Fisheries Research

journal homepage: www.elsevier.com/locate/fisheries

The socio-economic and ecological implications of banning fishing in the upper Gulf of California.

Arturo Heriberto Magaña, Northern Arizona University
Keywords: Small-scale fisheries, Upper Gulf of California, *El Golfo de Santa Clara, San Felipe, México*

ABSTRACT
This article examines the fisheries off the coasts *of El Golfo de Santa Clara, Sonora*, and *San Felipe, Baja California, México*, and the socio-economic and ecological effect the total fishing ban, enacted in 2015, had on these two communities. The article incorporates ethnographic and historical data, along with quantitative analysis, such as regression analysis to forecast fishery populations through time with the few data available from the Upper Gulf of California. Finally, this articles draws information from various fisheries throughout the world to suggest good fishery management practices that can inform management in the Upper Gulf of California.

Introduction: ethnographic, historical data

I grew up in *El Golfo de Santa Clara*. My mother's hometown, I spent many weekends and summers in *El Golfo*. *El Golfo* is a small town, less than 10,000 year-long residents. Many families, before the 2015 total fishing ban in *El Golfo* and *San Felipe*, subsisted from the sea. Fishermen would catch gulf *curvina*, *chano* (croaker), and *camaron* (blue shrimp). Years before, in the 1960s and 1970s, fishermen would catch *totoaba* (seabass), but in 1975, the Mexican government outlawed *totoaba* fishing, as marine biologists found the fish critically endangered (Findley, 2010). While overfishing contributed to the endangerment of the *totoaba*, and subsequently the *vaquita* porpoise—the reason for the 2015 total fishing ban to establish a *vaquita* preserve—many marine biological studies show that the damming of the Colorado River, which flowed into the Gulf of California before damming, lead to a decrease in freshwater that altered the fishery habitats ("Vaquita", Findley, 2010, Cisneros-Mata 1995).

Fishing in the upper Gulf of California dates back to the exploitation of *totoaba*, which began at the start of the 20th century (Arvizu-Martinez 1987, 33). The fishing ports of *El Golfo, San Felipe*, and *Puerto Peñasco* were established to furnish the Chinese desire of *totoaba's buche*, the swim bladder of the fish, used in China as an aphrodisiac and a cure-all remedy. During the 1940s, the exploitation of shrimp, mostly blue shrimp, began (Arvizu-Martinez 1987, 33). In subsequent years, leading up to the total fishing ban of 2015, the shrimping industry, and the fishing nets used to catch shrimp that did not discriminate between what is caught and what is not, decimated the *totoaba* fishery and *vaquita* porpoise populations.

The *totoaba* fishery through time

In 1923, six German fishermen followed the *totoaba* migration from *Guaymas, Sonora* to *San Felipe* (Cisneros-Mata 1995, 809). The men discovered large numbers of

totoaba in *San Felipe*. Figure 1 shows the mean annual kilos of *totoaba* the United States imported from the Upper Gulf of California.

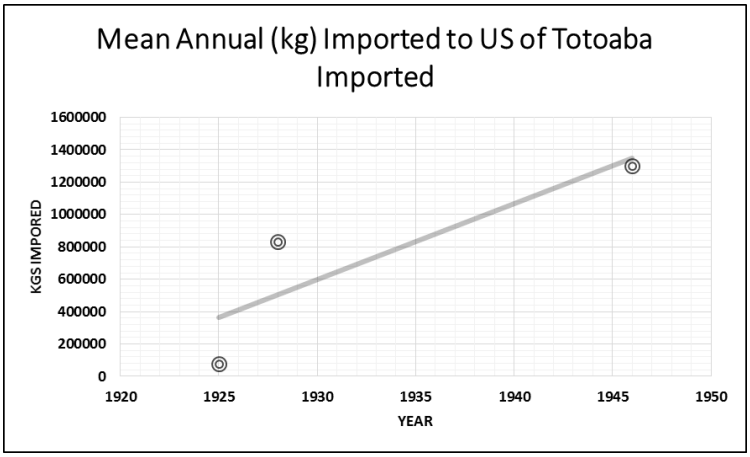

Figure 1. Shows annual kilos of *totoaba* the United States imported. Note that in the mid-1940s importation peaked.

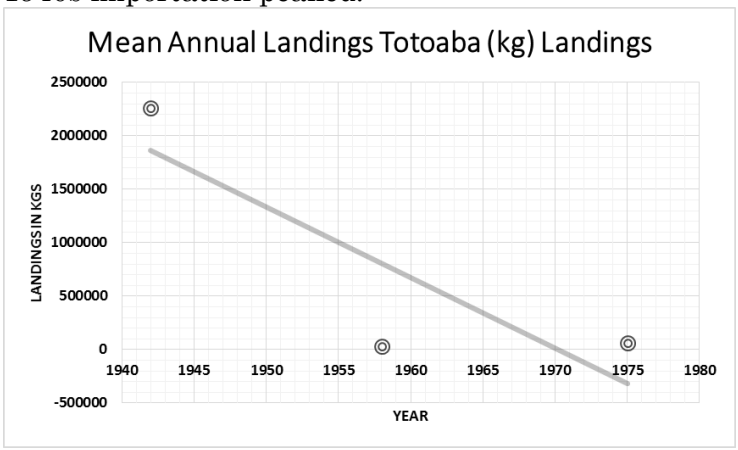

Figure 1.1. Shows the annual kilos caught of *totoaba* in the Gulf of Upper California through time. Note that in the mid-1940s, kilos caught peaked.

In 1955, the Mexican government declared a biological refuge zone that prohibited fishing at the mouth of the Colorado River in order to preserve the *totoaba* fishery (Cisneros-Mata 1995, 810). As you can see from Figure 1 and Figure 1.1., there was a sharp decline in *totoaba* fishing in the Upper Gulf of California. Later, in 1974, the Mexican government made the refugee zone into a reserve zone—all fishing was prohibited at the mouth of the Colorado River (Cisneros-Mata 1995, 810). In 1979, the United States included *totoaba* in the Endangered Species Act, in an attempt to stop imports (Cisneros-Mata 1995, 810). But, these laws were not strictly enforced. For example, fishermen in 1979 poached an estimated 70 metric tons of *totoaba* from the sea (Rosales-Juarez 1987).

In June of 1993, the Mexican government enlarged the reserve zone, declared it a biosphere reserve, to better protect the *totoaba* fishery and the *vaquita* porpoise. Figure 1.2 shows the biosphere reserve.

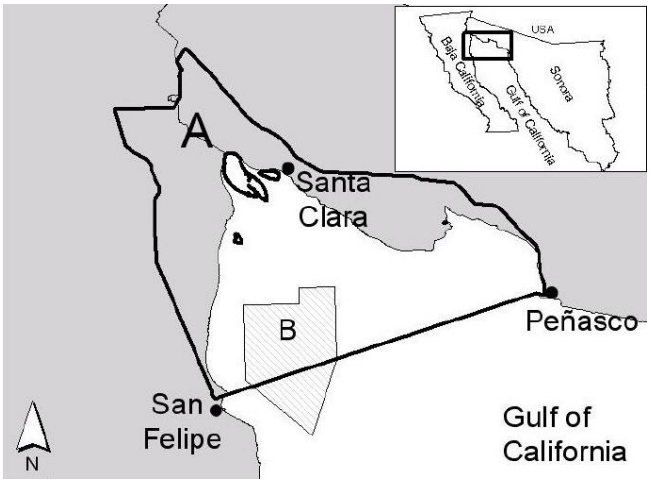

Figure 1.2. Shows the biosphere reserve, denoted as a "B."

Habitat alteration at the mouth of the Colorado River

Researchers estimate that in 1857, the annual river flow into the Gulf of California was $1.9728 * 10^{10} m^3$ (Cisneros-Mata 1995, 811). The construction of the Hoover Dam, in 1928, decreased much of the water flow and sediment that made its way down into the gulf (Sykes 1937, and Cisneros-Mata 1995, 811). The damming of the Colorado affected evaporation, and, thus, the gulf's hydrodynamics (Lavin 1988, and Cisneros-Mata, 811). Also, the damming increased the salt in the mouth of the gulf (Cisneros-Mata, 811).

"Colorado River water input…had a two-fold effect in the Upper Gulf, enhancing habitat for prerecruits and juvenile totoaba by increasing the carry capacity (adding nutrients and volume) and regulating water temperature and salinity" (Cisneros-Mata 1995, 812). Spawning rate of fish and carry capacity of fisheries in the Upper Gulf of California are linked the flow of freshwater from the Colorado River.

Along with alteration of habitat, over-fishing, as noted above with data from 1979 *totoaba* poaching, contributed to the decline of the *totoaba* fishery. Even now, in 2016, poaching is still common, regardless of the reserve areas, active patrols, and total fishing ban in the Upper Gulf of California.

Researchers estimate that a kilo of a *totoaba's* swim bladder goes between $7,000 and $14,000 (USD) on the Asian black markets (Diaz 2014).

Figure 1.3. shows evidence of poaching inside of the reserve, catch of shrimp in metric tons from 1996 to 2007 inside the *vaquita* refuge. Figure 1.4. presents data on the value, costs, and total profits extracted from shrimp inside the *vaquita* refuge—this is evidence of individuals disregarding to refuge laws and the economic gains extracted from the reserve.

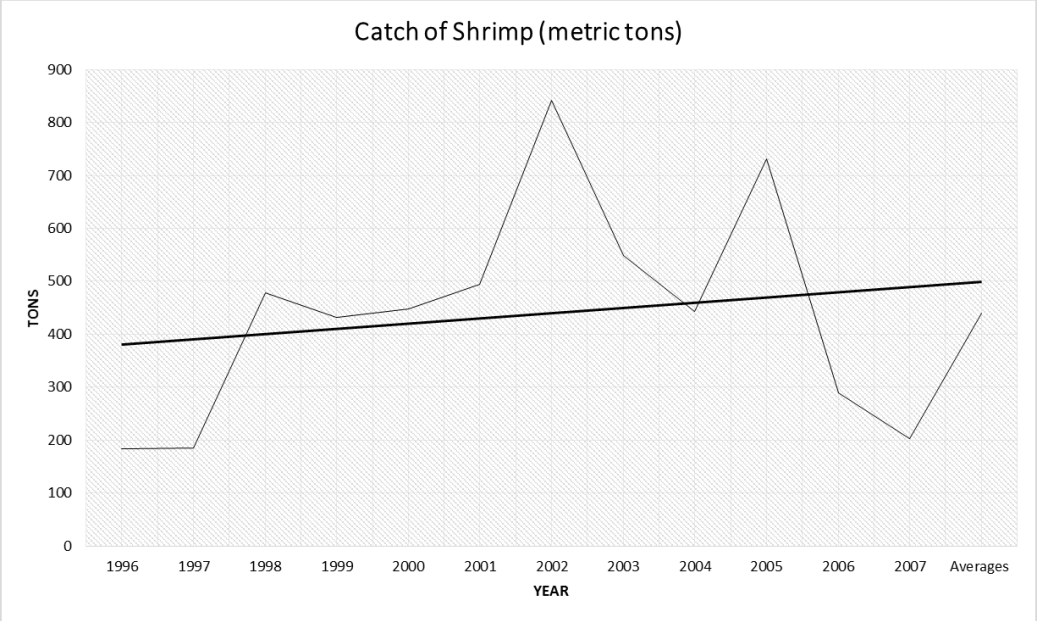

Figure 1.3. Shows poaching of shrimp inside *vaquita* reserve. These data are before the total fishing ban of 2015. This shows evidence of individuals acting in their own self-interest (Rodriguez-Quiroz 2009, 1490).

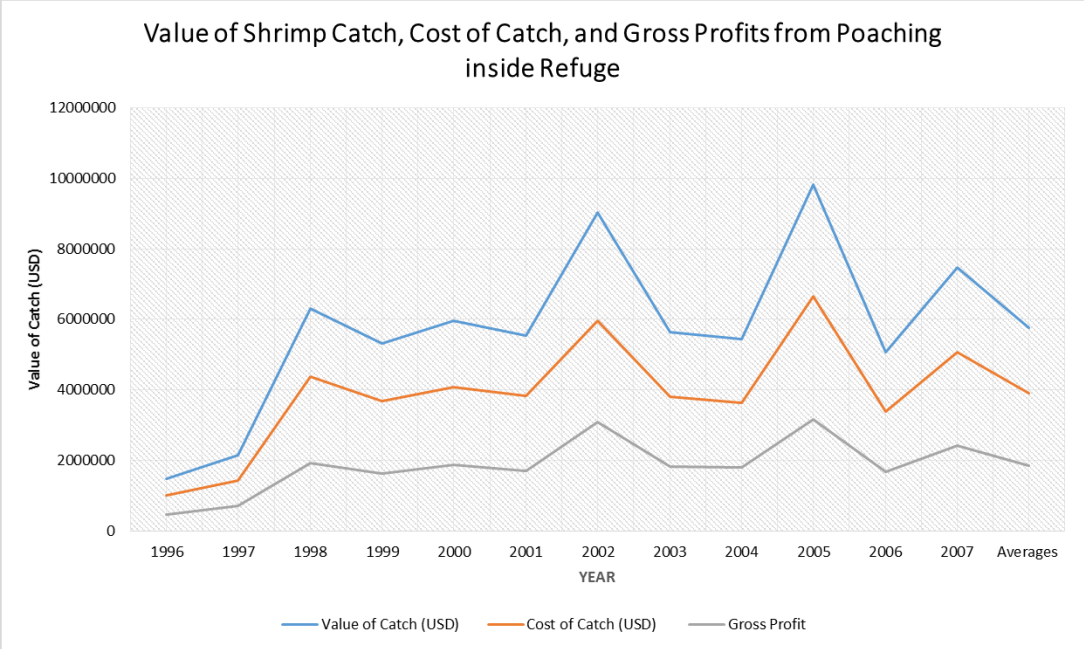

Figure 1.4. Shows the value of shrimp catch, the cost of the shrimp catch, and the profits extracted from shrimp from inside the *vaquita* refuge (Rodriguez-Quiroz 2009, 1490).

Regression analysis of shrimp fishery inside vaquita refuge

In addition from running descriptive statistics on the data above, I ran a regression analysis of the shrimp fishery with the data available. I plotted data of the catch of shrimp from 1996 to 2007 inside the *vaquita* refuge. Figure 1.5. shows the shrimp catch in tons inside the reserve, along with the linear equation of the tread line, where year 1 on the

graph represents year 1996, the beginning of the data, and year 12 on the graph represents year 2007, the last point in the data.

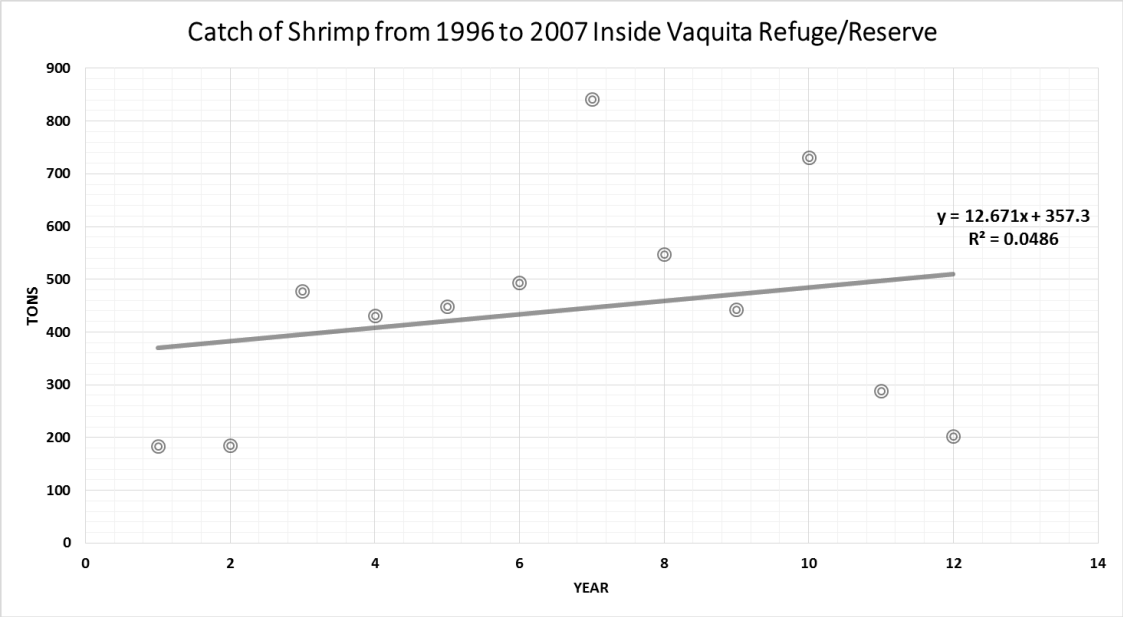

Figure 1.5. Catch of shrimp inside reserve, along with the tread line and its equation, $y = 12.671x + 357.3$.

Using the linear equation, $y = 12.671x + 357.3$, allowed me to forecast expected shrimp to be caught by fishermen inside the *vaquita* reserve in the year 2010. To calculate the forecast, using the linear equation, I imputed the value of 15 for x—15 represents the year 2010—into the linear equation. $y = 12.671(15) + 357.3$. Simplify, $y = 547.365$, tons of shrimp forecasted to be caught by fishermen inside the refuge in 2010, using a linear equation.

Additionally, I ran a regression analysis for the year 2016, using the same linear equation, where $x = 21$, and 21 represents the year 2016. $y = 12.671(21) + 357.3$. Simplify, $y = 623.391$ tons forecasted to be caught by fishermen inside the *vaquita* refuge in the year 2016 if the fishing ban had not gone into effect in 2015.

Now, what do these regression analysis tell us? I believe, from what little data I have to work with, that if the fishing ban had not gone into effect, poaching would have gone on to a larger extent, just as it had been from 1996 through 2007. Also, I believe that shrimping inside the reserve would lead to bycatch of juvenile *totoaba* and *vaquita* porpoise, both critically endangered species.

Totoaba black market and governmental assistance

Using the data above—$7,000 to $14,000 (USD)—the average for a kilo of a *totoaba* swim bladder is $10,500 (USD). So, let's propose a conservative estimate. Suppose a fishermen sells a swim bladder to a Chinese buyer, for $2,625 (USD), a quarter of the average price that a swim bladder is sold for on the black market—this value is calculated from $\frac{10{,}500}{4}$. This value, $2,625, is much more than what the Mexican government is giving in assistance to those that had a fishing permit before the total ban was enacted in 2015. The Mexican government is giving in assistance $30,000 (*pesos*) per month, per permit. As of April 17, 2016, the Mexican *peso* was trading at 17.68 per every U.S. dollar. So,

considering $\frac{30,000}{17.68}$ = $1,697 (USD(, this amount is much less than $2,625, what fishermen can get for a kilo of swim bladder—thus, there is much incentive for fishermen to poach. This mentality continues to lead to overfishing in *El Golfo*, which may potentially lead to what Garrett Hardin, ecologist and philosopher, described as a tragedy of the commons (Amaya 2016, and Tirado, 2016).

The tragedy of the commons

According to Garrett Harding (1968), "Ruin is the destination towards which all men rush, each pursuing his own best interest in a society that believes in a freedom of the commons. Freedom in a commons brings ruin to all." The commons are defined, simply, as land owned or used jointly by residents of a community. Hardin (1968) argued that all commons will be overexploited, for an individual, a rational individual, has a clear economic incentive to extract as much from a communal resource as possible before another individual beats him to the punch (McCay 1990, xiii).

Hardin's "parable can be easily reformulated for fisheries as the number of boats and fishing capacity keep on increasing, sooner or later the [fisheries] will be overfished, and there will be a social cost" (Berkes 1990, 66).

Many biologists have written about the social costs of overexploitation. In *El Golfo*, there has been many social implications as a result of overfishing and the ban that resulted from overfishing (Tirado 2016). Data compiled from 2001 to 2011, Figure 1.6, shows mean annual revenues (USD) for various fish species in the Upper Gulf of California.

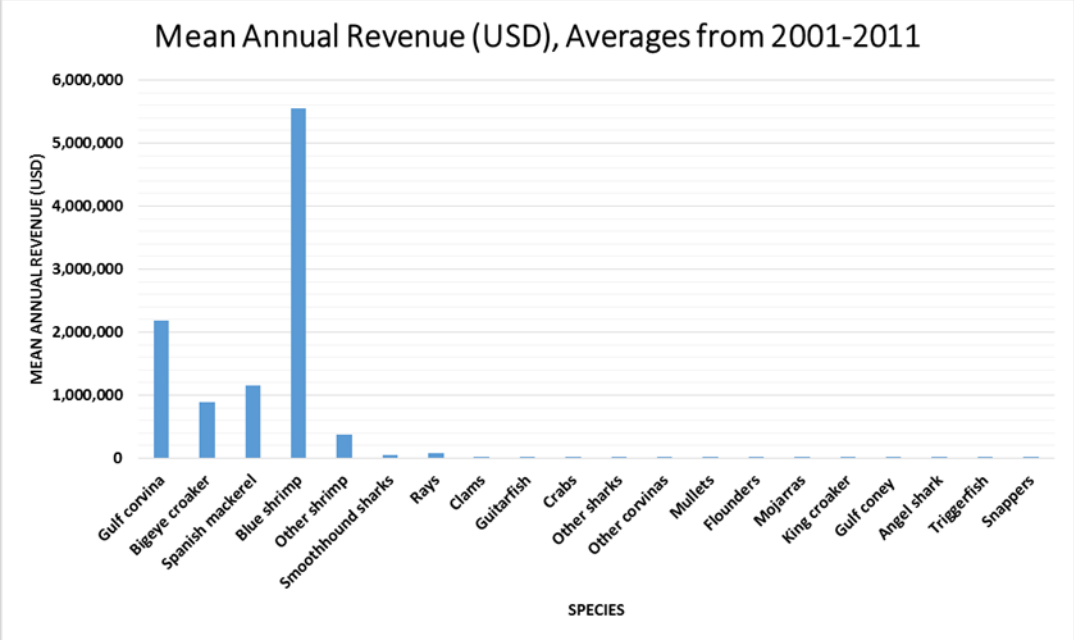

Figure 1.6. shows the most important fishing species in the Upper Gulf of California, and the respected mean annual revenues in *El Golfo de Santa Clara* over a ten year period, before the total fishing ban. Shows the least important species, but also the diversity in fishing (CONAPESCA Mazatlan, Erisman 2015).

Now, let's consider what an average fishermen earns (per one permit) in revenues for *curvina*, shrimp, croaker, and mackerel, the four most important fisheries in *El Golfo* (Figure 1.6.). If we do some simple division—*curvina* revenues for tons caught divided by

the number of permits (Table 1), and repeat this for the other fisheries we get: $5,405.05 (2,189,047/405) revenues for *curvina*, $13,128.12 revenues for shrimp, $2,195.87 for coraker, and $2,857.93 for mackerel. If we add all these revenues up, we get a total of $23,586.97 (USD)—this is how much an average fishermen (per one permit) on average from 2001 to 2011 earned, for the four most important fisheries in the *El Golfo*.

Table 1. Shows mean annual tons caught per four most important fisheries in *El Golfo* and *San Felipe*, and the revenues extracted from fisheries. Also, includes permit data from two towns (CONAPESCA Mazatlan, Erisman 2015).

COMMUNITY	SPECIES	CONAPESCA DATA		
		No. Permits	*Mean Annual Landings (Tons)*	*Mean Annual Revenues ($USD)*
GSC	Gulf corvina	405	2566.2	2189047
	Bigeye croaker	405	1249.8	889329
	Spanish mackerel	405	1129.8	1157461
	Blue shrimp	423	501.2	5553193
SF	Gulf corvina	239	195	170290
	Bigeye croaker	239	1055.1	670055
	Spanish mackerel	239	687.3	711346
	Blue shrimp	220	437.1	4153042

Here now I convert the average revenues for the four most important fisheries, $\$23{,}586.97(USD) * 17.68\ (pesos) = \$417{,}017.68\ pesos$ in revenues for the 4 most important fisheries earned by an average fishermen from 2001 to 2011, per one fishing permit.

Here now I consider how much the Mexican government is giving each fishermen (per one permit), per month—30,000 *pesos* (Amaya 2016, Tirado 2016). For a year total, $30{,}000 * 12 = \$360{,}000\ (pesos)$ per year in reparations. There is a difference of $57,017.68 (*pesos*) between what an average fishermen earned fishing just the four most important fisheries as opposed to what the government is handing out (calculated from 417,017.67 – 360,000 *pesos*). We can then convert this difference into (USD) by dividing by 17.68, what the *peso* was trading at. This is a $3,224.98(USD) difference from what an average fishermen earned off of just the four most important fisheries in *El Golfo* and what the government is providing as a reparation.

It is also important to consider the monetary impact of the fishing ban over the course of the year in *El Golfo* and *San Felipe*. The best data I have for total number of permits in *El Golfo* and *San Felipe*—the average number of permits, using the data from Table 1., shows 322 permits per both towns.

On average, in *El Golfo*, from 2001 to 2011, fishermen caught 5,643.91 tons of fish, with an average of $10,394,672 (USD) earned in revenues (Erisman 2015). On average, in *San Felipe*, from 2001 to 2011, fishermen caught 3,252.85 tons of fish, with an average of $7,126,757 (USD) earned in revenues (Erisman 2015).

Now I consider the monetary impact of the fishing ban for all the fishermen in *El Golfo*—I average the number of permit data for *El Golfo*; it equals 410 average number of permits for *El Golfo* (refer to Table 1 for permit data). I average the number of permit data for San Felipe; it equals 234 number of permits for *San Felipe* (refer to Table 1 for permit data). Thus, if we divide the average revenues per each town by the number of average permits, we will find a rough estimate of what an average fishermen earned per year on average. For *El Golfo*: $\frac{10{,}394{,}672(avg\ revenues)}{410\ (\#\ of\ permits)} = \$25{,}352.86\ (USD)$. For *San Felipe*: $\frac{7{,}126{,}757(avg\ revenues)}{234(\#\ of\ permits)} = \$30{,}456.23\ (USD)$. Thus, there is a large monetary impact of the ban,

considering that the government is only giving about $20,361 in reparation per permit (this figure calculated from $\frac{360{,}000(reparation\ per\ permit\ per\ year)}{17.68\ (trading\ value)}$). I averaged the number of permits, because this number fluctuates according to fishery and time of season.

Suggestions for fishery management

Data is spare for the Upper Gulf of Baja California. Thus, here now I present various suggestions from fisheries across the world for good, sustainable fishery management practices. Acheson (1990, 37) wrote that the lobster fishery in Maine, USA, showed that informal, traditional norms can maintain fisheries. Also, Acheson (1990, 37) noted that restrictions to fishery access in Maine, territoriality, and exclusive ownership of the fishery promote sustainability. In Maine, in addition to restrictions to access, fishing laws are "almost universally obeyed"—this is not the case in the Upper Gulf of California, as noted by poaching within the *vaquita* porpoise reserve (Acheson 1990, 37).

I am particularly interested in Maine's informal territory arrangement and the positive effects, sustainable effects, on the lobster fishery. These territory arrangements in perimeter-defined areas limit entry into the fishery for foreign fishermen, restrict fishing effort (how much can be caught), limit the length of the fishing season, and the number of lobster traps that can be set (Acheson 1990, 39). These practices undoubtedly maintain the lobster fishery for future generations. Acheson (1990, 40) wrote, "to go lobster fishing, one must be accepted by the men fishing out of the harbor [of the community]." There is verbal or physical repercussions—harbor gangs roam the waters—that block outsiders from encroachment. And though these territory arrangements do not provide equitable access into Maine's lobster fisheries, they maintain fish stocks in perpetuity. Refer to Figures 1.7 and 1.8 to compare lobster stock densities (weight of lobsters in lbs).

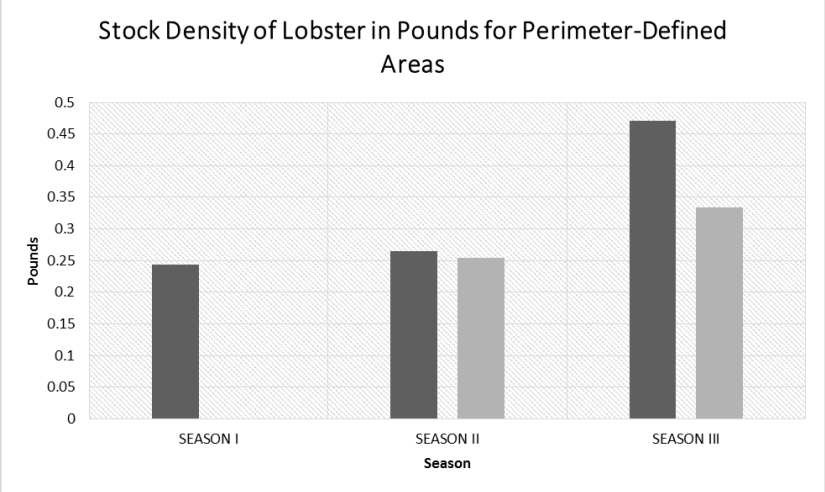

Figure 1.7. Shows stock densities of lobster over three seasons in perimeter-defined areas, areas that maintain informal territory arrangements in Maine.

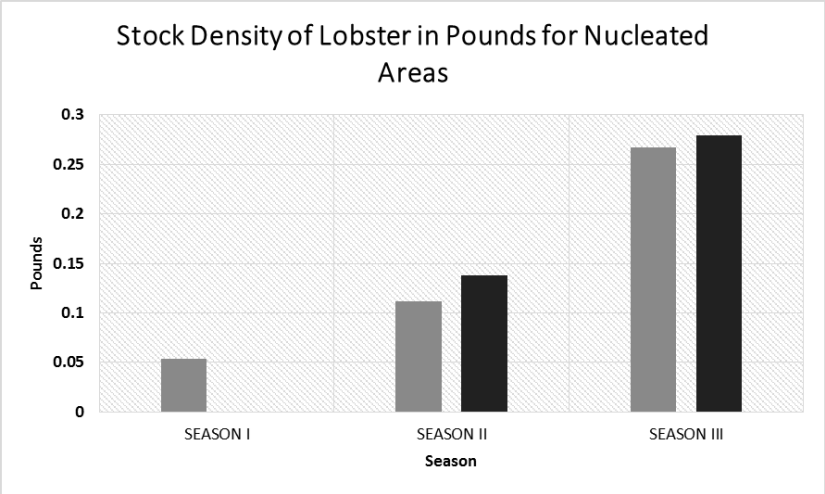

Figure 1.8. Shows stock densities of lobster over three seasons in nucleated areas, areas that do not maintain informal territory arrangements in Maine. These areas are only protected by Maine fishing laws, not by informal laws. Note that the density is stock is much lower in nucleated areas than in perimeter-defined areas.

Acheson (1990, 49) wrote, "Thus, in perimeter defined areas, a higher proportion of the lobsters reaching the minimum legal size remain uncaught and grow to larger sizes." Thus, Acheson (1990, 52) argued that fishing effort in perimeter defined areas—which is less than in nucleated areas, those areas not protected by informal laws—leads to biological benefits for fishery and economic benefits for the fishermen. Refer to Figure 1.9. to view gross incomes in perimeter-defined areas vs. nucleated areas.

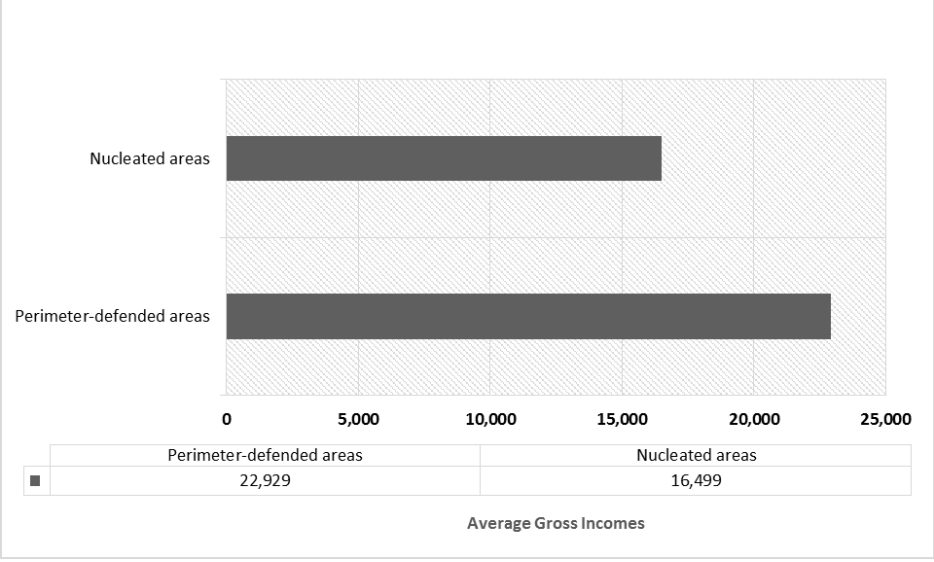

Figure 1.9. Shows average gross incomes per perimeter-defined areas vs. nucleated areas. Note that fishermen in perimeter-defined areas make much more than those in nucleated areas.

"The data we have on differences in average size of lobsters, size of catch, size of stock and fishing incomes suggest that men fishing in nucleated areas are bearing the costs of increased participation in an industry that has many characteristics of an open-access

common-property fishery" (Acheson 1990, 63). Acheson (1990, 62) argued that governmental fishing regulations that manipulate fishing seasons, fishing areas (like the *vaquita* reserve), the type of gear used (like gillnet use in the Upper Gulf of California), limit fish mortality, but ultimately lead to increased competition among fishermen. Better management practices involves limiting entry into fisheries by licensing or taxation.

The Seri case

The Seri natives are a part of a community of small-scale fishermen, who fish in the Gulf of California and maintain ownership of the fisheries off of the coasts of *Punta Chueca, Sonora*, and *Tiburon* Island (Basurto 2005, 643, 647). Basurto (2005, 643) noted that many outside fishermen are granted access to the Seri-controlled fisheries. The Seri have maintained a set of rules and regulations that allow outsider fishermen access (Basurto 2005, 643). Basurto argued that because "Seri government officials keep all the economic benefits generated from granting this access [to outsiders] for themselves, community members created alternative entry mechanism to divert those benefits to themselves" (2005, 643).

Hardin's tragedy of the commons model, taking into account the Seri case, predicts, because "Seri government officials and community members' self-interest in becoming the sole beneficiaries of the available-to-all-resource (the monies the outsiders pay to get in) will inevitably lead to too many outsiders using the Seri fishing grounds," will inevitably lead to overfishing and a collapse of the fisheries within Seri boundaries. But this is not the case. A tragedy of the commons has not taken place in Seri fisheries. There are various reasons for this.

The Seri limit outsider access. For example, an outsider may gain access through either formal or informal entry mechanisms—e.g. gaining access from the Seri government, hiring a Seri hand, contacting a Seri fishing patron, contacting a Seri fishing team, becoming part of the Seri kinship, or sneaking into the fishery without permission (Basurto 2005, 650-653). After an outsider enters the Seri fishery, scope rules are in place that prevent overfishing; these rules that take into consideration catch size and Seri culture (Basurto 2005, 651). For example, the Seri limit outsiders from fishing in culturally important areas, and maintain a certain maximum allowable catch per day for outsiders (Basurto 2005, 651).

Basurto (2005, 645) concluded "that the presence of boundary and scope rules across all different entry mechanisms is responsible for the Seri people's ability to maintain access and use controls, which in turn support the continued sustainability of their fishing system."

While it may be difficult to implement these practices in the Upper Gulf of California, considering the communities of *El Golfo* and *San Felipe* are not as cultural cohesive as the Seri and boundaries are not as clearly defined as the Seri fishing channel between *Tiburon* Island and *Punta Chueca*, the Seri case provides an interesting way in thinking about fishery management. The Seri case provides clear evidence that indigenous peoples have so much wisdom to offer, even though this wisdom may not be grounded in empiricism.

Conclusions

Reviewing the literature, I came across this quote, "It is more appropriate to think of resources as managing humans than the converse" (Ludwig 1993, 547). I feel the methods used by cultural anthropologists can assist in management of open-access commons, for the best anthropologists converse and live with people in the hopes of better understanding

their lives. Anthropologists have shown that their work is collaborative with the communities they work with—I believe the best way to manage our shared resources is through collaboration. What better way is there to collaborate with people than with the methods of anthropology—participant observation, interviewing people, and providing focus groups that strive to find data about local perceptions?

Badalamenti (2000, 116) noted that a good way to improve the success of marine protected areas—like the reserves in the Upper Gulf of California—is through involving "the local inhabitants as much as possible." Locals can provide their knowledge of an area and their experiences. Locals can provide information on how best to implement successful management practices (Badalamenti 2000, 116).

Finally, and most importantly, decisions to limit fishing access or banning fishing need to take into account the human aspect. Decision makers need to inform communities about planned change—this will ultimately lead to long-term success of a plan (Badalamenti 2000, 117). And, "While many regard the conservation of nature as the fundamental starting point, neglecting the sociocultural and socio-economic aspects can lead to only a partial comprehension of [marine protected areas] as a whole and often to poor local consensus, if not hostility"—I have seen this discontent in *El Golfo de Santa Clara*.

References

Amaya, Humberto. Interview by author. Personal interview. March 15, 2016.

Arvizu-Martinez, Joaquin. 1987. "Fisheries activities in the Gulf of California, Mexico." *CalCOFI Report* 28: 32-36.

Acheson, James M. 1990. "The Lobster Fiefs Revisited: Economic and Ecological Effects of Territoriality in the Marine Lobster Industry." In *The Question of the Commons*, edited by Bonnie J. McCay and James M. Acheson, 37-65. Tucson: University of Arizona Press.

Badalamenti, Fabio, A. A. Ramos, Eleni Voultsiadou, JL Sanchez Lizaso, Giovanni D'ANNA, Carlo Pipitone, Javier Mas, JA Ruiz Fernandez, David Whitmarsh, and Silvano Riggio. 2000. "Cultural and socio-economic impacts of Mediterranean marine protected areas." *Environmental conservation* 27, no. 02: 110-125.

Basurto, Xavier. 2005. "How locally designed access and use controls can prevent the tragedy of the commons in a Mexican small-scale fishing community." *Society and Natural Resources* 18, no. 7: 643-659.

Berkes, Fikret. "Common-Property Resource Management and Cree Indian Fisheries in Subarctic Canada." In *The Question of the Commons*, edited by Bonnie J. McCay and James M. Acheson, 66-91. Tucson: University of Arizona Press, 1990.

Cisneros-Mata, Miguel A., Gabriela Montemayor-López, and Martha J. Román-Rodríguez. 1995. "Life history and conservation of Totoaba macdonaldi." *Conservation Biology* 9, no. 4: 806-814.

Diaz, Rodrigo. 2014. "Crimen Organizado Opera Trafico Ilegal de Buche de Totoaba." Tijuana Digital. http://tijuanadigital.mx/2014/opera-crimen-organizado-trafico-ilegal-de-buche-de-totoaba-24881.html. Downloaded on 03 May 2016.

Erisman, Brad, Ismael Mascareñas-Osorio, Catalina López-Sagástegui, Marcia Moreno-Báez, Victoria Jiménez-Esquivel, and Octavio Aburto-Oropeza. 2015. "A Comparison of Fishing Activities between Two Coastal Communities within a Biosphere Reserve in the Upper Gulf of California." *Fisheries Research* 164: 254-265.

Findley, L. 2010. Totoaba macdonaldi. The IUCN Red List of Threatened Species 2010: e.T22003A9346099. http://dx.doi.org/10.2305/IUCN.UK.2010-3.RLTS.T22003A9346099.en. Downloaded on 03 May 2016.

Hardin, Garrett. 1968. "The Tragedgy of the Commons." Science 162, no. 3859: 1243-1248.

Lavin, M.F., and S. Organista. 1988. "The Surface Heat Force in the Northern Gulf of California. Journal of Geophysical Research 93: 1433-1445.

Ludwig, Donald, Ray Hilborn, and Carl Walters. 1993. "Uncertainty, resource exploitation, and conservation: lessons from history." *Ecological applications*3, no. 4: 547-549.

McCay, Bonnie J. and James M. Acheson. 1990. *The Question of the Commons: The Culture and Ecology of Communal Resources* University of Arizona Press.

Rodriguez-Quiroz, Gerardo, E. Alberto Aragón-Noriega, and Alfredo Ortega-Rubio. 2009. "Artisanal shrimp fishing in the biosphere reserve of the upper gulf of California." *Crustaceana* 82, no. 12: 1481-1493.

Rosales-Juarez, F., and E. Ramirez-Gonzalez. 1987. Estado actual sobre el conocimiento de la totoaba (Cynoscion macdonaldi Gilbert 1890). Secretaria de Pesca, Mexico.

Sykes, G. 1937. "Delta, Estuary, and Lower Portion of the Channel of the Colorado River 1933 to 1935." Publication no. 480. Carnegie Institution of Washington, Washing D.C.

Tirado, Eduardo. Interview by author. Personal interview. March 15, 2016.

"Vaquita." EDGE: Evolutionarily Distinct and Globally Endangered. http://www.edgeofexistence.org/mammals/species_info.php?id=78. Downloaded on 03 May 2016.