may be used for mackerel or finfish, but these are less common in San Pedro than in Campeche City, Sabancuy and Champotón. According to one fisherman, cazón comprises about 25% of the total catch in San Pedro during high season for cazón. But many juvenile sharks are caught as bycatch in San Pedro year round (PC with Pérez-Jiménez).

Most fishermen in San Pedro stay at sea for one day, only. They travel relatively far offshore to fish. Almost all the product landed is shipped to Mexico City.

There are nine permisionarios that work in San Pedro and each has their own bodega (Interview San Pedro #2). The permisionarios themselves are rarely at the bodegas, so the bodega managers effectively run the business. There are also three cooperatives that exist on paper, but no longer own lanchas or participate in the fishery.
Some of the cooperatives have even sold their permits to the permisionarios (Interview San Pedro #1, #2). There are also boat owners in San Pedro that do not have fishing permits, so they affiliate themselves with a particular bodega. In exchange for ice, bait and gasoline, the fishermen agree to sell their catch to that particular bodega. There are traveling buyers (coyotes) that regularly pick up the catch from the bodegas and take it to Mexico City.

The fishery in San Pedro is unusual in a few ways. First, most of the fishermen don’t actually live in San Pedro but rather next door in Nuevo Campechito. Additionally, the women in San Pedro are highly involved in the fishery. When the lanchas arrive after a trip, the women are waiting, tools in hand, to gut and clean the fish on the lanchas before they’re unloaded and brought into the bodegas. Women typically work on one particular dock and don’t switch between them. For such a small community, there is a remarkable sense of territoriality and even hostility between fishery participants (PC with Pérez-Jiménez).

Because of the proximity to PEMEX operations, there seems to be higher than average vigilance in the San Pedro region. If fishermen are caught on the water without permits, lanchas are impounded all the way back in Campeche City, and fishermen must travel the multi-hour journey and incur significant expense to recuperate them (Interview San Pedro #2).

CHAPTER 3: FISHERY PARTICIPANT PERSPECTIVE

An endless stream of input controls such as closed seasons and size and quota limits, especially when monitoring and enforcement are lacking, are not enough to ensure the sustainability of a fishery. Successful management in such conditions requires first understanding the behavior of fishermen and then designing incentives accordingly (Hilborn 2007). A characterization of the shark fishery in Campeche is incomplete without a glimpse into the minds and motivations of those directly involved in the industry. In this chapter, I will share some of the insight gained through firsthand interviews with fishermen, permisionarios, bodega managers and buyers about compliance and illegal activity, fishery roles, communication and regulations.
3.1 Compliance and Illegal Activity

Although an understanding of the institutional environment is critical to fishery characterizations, in many situations the formal laws and regulations do not resemble the rules-in-use, or the practices observed on the ground (Cinti, Shaw et al. 2010). The artisanal nature of the fishery makes enforcement of regulations difficult, and illegal fishing is commonplace. With the exception of the area around the offshore PEMEX facilities, almost all fishermen explained that there is little to no presence of fishing authorities (Interviews Campeche #1, #5, Champotón #3). Without enforcement, fishermen find that “it is cheaper to be illegal than legal”; as a result, the number of boats on the water far exceeds the number officially permitted (Mata 2012; Pérez-Jiménez 2012). Many times, the identifying numbers and names on the lanchas are worn or scratched off, making it difficult to associate them with a particular permit. Although the General Law of Sustainable Fisheries and Aquaculture mandates that permits be distributed “by vessel or unit of fishing effort,” CONAPESCA allows many boats to be registered under each permit, decreasing the effectiveness of a shark permit moratorium (Federal 2007b).

Underreporting of catch is a problem across all Mexican fisheries. From 1950 to 2010, researchers estimate that total catches were nearly twice as high as official reports (Cisneros-Monetemayor, Cisneros-Mata et al. 2013). As mentioned, it is not only the fishermen targeting sharks who are catching them. Many fishermen have no shark permit but catch and report sharks and rays as “incidental catch”. However, under the escama permits, only 10% of all landings can be incidental catch of any sort, but it is common for sharks and rays to comprise more than 10% of the total catch on certain days. The escama permit-holders address this dilemma by neglecting to report the additional shark catch at all, choosing to shelter their shark catch under someone else’s permit (a practice called amparo), or inventing additional escama catch that was not actually landed to make it appear that the shark catch comprised only 10% of the total (PC with Pérez-Jiménez). All of these approaches result in inaccurate landings data, and represent a huge obstacle for improved management in the fishery.

Fishery participants also employ other tricks to feign compliance with regulations. At the end of a fishing season, some permisionarios will intentionally report in their
records to CONAPESCA a higher amount of a particular species than was actually caught and stored in the bodega. They then continue catching the species after the season has closed and simply use the backdated invoices to make it appear as though the product was caught during the legal season and is simply being distributed later (Interview Champotón #4).

In cases where sharks are purchased for sale in a local market (like the fish market in Champotón, for instance), these animals are seldom documented at all. In the eyes of the fishing authorities, it is essentially as though the product never existed. Seafood invoices are typically only checked when product is in transit to a larger market in another state or abroad (PC with Pérez-Jiménz). Therefore, it is only the buyers who generally worry about encounters with fishing authorities.

Many fishermen were clearly frustrated with the lack of compliance with regulations (Interviews Champotón #3, Campeche City #4). One fisherman expressed that there should be stricter penalties for illegal fishing, with perpetrators thrown in jail (Interview Campeche City #4). Unfortunately, reporting illegal activity actually seems to be discouraged in some communities in Mexico. Fishermen in Champotón explained that if they report illegal fishing, the local CONAPESCA official takes down their name along with the name of the transgressor. Because the reports cannot be made anonymously and because fishermen want to avoid confrontations with their fellow fishermen, they feel that “tattling” just isn’t worth the effort or trouble (Interview Champotón #4).

Many others identified corruption of fishing authorities as one of the largest problems facing the fishery. For example, in Sabancuy and San Pedro, bodega owners commented that inspectors often come into the bodega to buy seafood at reduced prices, but they don’t actually do any investigation or inspection (Interviews Sabancuy #1, San Pedro #2).

The Director of the Regional Center of INAPESCA acknowledged that regulations such as seasonal closures aren’t always well respected by illegal fishermen, and that there is a lot of illegal activity during closed seasons and in closed areas. However, he commented that illegality is a national problem in Mexico, not just a fisheries problem, and is motivated by economic gain (Interview INAPESCA #1).
3.2 Fishery Roles

A number of themes emerged from conversations with fishery participants about fishery organizational structure. First, as alluded to earlier, the cooperatives in many of the fishing communities in Campeche no longer function as originally intended. Many of the cooperative members no longer fish, either employing others to fish on their boats or selling off their equipment entirely and becoming “ghost cooperatives”. CONAPESCA distributes support on the basis of permits, but doesn’t take the time to verify which cooperatives are still operational (Interview Sabancuy #1). The one community that I visited where cooperatives appeared to work according to original design was Emiliano Zapata. It’s possible that Sabancuy also has functioning cooperatives, although we were unable to speak with anyone from a cooperative directly during our visit.

There is no apparent functional difference between fishermen employed by a cooperative and fishermen who work for a permisionario (Interview Sabancuy #1, San Pedro #1). In both cases, the government support must filter through the permit-holder before it reaches the fishermen. Depending on the permit-holder, the fisherman himself may or may not benefit from any of the government subsidies for gas, ice, etc (Interview Champotón #4).

Many fishermen appeared to be very complacent in their positions. Even if they know that they are not fairly compensated for their work, they are comfortable enough to get by and lack the motivation to modify their habits (Interview Campeche #5). Many are willing to accept lower prices for the fish that they harvest for the stability of having a permisionario or boat owner who will insure that the fishing gear is provided and repaired as needed (Interviews Champotón #2, #4). However, I did learn that nearly all fishermen self-identified as “free fishermen,” implying that their interpretation of freedom relates to their ability to switch between bosses or fisheries at will (Interview Campeche #5).

Finally, a very important point to reemphasize is the power of the buyers in these fishing communities. Much of their influence stems from their ability to transport the product to market with trucks. They are an indispensible link in the market chain, and anyone selling beyond the local level relies on them. Not only do buyers collectively set prices for various fish species, they also dictate what species fishermen will target in the first place. If a buyer says that he does not want to purchase a particular species because
the season is closed and he will not risk receiving a fine, the fishermen will avoid catching that species. If buyers will pay for a species during its closed season, they are in effect provoking illegal fishing to occur (Interviews Campeche #1, Champotón #4, Sabancuy #1). My impression from my observations was that there were a fair number of buyers that respected regulations and season closures, but also a large proportion that did not (Campeche #2, Sabancuy #1).

3.3 Communication in the fishery

As a general rule, Campeche’s fishing communities have strong horizontal communication among and between permisionarios and buyers, but weak vertical communication between fishing authorities, permit-holders, and the fishermen themselves.

The buyers and permisionarios communicate frequently to set prices, in an effort to prevent fishermen from seeking better prices for their product elsewhere. If one permisionario attempts to pay a fisherman a higher price for his catch, he will be pressured and bullied by other permisionarios in the community to drop the price back down (Interviews Campeche #2, Champotón #4, San Pedro #1, #2).

The prominent buyers and permisionarios in a community are in relatively regular contact with government authorities. They are the most likely parties to be invited to weigh in on regulations, although many expressed that they only attend some of the meetings where they are invited to comment (Interviews Campeche #2, #3). Independent permit-holders or smaller permisionarios may not be contacted with as much frequency, and bodega managers are likewise excluded (Interviews Sabancuy #1, Champotón #3, San Pedro #2). One permit-holder that was very active in the fishery felt that, even when they seek public input, the fishing authorities only share information that is convenient for them to share (Interview Campeche #4).

There is little to no communication between the fishing authorities and the fishermen themselves (Campeche #1, San Pedro #1). All fishermen interviewed expressed that they are not invited to participate in the design of fishery rules and regulations, but they would like to be.
According to INAPESCA, the public input process for the management of any particular species is run at the discretion of the INAPESCA staff member responsible for pulling together that particular fishery management plan. Most choose to hold only one public input meeting, which they advertise among permissionarios and buyers. However, when he was in charge of the snail (“caracol”) fishery management plan, one INAPESCA staff member explained that he decided to have two meetings – one for permit-holders and buyers and another that he specifically advertised to fishing crew (Interview INAPESCA #1). Therefore, it is within the power of INAPESCA to involve the actual fishermen in the public input process.

3.4 Response to shark closure

During interviews, I asked many fishery participants to share their experience with and attitudes towards the 2012 shark fishery closure. The closure applies for May and June in the entire Gulf of Mexico, along with August for Campeche Bank.

News of the closure arrived to Campeche City via radio communication and written notice (Interview Campeche #5). CONAPESCA hosted meetings all along the coast of Campeche and in the other Mexican Gulf States to allow people to comment on the closure, but these input meetings were held in September and October after the closure was already published. No changes have yet been made to the existing closure in response to public comments.

Fishermen have varying perspectives on the fishery closure. Some said that it was “terrible” and forced them to waste many sharks, throwing them away at sea already dead (Interviews San Pedro #2, Campeche #5). Other fishermen still landed sharks during the closure, but either hid them in garbage bags to sneak off the lanchas or gave them to the ECOSUR team (when they were present) for research purposes (PC with Pérez-Jiménez).

Another subset of fishery participants agreed with the closure in principle because they acknowledged that the fishery is in trouble, but disagreed with the duration of the closure. Many expressed a preference for a closure from May 15th to June 15th, rather than May 1st to June 30th. They explained that this time frame would protect the vast majority of the spawning aggregations, but still allow for some capture on either end of spawning season (Interview Campeche #3, #4). Some fishermen felt that an abbreviated
closure would also be much more likely to be respected (Interviews Campeche #4, Sabancuy #1).

An INAPESCA researcher commented that he feels that the closure is well-designed and would serve its purpose if adhered to; however, he believes that people won’t respect it, so it’s impossible to predict whether it will work (Interview INAPESCA #2).

DISCUSSION AND RECOMMENDATIONS

Data deficiencies, low vigilance and enforcement and lack of fishermen investment in the sustainability of the resources are some of the most pressing challenges facing Campeche’s fisheries. Improving fisheries management under any circumstances requires a combination of changes in management measures and policy approaches tailored to the context of a given fishery (Salas, Chuenpagdee et al. 2007). The extreme heterogeneity between fishing communities in Campeche means that a one-size-fits-all solution may be unfeasible. Nevertheless, there are some more general next steps that can prepare Campeche for more innovative management approaches moving forward.

Efforts by INAPESCA and its research partners to reassess the shark fishery in the Gulf of Mexico are already underway, and knowledge of stock status is slowly improving as a result; however, INAPESCA presently lacks the socio-economic expertise to adequately characterize the human component of the fishery (Baker, Hueter et al. March 2011). This is a significant challenge to improved management in Campeche, since a thorough understanding of the social dimension of the shark fishery is a prerequisite to the prescription of future management actions (Berkes 2003). Particularly in the case of small-scale fisheries, knowledge of the values and structure of fishing communities and the overall environment in which fishermen work is necessary to set wise objectives (Kuperan and Abdullah 1994). I recommend that EDF work with ECOSUR to build on my research and continue investigating the social components of this fishery.

Although specific policy changes for improved management are still out of reach due to knowledge deficiencies, in the remainder of this section I will evaluate a variety of
broader policy approaches based upon their feasibility and capacity to maintain the ecological and commercial existence of sharks in Campeche’s waters:

‘Input’ controls and enforcement

Due to their low biological productivity, the large sharks (bull and blacktip) are the species of greatest concern in the Campeche shark fisheries (Pérez-Jiménez, Méndez-Loeza et al. 2012). Effort controls designed to decrease catches of bull and blacktip sharks seem like a reasonable solution; however, such conventional, species-specific management measures are not appropriate for this multi-gear and multi-species fleet. The continual decline in shark populations over the past two decades despite a permit moratorium, gear specifications, and time/area closures illustrates this clearly. Time/area closures, like the ones mandated in 2012, increase the race to fish during open seasons and ultimately hurt fishermen who depend on shark resources as a subsistence fishery or for supplementary income between seasons for more lucrative species (Fernández-Méndez 2006; Soriano 2010). And virtually any other attempt to control effort is futile given the absolute lack of enforcement of the existing regulations. Miller argued that if the capacity does not exist to enforce a regulation, that rule should not be included as part of a management plan for a fishery (Miller 1999).

I suggest that Mexico’s limited resources for inspection and vigilance be concentrated at points of commercialization, whether at bodegas or other sites of distribution. In the words of ECOSUR’s Dr. Pérez-Jiménez, “Commercialization is key.” If the permisionarios and buyers who hold most of the power in the fishery feel increased government pressure to obey a certain regulation, they will instruct their fishermen to avoid capture of certain species.

Currently, buyers transporting product across state boundaries encounter SAGARPA officials along their route who ask them to present paperwork for the product they carry. However, many of these enforcement officials are not able to distinguish between species and are unaware of specific fishery closures at any given time. CONAPESCA should invest in training for enforcement officials at state boundaries and other checkpoints, so that buyers are unable to transport any product that has been captured illegally during a closure.
Providing alternate employment for fishermen during closed seasons may also prevent illegal fishing, while simultaneously ensuring fishermen’s livelihoods. One fisherman in Champotón suggested clearing the litter from the beaches as one form of useful temporary employment. This fisherman said he’d be willing to do anything to still have an income but avoid fishing illegally during fishery closures (Interview Champotón #4). Of course, the Mexican government may currently lack the funding to set up such a temporary employment program. Even so, it’s important to acknowledge and address the repercussions of fishery closures on fishermen’s incomes, as many currently have no alternate employment options.

Finally, the shark fisheries in the Pacific have more developed monitoring and data systems, as well as better all-around enforcement of regulations (Baker, Hueter et al. 2011). The Gulf fisheries may benefit from examining and emulating the approaches used in the Pacific, specifically the use of microchips in tracking lanchas.

**Catch shares for Campeche?**

Individual transfer quotas can contribute to management success by promoting ecological stewardship and increasing the economic value of the landed resource (Gutiérrez, Hilborn et al. 2011; Pérez-Jiménez, Méndez-Loeza et al. 2012). However, they are not appropriate for all fisheries at all times.

In the case of Campeche, the lack of clear resource boundaries and enforcement capability are enormous impediments to rights-based management, since exclusion of outsiders cannot be guaranteed in such a large, low-capital fishery with no surveillance (Pomeroy 1992). The multi-species nature of the fishery complicates catch share distribution, and the highly migratory nature of the tiburones in particular renders any localized system useless. An INAPESCA researcher indicated that because sharks move so much between Veracruz, Tamaulipas, Tabasco and Campeche waters, any sort of quota would have to be shared between all of these Mexican states to make any sense (Interview INAPESCA #2).

Furthermore, stock size of various shark species is still not known with enough certainty to allocate catch wisely among the fishermen (Pérez-Jiménez, Méndez-Loeza et al. 2012). Better record-keeping and data collection are prerequisites to effective rights-
based management. Through the work of INAPESCA and ECOSUR, stock assessments are improving. However, inaccuracies in landings data are another obstacle. Under the current system, policies intended to limit catch (like the 10% incidental catch limit in the escama fishery) are in reality just resulting in more unreported catch (Cisneros-Monetemayor, Cisneros-Mata et al. 2013). CONAPESCA should consider lifting the incidental catch limits or removing the penalties for exceeding those limits in the case of sharks or other highly endangered species. Some might argue that this could result in more fishermen intentionally targeting sharks out on the water; however, because sharks are not species of particularly high value in Campeche, I believe the risk of such a policy significantly altering fishermen’s behavior to be quite low.

Rights-based management in Campeche also requires that the participants in the fishery be well defined, and an even bigger problem is that many (if not most) of the active fishermen themselves are not legally permitted to harvest sharks. This is a challenge under the current permisionario employment system, and official government records only contain the names of permit-holders. Catch shares could theoretically be distributed amongst cooperatives and permisionarios, who could in turn distribute them to their employees or members; however, this would overlook the significant number of illegal fishermen that are unaffiliated with any permit holder. Additionally, the catch share system may work more effectively if the fishermen interacting directly with the resources feel a stronger sense of ownership over their shares (and not like they are simply borrowing the shares from a permisionario).

One approach for identifying the fishermen themselves may be to utilize the fishery interest groups called “Frentes Comúnes de Pescadores”. I found that these organizations were established in all of the major fishing communities in Campeche. All fishery participants are incentivized to register because it is through these organizations that annual compensation from PEMEX (in the amount of about $1400 pesos) is distributed (Interview Champotón #4, Campeche #1). Fishermen must sign up with the Frente Común in order to access this money, which is intended to compensate fishermen for disruption to fishing activities caused by the offshore oil industry. Usually registration is free, although in Champotón we learned that fishermen must pay a monthly membership fee of $20 pesos (Interview Champotón #4). We can expect the membership
of these organizations to represent a more complete list of local fishermen than anything CONAPESCA is able to provide. The Frente Común de Pescadores may also be a good vehicle for advertising public input meetings to fishermen.

Looking ahead, even with reliable data and clearly defined participants, catch shares may be difficult to enforce in the tiburón fishery. This is not only because sharks are migratory, but also because the gillnets used to catch them are extremely unselective. Fishermen may go many weeks without catching any sharks, and then suddenly land many all at once. Blacktip sharks in particular travel in schools, and when a fishermen collides with a school he has a difficult time controlling how many individual sharks fall into his gillnet (PC with Pérez-Jiménez). However, a catch share program may make sense for the cazón fishery that operates out of Campeche City and Isla Arena. In this situation, the season and area of the spawning aggregations are more clearly defined and predictable, and the fishermen targeting cazones are easier to identify (PC with Pérez-Jiménez).

**Participatory governance and fishery co-management**

The once prevalent notion that privatization or centralized government control is the only means of avoiding the tragedy of the commons has been displaced by hundreds of examples of successful community-based co-management arrangements (Hardin 1968; Ostrom, Burger et al. 1999; Dietz, Ostrom et al. 2003). Co-management refers to a scenario where the government and the user groups are working together to manage fisheries (Barker and Schluessel 2005).

Cooperation between managers and fishermen in a cross-scale governance approach can be effective for a number of reasons. First, fishermen have valuable resource knowledge that can be used to productively supplement science-based stock assessments for a better understanding of species distribution and ecosystem health (Salas, Chuenpagdee et al. 2007). Second, increased communication creates trust between parties that is useful to achieve consensus when management decisions to improve the fishery must be made. Additionally, community leaders become apparent through the participatory process. This is important because strong local leadership has been deemed critical to successful co-management (Gutiérrez, Hilborn et al. 2011). Finally, if
fishermen are acknowledged as stakeholders and incorporated into the decision-making process, they will be more invested in the protection and sustainability of the resource and committed to the fishery rules (Berkes 2003; Hernandez and Kempton 2003). This may help to lower monitoring costs and increase enforcement effectiveness.

A participatory management approach, if constructed carefully, may also facilitate the identification of unpermitted participants in the fishery, which is critical to the success of virtually all future management approaches including catch shares (Pérez-Jiménez, Méndez-Loeza et al. 2009). Fishermen may be initially contacted to participate through the Frentes Comunes de Pescadores, as I already mentioned.

Furthermore, in order for people to want to assist through participatory management, they must feel some degree of claim to or stake in the fishery (Hanna May 1998). This is a problem under the current system, where permisionario-employed fishermen have no incentive to care because the government does not even legally recognize their involvement in the fishery (Cinti, Shaw et al. 2010). Perhaps, once identified, shark fishermen should be offered permits (without the usual condition of owning their own equipment) so that their participation in the fishery is legalized, and more importantly, documented.

Although it may seem that the distribution of additional permits might diminish their power and influence and therefore be undesirable to original permisionarios, the fact remains that even once permitted and able to claim their catch directly with CONAPESCA, many fishermen would still rely on the permisionarios for their equipment, ice, fuel, storage space and transportation of product to market. The original permisionarios are still the owners of the bodegas, and therefore integral players in the commercialization of the product. Thus, under this approach the overall structure would not be expected to change drastically in the near-term.

Surely, this re-permitting of the fishery would be no small administrative feat. It might need to be accompanied by a strict quota for the shark fishery based upon historical landings data to lessen the risk that non-shark fishermen would try to gain entry into the fishery. However, because illegal fishing activity is already rampant in Campeche, it seems that there is more to gain from defining fishery participants than there is to lose.
Whether or not it involves the distribution of new permits, any co-management attempt would require the willingness of both government officials and fishermen (Berkes 2003). All fishermen interviewed expressed their desire to be included in the design of regulations, but if permisionarios and government officials were uncooperative, it would be difficult to establish the vertical and horizontal linkages essential for co-management (Hanna May 1998). Nevertheless, assuming participants are willing, I believe participatory management is the appropriate next step toward more innovative management approaches, and in time could result in improved conditions for sharks and fishermen alike.

**CONCLUSION**

Even for the more biologically productive shark species, once a stock is severely reduced, recovery even in the long-term is unlikely (Márquez-Farias and Castillo-Géniz 1998a). A proactive approach will be necessary to sustain the shark populations in the Bay of Campeche.

Although international collaboration may be necessary to rebuild stocks of these highly migratory species, management approaches should reflect the specific characteristics of the fisheries in which they are applied (Kuperan and Abdullah 1994). Identifying the active shark fishermen and involving them in the discussion is an important next step for the fishery. Through continued research in and engagement with the fishing communities and authorities in Campeche, EDF and ECOSUR can begin to identify opportunities for management action to protect shark populations.
INTERVIEWS:

Campeche* #1, Fisherman, employed by permisionario
Campeche #2, Buyer with truck and permisionario (without bodega)
Campeche #3, Female buyer, local distribution
Campeche #4, Permisionario (formerly fisherman)
Campeche #5, Fisherman, employed by boat owner
* “Campeche” in interview citations signifies Campeche City

Champotón #1, Buyer, local distribution only
Champotón #2, Fisherman employed by boat owner
Champotón #3, Family group of “free” fishermen, own gear and permits
Champotón #4, Group of fishermen, employed by same permisionario

Emiliano Zapata #1, Cooperative member/fisherman

Sabancuy #1, Bodega manager

San Pedro #1, Fisherman, employed by permisionario
San Pedro #2, Bodega manager

INAPESCA #1, Administrator
INAPESCA #2, Researcher

PERSONAL COMMUNICATION (PC):


Méndez-Loeza, Iván. ECOSUR, Jan 19-29th, 2013

Pérez-Jiménez, Juan Carlos. Principal Informant, ECOSUR, July 2012 - January 2013


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APPENDIX

Interview Guide

Preguntas para los pescadores:
* = Preguntas de prioridad

Inicios de Conversación

How was the fishing today? What did you catch?
¿Cómo estuvo la pesca hoy? ¿Qué caputró?

How did you become a fisherman?
¿Cómo se convirtió en pescador?

- Are you a full-time or part-time fisherman?
- ¿Se dedica a la pesca exclusivamente? Si no, ¿qué otra actividad realiza?
- How many years have you been fishing?
- ¿Cuántos años lleva pescadondo?

Tell me about a normal fishing day/week.
Platíqueme sobre un día o semana de pesca normal.

- How many days a week do you go out to fish?
- ¿Cuántos días a la semana sale usted a pescar?
- What species do you target?
- ¿Qué especies le interesan?
- Why do you choose to target these species?
- ¿Por qué ha elegido capturar esas especies?
- What species do you catch (target and incidental)?
- ¿Cuáles son los especies que captura usted regularmente (incluyendo la captura incidental)?

Preguntas Sobre Tiburones/Cazones

Broad: I’m interested in learning about sharks. Are you a shark fishermen, or do you catch sharks accidentally? Why do/don’t you target sharks?
Quiero aprender sobre los tiburones y cazones. ¿Se dedica a la captura de tiburones/cazones, o son capturas incidentales? ¿Por qué o por qué no se dedica a la captura de tiburones/cazones?
Could you describe how you go about catching and selling sharks?
¿Podría describir cómo es el proceso de la captura y venta de los cazones y tiburones?

Follow-up Questions:
- How often do you catch cazones? How often do you catch tiburones?
- ¿Con qué frecuencia capturas tiburones/cazones?
Do you target certain types of cazones/tiburones? Why?
¿Tiene como objetivo ciertas especies de tiburones/cazones? ¿Por qué?
What months do you catch them?
¿En qué meses los captura?
How many cazones/tiburones per trip on average during those months?
¿Cuántos cazones/tiburones capturas en cada viaje en promedio durante esos meses?
What type of gear do you use? Why do you use this type of gear?
¿Qué arte de pesca utiliza usted? ¿Por qué utiliza este arte de pesca?

Do you know what species of cazones/tiburones you catch? Do you record the cazones/tiburones that you catch by species and/or by size?
¿Sabe cuáles son las especies de cazones/tiburones que captura usted? ¿Se registran en la oficina de pesca los tiburones por especies o sólo por el tamaño?

What parts of the cazones/tiburones do you sell? How much money do you make for these parts (pesos/kg)?
¿Qué partes de los tiburones/cazones se venden? ¿Cuál es el precio por esas partes?

What is your approximate monthly income from fishing for cazones/tiburones? How important is this component to your total monthly income? (Sensitive question, going to work with Juan Carlos on phrasing)
¿Cuál es el ingreso mensual que obtiene del recurso tiburón/cazón? ¿Cuál es la importancia de ese componente de sus ingresos mensuales totales?

What do you do with the sharks you catch? Do you sell all of them? Do you take some home to feed your family?
¿Qué hace usted típicamente con los cazones/tiburones que captura? Vende todos? Lleva algunos a casa para alimentar a su familia?

How often do you and your family consume or use products from cazones/tiburones?
¿Con qué frecuencia consumen o utilizan usted y su familia productos de cazones/tiburones?

Has the shark fishery changed since you started fishing? If yes, how? Why do you think that is? Do the changes concern you?
¿Ha cambiado la pesquería de tiburón/cazón desde que usted empezó la pesca? En caso afirmativo, ¿cómo? ¿Por qué crees que es? ¿Te preocupan los cambios?

What are the biggest problems with the shark fishery here? What do you think should be done about it?
¿Cuáles son los mayores problemas con la pesquería de tiburón/cazón aquí? ¿Qué cree que se debería hacer al respecto?

Would you be willing to change your fishing practices if it meant that the shark populations would increase? Why or why not?
¿Cambiaría su manera de pescar si esto significa que las poblaciones de tiburones y cazones se incrementen?

Preguntas de la Organización de la Pesquería*

Are you a member of a fishing cooperative?
¿Pertenece a una cooperativa?

If no:
Do you consider yourself an independent fisherman or do you work for someone?
¿Es pescador libre, o trabaja para algún permisionario?

- Do you have a shark permit? An escama permit? *(All questions about permits are potentially sensitive, going to discuss with Juan Carlos)*
- ¿Tiene usted un permiso para la pesca de tiburones/cazones? ¿Un permiso para escama?
- Do you own your own boat and gear?
- ¿Cuenta con embarcación propia? ¿Equipo?
- Do you sell your catch to the same person/bodega all of the time?
- ¿Vende su captura a la misma persona o bodega todo el tiempo?

Broad: Can you tell me about your experience as an independent fishermen/employed fishermen/cooperative member? What’s it like?
¿Me puede decir sobre su experiencia como pescador libre/pescador asalariado(empleado)/miembro de cooperativa?

Follow-up Questions:

If independent or employed fisherman:

Why do you fish independently/work for permit-holder instead of under a cooperative?
¿Por qué decidió usted ser pescador libre/trabajar para un permisionario en vez de afiliarse a una cooperativa?

Are fishing practices of people with permits different than practices of people without permits? How?
¿Trabajan de manera diferente las personas con permisos y las personas sin permisos?

If you were given a permit for the shark fishery, would your fishing practices change? How?
¿Si le dieron un permiso para la pesca de tiburón/cazón, cambiaría sus prácticas de pesca? ¿Cómo?

How often do you interact with other fishermen (both independent, employed, and cooperative)? What are those interactions like?
¿Con qué frecuencia se relaciona con otros pescadores (pescadores libres, empleados, y cooperativas)? ¿Cómo son esas interacciones?

- Are you friends with other fishermen?
- ¿Es amigo de otros pescadores?
- Is there competition between fishermen?
- ¿Hay competencia entre pescadores?

Have there ever been disagreements among fishermen in the fishery? What happened? How was it resolved?
- ¿Alguna vez ha habido desacuerdos entre los pescadores? ¿Qué pasó? ¿Cómo se resolvió?

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If cooperative fisherman:

How long have you been a member of your cooperative? How many members does it have? What is your role in the cooperative?
- ¿Cuánto tiempo ha sido un miembro de la cooperativa? ¿Cuántos miembros tiene? ¿Cuál es su papel en la cooperativa?

Approximately how many cooperatives are there in [enter town]?
- ¿Aproximadamente cuántas cooperativas hay en [nombre de ciudad]?

What is the relationship between the cooperatives? Do they interact with each other? Are they friendly or competitive?
- ¿Cuál es la relación entre las cooperativas? mucha Comunicación? ¿Son amistosos o competitivos?

Has there ever been a disagreement within the cooperative members? Between the cooperatives and other fishermen? What happened? How was it resolved?
- ¿Alguna vez ha habido desacuerdos entre los pescadores en la cooperativa? ¿Qué pasó? ¿Cómo se resolvió?

How are decisions made in the cooperative? Who do they consult for advice/guidance?
- ¿Cómo se toman decisiones en la cooperativa? ¿A quién consultan para el consejo/dirección?

Why did you choose to join a cooperative?
- ¿Por qué decidió afiliarse a una cooperativa?

Are you happy that you joined a cooperative? Why or why not?
- ¿Es usted contento de ser miembro de una cooperativa? ¿Por qué o por qué no?

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For all:

Would you say that the majority of fishermen in [enter town] are in a cooperative, employed for a permit-holder, or fish independently?
¿Son la mayoría de los pescadores en (nombre de ciudad) pescadores libres, pescadores empleados, o miembros de cooperativas?

How do fishermen in cooperatives differ from independent or employed fishermen?
¿Trabajan diferente los pescadores en cooperativas y los pescadores libres o empleados?

Have you ever worked with other fishermen to solve a problem in the fishery? Will you tell me about it?
¿Alguna vez ha trabajado con otros pescadores para resolver un problema en la pesquería? Dígame sobre ello.

Would you say that there are leaders in this fishing community? If so, what are their roles?
¿Diría usted que hay líderes en esta pesquería? Si es así, ¿cuáles son sus funciones?

**Preguntas de Opinión**

(exact placement of these questions TBD)
In general, what are the biggest challenges that you face as a fisherman?
En general ¿cuál es su major preocupación como pescador?

Do you want your children or younger generations to be fishermen? (ask JC about placement)
¿Quiere que sus hijos o generaciones más jóvenes sean pescadores?

**Reglas**

**Broad:** Are there rules and regulations for the shark fishery? What kinds?
¿Hay normas y reglas para la pesquería de tiburón? ¿Qué tipo?

**Follow-up Questions:**

*Tell me about how you found out about the veda (or other regulation) and what happened after.
Dígame cómo averiguó sobre la veda (u otra regulación) y lo que pasó después.

Do you feel like most fishermen follow government regulations? Why or why not?
¿Piensa que la mayoría de los pescadores siguen las regulaciones del Gobierno? ¿Por qué o por qué no?

What happens when a fishermen breaks a rule? How often does that happen?
¿Qué pasa cuando un pescador rompe una regla? ¿Con qué frecuencia pasa esto?

What type of enforcement is there? Have you ever encountered an enforcement official?
¿Qué tipo de vigilancia existe? ¿Con qué frecuencia encuentra inspectores?
*Are you involved in the drafting and/or design of government regulations? If no, would you like to be? In what way would you like to be involved?*

¿Participa usted en la elaboración y/o diseño de regulaciones del gobierno? Si no, ¿le gustaría participar? ¿De qué manera le gustaría participar?

*Are there unofficial community “rules” related to the harvest of sharks that you follow? What are these rules? What happens if you don’t abide by them? (ask JC about phrasing question or citing example so fishermen understand)*

¿Hay reglas no “oficiales” relacionadas con la captura de tiburones en la comunidad? ¿Cuáles son estas reglas? ¿Qué pasa si no cumple con ellos?

*Does your cooperative have any rules that you must follow?*

¿Tiene su cooperativa reglas que necesita seguir?

Do you think that regulations are needed for the shark fishery in [enter town name]? Why or why not? If so, what types of regulations are appropriate?

¿Piensa usted que las reglas son necesarias para la pesca de tiburones/cazones en [nombre de ciudad]? ¿Por qué o por qué no? Si es así, ¿qué tipos de reglas son apropiados?

**Ejemplos de Preguntas para los funcionarios del gobierno**

How do the fishery management Agencies in Mexico interact with each other? How do they rank on decision-making power?

¿Cómo interactúan las instituciones de la pesquería en México el uno con el otro? ¿Cuál es su poder de decisión?

What tools does your Agency use to regulate fisheries? How are these tools decided upon? How can they be improved?

¿Qué instrumentos usa su institución para regular pesquerías? ¿Cómo se seleccionan estos instrumentos? ¿Cómo se pueden mejorar?

In the case of the shark fishery, why did you decide to implement a veda? Has it been effective?

En el caso de la pesquería de cazón/tiburón, ¿por qué se decidió aplicar una veda? Ha sido eficaz?

Do the permit-holders have a role in the design of fisheries regulations? Are the illegal fishermen consulted at any point in the design of regulations?

¿Tienen los permisionarios un papel en el diseño de normas de pesca? ¿Se consultó a los pescadores libres en cualquier punto en el diseño de normas?

*What factors do you think influence fishermen’s behavior? What drives and motivates fishermen to make choices?*

¿Qué factores cree que influyen el comportamiento de los pescadores? ¿Qué motiva a los pescadores a tomar decisiones?
Do you think that regulations are respected? Why or why not? If no, what do you think should be done about this?
¿Cree que los pescadores respeten las normas? ¿Por qué o por qué no? Si no, ¿qué cree que se debe hacer al respecto?

*What is the biggest problem with the shark fishery in Campeche? What should be done about it?
¿Cuál es el problema más grande con la pesquería del tiburón y cazón en Campeche? ¿Qué debería hacer sobre ello?

*Do you feel that the Agencies are open to trying new management strategies? What about participatory management? Rights-based fishing (will cite example)? Would these approaches currently work in Mexico? Why or why not?
¿Piensa que las agencias están abiertas a probar nuevas estrategias de manejo? ¿Como manejo participativa? ¿Pesca basado en los derechos(a citar el ejemplo)? ¿Se trabajan estos enfoques actualmente en México? ¿Por qué o por qué no?