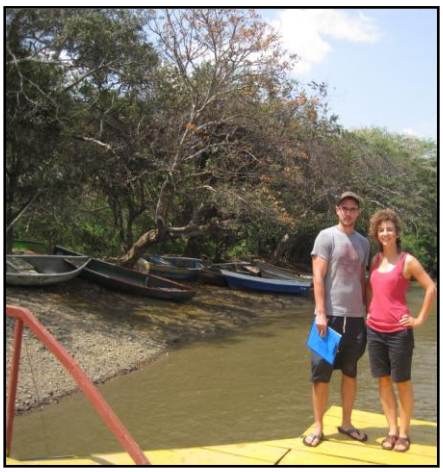
Secondary Evaluation of Shark Fisheries in the Pacific Coast of Panama

Evaluación Secundaria de la Pesca del Tiburón en el Pacifico de Panamá



Chloe Nadeau-Perrier and Ivan Skafar

An Internship with Héctor M. Guzmán and the Smithsonian Tropical Research Institute (STRI)

McGill University - ENVR 451 – Research in Panama

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Supervised by:

Héctor M. Guzmán
E-mail: guzmanh@si.edu
Phone: (507) 212-8733
Fax: (507) 212-8190/8791
Mailing Address:

Smithsonian Tropical Research Institute
MRC 0580-08
Apartado 0843-03092
Panama, Republica de Panama

Smithsonian Tropical Research Institute
MRC 0580-08, Unit 0948,
DPO AA 34002-9998,
U.S.A.

Dr Rafael Samudio

Panama Field Study Semester ENVR 451 course, McGill University
E-mail: SAMUDIOR@si.edu

In affiliation with:

McGill University General Information
James Administration Building, 845 Sherbrooke Street West
Montreal, Quebec H3A 2T5

Smithsonian Tropical Research Institute
Roosvelt Ave.
Tupper Building – 401
Balboa, Ancón
Panamá, República de Panamá

Authors Information:

Chloé Nadeau-Perrier
B.sc Agricultural and Environmental Sciences;
E-mail: *Chloe.nadeau-perrier@mail.mcgill.ca*
Phone: (514) 770-0228
Fax: (514) 387-3869

Ivan Skafar
B.sc Sciences, Biodiversity and Conservation
E-mail: *Ivan.skafar@mail.mcgill.ca*
Phone: (450) 465-6843

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1. SUMMARY OF THE PROJECT

1.1 Executive summary

Throughout recent decades, the increasing demand for shark fin products has put an immense pressure on shark populations. The high value of shark fins on the international market has created a strong incentive for fisherman, industrial as well as artisanal, to intensify their shark fishing activities to a point that has surpassed sustainability. As apex predators, shark species are at the top of their respective marine food webs. Therefore, a significant reduction in their density worldwide could have dramatic cascading effects on lower trophics levels. Moreover, due to their low fertility, long life and their late sexual maturity, shark populations may have real difficulties recovering if they were to collapse.

Unfortunately, shark fisheries around the world are being loosely monitored and regulated, putting at great risk the future stability of marine ecosystems. However, in order to produce sustainable and realistic resource management plans, more information about the social and biological aspects of shark fisheries must be obtained and rendered available.

Due to their geographical position, waters of the Pacific Ocean, boarding the coast of Central America, are recognized to be within the most productive and diverse areas in the world, making it essential to the countries of Central America, such as Panama, to adopt policies promoting sustainable fishing activities. Therefore, the goal of this research was to collect secondary information about multiple aspects of the artisanal shark fishery taking place in different fishing villages along the pacific coast of Panama. The collected data will be used to direct further research on the subject and, on a greater scale, lead the discussion about future shark fishing policies.

Through informal but structured social interviews of more than 35 questions and conducted during the months of January, February, March and April 2009, four aspects of the artisanal shark fishery were studied: technical, historical, economical and biological. The subjects dealt with were issues such as the type and size of equipment used to fish shark, the kind of boats that fishermen use, information about the investment that fisherman need to put in to be able to practice their livelihood, as well as the approximate income of an artisanal fisherman, the evolution of shark populations overtime, and the kind of species fished and the location in which they are fished.

The interviews took place all along the pacific coast of Panama and the towns were visited following a list of artisanal ports provided by the government of Panama. Through the whole process of our internship, we followed the Code of Ethic of McGill University and the interviewees were aware of their rights.

As a result of the research, a hundred and thirty eight interviews were realized in 39 ports in the regions of Chiriqui, Coclé, Herrera, Los Santos, Panama, Las Perlas and Veraguas. More than 99% of the interviewees were men and fisherman. About a third of these fishermen direct their fishing activities towards sharks during some period of the year. As much as 97% of the fishermen, however, do catch sharks in an involuntary way.

Once the sharks are caught, either voluntarily or involuntarily, the majority of the fishermen sell their catch to a general intermediate buyer.

Seven species of sharks were identified by the fishermen, the Hammerhead Shark (*Sphyrna spp.)*, the Blacktip Shark (*Carcharhinus spp.)*, the Bull Shark (*Carcharhinus leucas)*, the Tiger shark (*Galeocerdo cuvier)*, the Whitetip Shark (*Triaenodon obesus* or *Carcharhinus longimanus*), the Great White Shark (*Carcharodon carcharias)*, and finally, the Smooth Hound Shark (*Mustelus spp.)*. They were classified in order of abundance, the most abundant being the Hammerhead Shark with 92 mentions, and the least abundant being the Smooth Hound Shark with only 6 mentions for the whole country. Equal abundance of the Whale Shark in the Gulf of Panama and in the Gulf of Chiriqui were recorded, while a greater presence of Saw Sharks in the Gulf of Panama was noted when compared to the Gulf of Chiriqui. In general, sharks were said to be encountered more during the summer especially in the months of April and March, at open sea and were believed to be reproducing.

It was also found that the majority of direct shark fishermen fish with bottom longlines and use a fish of the genus *Sarda spp* that they call "Bonito" as bait. The use of a T-test also proved that the mesh size used by the group of fisherman who directly fish sharks with nets was significantly higher than the mesh size of nets used by other types of fisherman. Shark fishermen mostly fish during the night, the size of boats and the size of the motors that they use and the length of their fishing trips do not vary significantly between them and the fishermen who do not target sharks. Moreover, 80% of the shark fishermen confirm that their fishing activities are negatively affected by industrial fishermen.

Finally, all of the fisherman think that there are more artisanal boats now then when they began fishing, but also that there are less sharks now then before. Therefore 62 % of all the fishermen and 73.9% of the shark fishermen are in favour of the implementation of more regulations on shark fishing activities. They, as an example, would support the creation of a ban during the months where sharks are reproducing.

In conclusion, there is the presence of an artisanal shark fishery in the Panamanian pacific and there seems to be a problem with its management since shark populations are said to be declining. However, this is not an easy problem to solve and one has to be very careful when imposing regulations that may affect the livelihood of artisanal fishermen. Solving environmental issues is extremely challenging, especially in a world where man and nature are inextricably interconnected.

1.2 Resumen Ejecutivo

Dentro de los últimos decenios, la solicitud para las aletas de tiburones nunca ha parado de aumentar, poniendo una gran presión sobre las poblaciones de tiburones. El alto valor de las aletas de tiburones en el mercado internacional creó un estímulo fuerte sobre los pescadores para que ellos intensifiquen sus actividades de pesca dirigidas hacia los tiburones hasta un punto que no es sostenible. Las especies de tiburones son conocidas como depredadores que se encuentran en los niveles más altos de su respectiva cadena alimenticia marina. Entonces, una disminución significativa de la densidad de tiburones en el mundo podría causar repercusiones dramáticas sobre los niveles tróficos más bajos. Además, debido a su baja fertilidad, su larga vida y el hecho de que los tiburones alcanzan la madurez sexual muy tarde, las poblaciones de tiburón podrían tener dificultades de recuperación en el caso de que cayeran.

Desafortunadamente, las regulaciones sobre la pesca de tiburón en el mundo no son bastante estrictas, poniendo en peligro el futuro y la estabilidad de los ecosistemas marinos. Sin embargo, para producir planos de manejos que van a ser sostenibles y realistas, más información sobre el aspecto social y biológico de la pesca de tiburones debería estar disponible.

Debido a su ubicación geográfica, las aguas del Océano Pacifico, costeando América Central, se conocen como unas de las más productivas y diversificadas áreas del mundo. Estas características hacen que los países de América Central, como Panamá, se vean obligados de adoptar regulaciones promoviendo actividades de pesca que sean sostenibles. Por lo tanto, el objetivo de esta investigación es colectar información secundaria sobre diferentes aspectos de la pesca artesanal de tiburones en pueblos de la costa pacífica de Panamá. Los datos colectados van a ser útiles para dirigir investigación adicional sobre el sujeto de la pesca de tiburones y a escala más grande, dirigir la discusión sobre las normas del futuro.

Con informales pero estructuradas entrevistas realizadas durante los meses de enero, febrero, marzo y abril del año 2009, cuatro aspectos de la pesca artesanal de tiburón han sido estudiados: técnico, histórico, económico y biológico. Ejemplos de asuntos tratados son el tipo y el tamaño del equipo utilizado para pescar tiburones, los tipos de bote que poseen los pescadores, la información sobre su inversión cada vez que salen a pescar, la estimación de sus ingresos, cómo han evolucionado las poblaciones de tiburones dentro de unos años y el tipo de especie que se pesca y su localización.

Las entrevistas sucedieron en todas partes de la costa pacífica de Panamá y seguimos una lista de los puertos artesanales dada por el gobierno de Panamá. Aunque las entrevistas se desarrollaron de manera espontánea, los entrevistados fueron conscientes de sus derechos debido a que respetamos el código ético de McGill.

Como resultado de la investigación, 108 entrevistas fueron realizadas en 39 puertos en las regiones de Chiriqui, Coclé, Herrera, Los Santos, Las Perlas y Veraguas. Más del 99% de los entrevistados eran hombres y pescadores. Cerca de un tercio de ellos dedican su pesca a los tiburones durante algunos meses del año. Sin embargo, un 97% de los pescadores agarran a tiburones incidentalmente. Una vez que los tiburones son

agarrados, incidentalmente o no, la mayoría de los pescadores los venden a un comprador intermedio.

Siete especies de tiburones fueron identificados, el Tiburón Martillo (*Sphyrna spp.)*, el Tiburón de Puntas Negras (*Carcharhinus spp.)*, el Tiburón Toro (*Carcharhinus leucas)*, Tiburón Tigre (*Galeocerdo cuvier)*, Tiburón de Puntas Blancas (*Triaenodon obesus* or *Carcharhinus longimanus*), el Tiburón Blanco (*Carcharodon carcharias)*, Tiburón Mamón (*Mustelus spp.).* Fueron clasificados en orden de abundancia, el más abundante fue el Tiburón Martillo con 92 menciones y el menos abundante fue el Tiburón Mamón con solamente 6 menciones para todo del país. Igual abundancia del Tiburón Ballena en el Golfo de Panamá y en el Golfo de Chiriquí fueron registrados, al mismo tiempo que una mayor presencia del Tiburón Serrucho en el Golfo de Panamá fue notada cuando se comparó al Golfo de Chiriqui. En general, los tiburones se ven más durante el verano, especialmente durante los meses de abril y marzo, en el mar afuera y los pescadores piensan que se están reproduciendo.

También fue encontrado que la mayoría de pescadores que dirigen su pesca a los tiburones pesca con palangres de fondo y utilizan el Bonito, un pez que pertenece al género *Sarda*, como carnada. El uso de una prueba T demostró que el tamaño de la apertura de las mallas que utilizan los pescadores de tiburones es apreciablemente más grande que la de las mallas de los otros tipos de pescadores. Los pescadores de tiburones en su mayor parte pescan durante la noche, el tamaño de los barcos y el tamaño de los motores que utilizan y la longitud de sus viajes pesqueros no varían apreciablemente entre ellos y los pescadores que no dirigen su pesca a los tiburones. Además, 80% de los pescadores de tiburones confirman que sus actividades de pesca son afectadas negativamente por los pescadores industriales.

En fin, todos los pescadores piensan que hay mas botes artesanales hoy que cuando ellos empezaron a pescar, pero también que hay menos tiburones hoy que antes. Entonces, 62% de todos los pescadores y 73.9% de los pescadores de tiburones apoyarían la implementación de más regulaciones sobre la actividades de pesca del tiburón. Ellos, por ejemplo, apoyarían la creación de una veda durante los meses que los tiburones están reproduciéndose.

En conclusión, la pesca artesanal de tiburón está presente en el pacifico de Panamá y parece que la pesquería de tiburón en general es problemática debido a que las poblaciones de tiburón están disminuyendo. De repente, no es un problema fácil de solucionar y uno tiene que tomar precauciones cuando se impongan regulaciones que pueden afectar el sustento de los pescadores artesanales. La situación es complicada, especialmente en un mundo donde los problemas del medio ambiente no se pueden disociar del ser humano.

2. ACKNOWLEDGMENTS

First and foremost, we would like to express the upmost gratitude to our supervisor Héctor M. Guzmán who has inspired us to become better scientists as well as people. His direction and supervision facilitated our task as he took it upon himself to help us learn through a project about which he is passionate. We are also very grateful for the help received from Dr. Guzman's research assistants; thank you very much Carlos Guevara, Catalina Gomez and Xavier Pinzon. Finally, we would like to thank the staff at STRI for making us feel comfortable in their institution and workplace.

McGill should therefore send a thank you note to the above mentioned people: Héctor M. Guzmán, Carlos Guevara, Catalina Gomez and Javier Pinzon. The notes could all be sent to the address below.

Smithsonian Tropical Research Institute
MRC 0580-08
Apartado 0843-03092
Panama, Republica de Panama

Smithsonian Tropical Research Institute
MRC 0580-08, Unit 0948,
DPO AA 34002-9998,
U.S.A.

3. HOST INSTITUTION AND SUPERVISOR

3.1 Smithsonian Tropical Institute (STRI)

For our internship, we were working with the Smithsonian Tropical Research Institution (STRI) which is based in Panama but conducts biological research throughout the tropics. The main objective of the scientists at STRI is to comprehend biodiversity on land as well as in the water. An emphasis is placed on conservation and STRI is implicated in numerous conservation initiatives worldwide. What began as a single research station on Barro Colorado Island in 1913 has now become one of the most prestigious research institutes in the world as well as the leading research institute for tropical ecology and evolutionary studies. The research conducted at STRI takes place in over 40 tropical countries around the world and is carried out by a current staff of 40 permanent scientists that reside in the tropics. Their facilities are also used by a countless number of visiting scientists, undergrad and graduate students, and postdoctoral fellows every year.

3.2 Héctor M. Guzmán

Our supervisor, Héctor M. Guzmán, is a well known staff scientist at STRI. Dr Guzmán is a marine conservation biologist. He studied at the University of Costa Rica in order to obtain his bachelor as well as his master degree. He received his PhD from NewCastle University in the United Kingdom. His current research is devoted to coral-reef monitoring, population dynamic and taxonomy of octocorals, migratory patterns of large pelagic species as well as the shark fisheries which is the subject of this internship. One of his primary objectives is to establish marine conservation areas in order to protect marine flora and fauna.

4. INTRODUCTION

4.1 General Context Information

As the human population on Earth is continuously increasing at rates far beyond those of any animal species in history, our global system is experiencing pressures of which it has no adapted defence mechanisms (Smith et al. 1993). The exploitation of natural resources for the short term benefit of humans is causing the degradation of habitats all around the world. As a consequence of this degradation and a combination of other anthropogenic factors, diversity is decreasing worldwide to the extent where it is thought that a 6th mass extinction is taking place in the present day (Rosenzweig, 2003). Humans have, since their beginning, had a large effect on the ecosystems in which they lived and have been responsible for many species extinctions but this effect has historically been restricted to land and took place in the form of a vigorous hunting pressure (Alroy, 2001). Unfortunately, this trend has been making its way into the waters and today there is no ecosystem that is safe from the destructive power of man.

Just as the story has been told on land, the world's fisheries of the present day exploit marine resources and were traditionally focused on large mega fauna. This is presently not always the case but the potential to initiate a wide variety of species extinctions is greater than ever (Jackson, 2001). Today, two thirds of the global fisheries are characterized as fully-exploited, over-exploited, or depleted (Botsford et al. 1997). This can be seen with the state of shark populations worldwide. According to the IUCN Species Survival commission, in the early days of intensive fishing, sharks were not very highly valued which allowed them to squeeze through the grasp of the fisheries, but this

could not last forever. Today, these creatures are targeted because of their growing economic importance. There is a high demand for shark, especially their fins which can be sold for incredibly high prices to markets in Asia. Consequently, this has given rise to the fining and discarding phenomenon (Fong & Anderson, 2002). This great demand for shark fins as a luxury food item in China for example is thought to be one of the main driving forces in the rapid reductions in populations of all species of shark around the world (Clark et. al, 2007). Unfortunately there is not sufficient data to fully understand the impact that this market has created on sharks worldwide, but it is widely accepted that, due to overexploitation, the majority of shark species are threatened and therefore in danger of extinction (Dulvy et al. 2008).

All Chondricthyans (elasmobranches) are unfortunately very susceptible to fishing pressure which leaves shark populations very vulnerable to major population reductions in the face of overexploitation. This is due to the fact that they have a very slow population growth which is the result of late sexual maturity, low fecundity and long life (Camhi et al. 1998). Their life history traits have not evolved with a high level of natural mortality as the one being anthropogenically imposed on them today (Fowler et al. 2005). This strongly reduces any chance of recovery that a shark species or population has if it were to collapse.

It is also important to define the role that shark species play in their respective marine ecosystems in order to realize the potential effects on the species with which they share them. Sharks are at the top of the food chain in almost all of the communities that they inhabit and are even thought to be in certain cases keystone species (Stevens et al. 2000). This is why they can potentially have a disproportionately large effect on their

communities relative to their abundance (Power et al., 1996). As it is explained by Myers et al (2007), the reduction in shark populations can cause a cascading effect downwards throughout the food web which can alter community compositions in ecosystems. On the other hand, Kitchell et al (2002) found that certain species of shark in the Central North Pacific were not apex predators. Whether they are or not, however, it is certain that sharks play an important role in the food web structure of the communities to which they belong (Schindler et al. 2002; Kitchell et al. 2002).

Not only are sharks important for their respective marine communities but today they are also important economically (when they are alive) for tourism all around the world. Traditionally, sharks were viewed as being negative for tourism because they represented a potential threat to human life, but today people are willing to pay large sums of money in order to swim with sharks in their natural habitat (Topelko & Dearden, 2005). This, therefore, creates another incentive to keep their populations healthy and abundant, though it may potentially change their natural behaviour.

Although it is generally well understood that there is a problem with the overexploitation of sharks, they are not always the intended catch of fisherman (Crowder & Murawski, 1998). According to Bonfil (2000), half of the Chondricthyans that are caught in the nets of fisherman each year are caught as by-catch. What this means is that a very large portion of shark mortality through the fisheries is not present in any kind of statistical database and in consequence the situation is left highly unmanaged. However, there is growing awareness of the continuously diminishing shark populations worldwide. The IUCN has implemented a global policy against shark fining and other efforts are being put into shark conservation in many countries. Focus has been put on the need to

conserve the earlier juvenile classes in order to allow shark populations to stay above the point of no return. This is being done through the protection of shark nursery grounds (Carrier & Pratt, 1998). There is an increasing amount of data showing that, although the nursery life stage is very important, other life stages might also play very important roles in keeping populations at healthy levels (Kinney & Simpfendorfer, 2008). While the exact conservation strategy that should be implemented for the protection of shark populations is still being debated due to the lack of scientific evidence, the IUCN Species Survival Commission believes that there is a definite need for action and fast.

4.2 Justification

Ultimately, a reduction in the fishing of sharks is needed if these species are to be saved. Policy must be implemented and enforced for any kind of management strategy to be successful. Species-specific information is also necessary in order to design successful management plans, but unfortunately, as mentioned previously, there is a gap in terms of this information for artisanal shark fisheries due to the great incidence of by-catch as well as for other reasons (Bizzarro et al. 2009). There is a lack of available shark exploitation information that needs to be remedied before any kind of proper action can be put in place (Lack & Sant 2006). The circumstance is no different on the Pacific Coast of Panama. This, along with other factors, is responsible for the fact that in Panama there is not sufficient regulation when it comes to the shark fisheries. Although Panama did prohibit the fining of sharks (Meliane 2010), laws that have been implemented are not always respected. The main reason for this is a lack of Government enforcement and local cultural practices. These regulations along with their enforcement are especially necessary along the Pacific coast of Panama because of the believed presence of shark

nurseries which, as discussed earlier, probably play a very significant role in sustaining the shark populations of surrounding areas. Also the Pacific Coast of Central America as a whole is thought to harbour the most diverse and productive marine areas in the world (Oregon State University 2007).

A collapse in the shark fishery would not only cause major ecological effects but serious economic effects as well because many people make their living through the fishing of sharks and/or other species which belong to the same ecosystem. This is why it is important to talk with artisanal fishermen who live along the Pacific coast of Panama. Although they are not always formally educated, they can provide very valuable information through their experiences such as the location of shark nurseries as well as the different shark species that can be found in different parts of the waters. Because the fishermen have a vested interest in the resources of the ocean which include sharks, they could prove to be very useful in terms of pressuring the government to create new laws and making sure that they are enforced. This would have the effect of protecting the ecosystems and the livelihoods of many Panamanians.

5. GOALS AND OBJECTIVES

Our goal was to obtain secondary information about multiple aspects of the artisanal shark fishery that takes place in different fishing villages along the pacific coast of Panama. We wanted to document aspects of this fishery which to this day remain unknown, but that could be relevant to future conservation and resource management issues.

We focused our attention on four aspects of the shark fishery: technical, historical, economical and biological. The technical aspect concerns subjects such as the type and size of equipment used to fish shark, the kind of boats that fishermen use, as well as the amount of time that they spend fishing. The study of the historical aspect of shark fisheries gave us the opportunity to learn about shark population dynamics over time. Through information about change in population location, species ratios, shark abundance and size, we aimed to assess the evolution of shark populations over time with the presence of a fishing pressure. The third part of our study concerns the economical aspect of the fishermen's life. We obtained information about the investment that fisherman need make to be able to practice their livelihood, as well as what is the approximate income of an artisanal fisherman. Finally, through the aspect concerning the biological side of the shark fishery, we tackled questions about the kind of species fished and the location in which they are fished, as well as additional information linked to shark biology.

In order to collect the data, we used a social approach. Information on the social aspects of shark fisheries, as well as information obtained through interviews is not to be neglected in a scientific study. In this case, fishermen have been in close contact with the resource, sharks, on a regular basis and for a long time. Therefore, they represent an inestimable source of information about the past and present of shark fisheries and shark populations. Moreover, knowing about the social impacts and motivations that are behind this fishery is an essential tool in order to implement a sustainable control of the shark populations, and by sustainable, we mean, sustainable for the species as well as for the fishermen and their families.

In conclusion, by conducting this study, our desire was to obtain more information about the shark fisheries along the pacific coast of Panama. We sought to bring into light knowledge about fisherman and their lifestyles that has not previously been discussed in relation to the fishing of sharks in Panama.

6. METHODS

6.1 Methods

In order to target the problem and extract the desired information from the field, social interviews were conducted. A questionnaire was put together, that can be seen in the Appendix 4, which permitted the acquisition of the required information.

Each interview was of an approximate duration of 15 minutes, with the possibility of extending it if the person being interviewed had the desire to provide supplemental information about the fishery. The people interviewed were either fishermen (anyone who practices fishing activities for other purposes than recreation only) or someone who has been in close contact with fishermen for an extensive period of time (more than 10 years). Persons belonging in this second category were, as an example, sons of fishermen or intermediaries in charge of buying fish from fishermen with the goal of eventually reselling. It was made sure that all the interviewed subjects were over 18 years old.

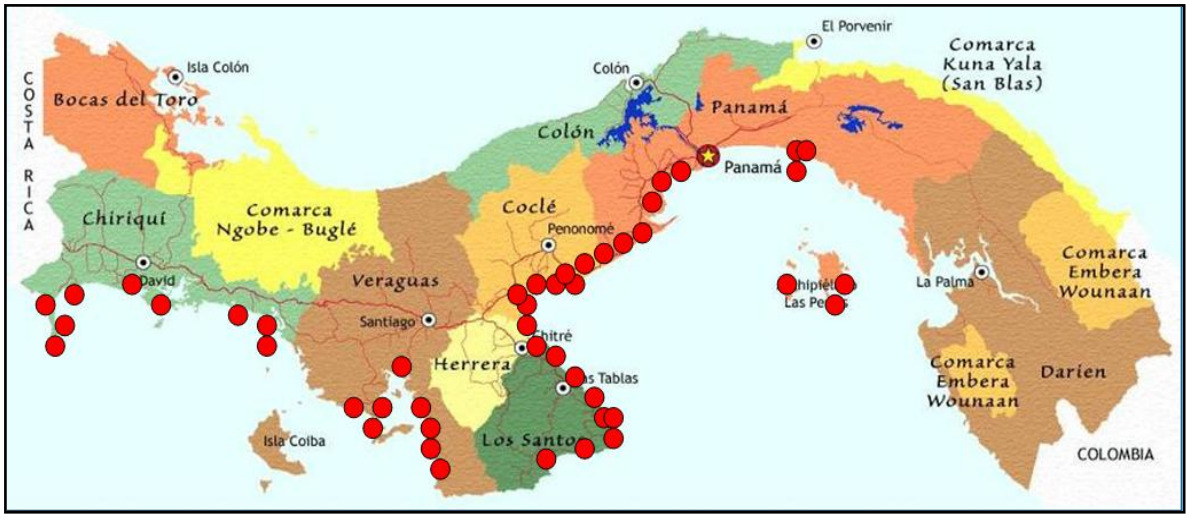
In order to get in contact with interviewees, pre-determined fishing communities were visited and ports were found with the help of locals. Once at the ports, it was asked to be directed towards people practicing artisanal fishing activities. Once a fisherman was encountered, all parties involved presented themselves. The purpose and objectives of the interview as well as the fate of the information that would be obtained was explained. The interviewees were made aware that they were free to interrupt the interview at any time if they did not feel comfortable with the questions, and that all the results were to be anonymous. Two persons conducted the interview together, a man and a woman,

attempting to make the discussion resemble more of a conversation rather than a questionnaire. The goal was to make the fisherman feel comfortable, therefore, a precise order of questions was not followed. The desired questions came out naturally with the flow of the conversation.

All of the data collected was entered into an excel file in order to be analysed. All of the questions were present in the file. Each row has a number which associates it with a specific questionnaire. Yes and no answers were represented as 1s (yes) and 0s (no). Answers where choice was involved were also represented this way except with each choice occupying a new cell. Answers that were given as a number were entered as is. Data was entered exactly how it was found on each of the different questionnaires except for when there were multiple answers for a question. In this case, the averages of the answers were taken. An example of this would be if a man had 2 artisanal boats. For the size of the boat question, the average size of the boats was used. For questions that were directly related to shark fishing, it was done a little differently. For example, if a fisherman told us that he used many different mesh sizes during the year to fish different things but that he used a specific mesh size to fish sharks, then an average was not entered and instead the mesh size used to fish sharks was entered. Percentages, sums, number of participants, graphs, t-tests, etc. were all calculated with excel in this sheet.

6.2 Study Sites

The interviews were conducted in all of the provinces of Panama boarding the Pacific coast, except Darien. The data was organized by province. For each field trip, a list of artisanal ports provided by the ARAP (Autoridad de los Recursos Acuaticos de Panama)[1] was followed. **Appendix 1** gives a list of the ports that were visited in each province. Some ports present on the final list have been visited but no interview was conducted there. This was either due to a lack of time, inaccessible roads, danger, emptiness of the ports, etc.



Map of the visited ports
Map of the ports that were visited during the period of the investigation. All the ports are included, even the ones where no one was present and where therefore, we did not conduct any interviews. An extensive list of all the ports classified by provinces and then by alphabetical order is available in the APPENDIX 1

6.3 Ethics

This project strictly followed the McGill University Code of Ethics, available at http://www.pre.ethics.gc.ca/english/policystatement/policystatement.cfm. Before the beginning of each interview, the researchers introduced themselves and the interviewees were orally informed of the nature and the goals of the project. The participants were

[1] Authority of marine resources of Panama

aware of their right to not participate in the interview or to not respond to any questions with which they did not feel comfortable. All participants were ensured that no identifying information would ever be published in the project's final report or be revealed to any organization or person other than the researchers.

6.4 Details about the days spent working on the project

The total number of days spent working on the project is **35.5**. These can be divided in two categories, the days spent either working at the NAOS STRI laboratory or at home, and the days spent in the field collecting information. We spent **16.5** full days on the project in Panama doing office work, and **19** full days outside of the city of Panama, collecting data. For more details, one may refer to the ***Chronogram of the activities*** in Appendix 7.

RESULTS

7.1 General Context

The total number of interviews conducted along the Pacific coast of Panama between the months of January and April was **108**. However, since not every interviewed subject answered every question of the questionnaire, the sample size is question-specific. The total number of ports visited was **48**, and are geographically distributed as follows: **17%** (8) in Chiriqui, **6.3%** (3) in Coclé, **4.2%** (2) in Herrera, **6.3%** (3) in Las Perlas, **22.9%** (11) in Los Santos, **20.8%** (10) in Panama and finally **22.9%** (11) in Veraguas. Interviews were not conducted at all ports due to the fact that there were not always fishermen present. The number of ports visited where interviews were conducted

was **39** (77.5%). We were unable to conduct interviews in Rio Pedasi, La Enea and Bellavista in the province of Los Santos, in Paris in the province of Herrera, in Aguadulce and Puerto Gago in the province of Coclé, in Arena and Salado in the province of Veraguas and in El Salado in Chiriquí.

All the interviewees, except for **1**, were males, and all of them, except for **2** who were intermediate buyers, were fisherman or had been fisherman for most of their lives. The fishermen were all artisanal fisherman practicing fishing activities for commercial purposes, at least during some part of the year. Their fishing activities ranged from fishing fish, such as, Sea bass, Snapper sp., Bream sps., and more, to fishing shrimps and diving to capture lobsters and octopus.

Part 1 - Biology

On a total of 106 fishermen who answered the question, **29.25**% (31) told us that they would direct their fishing activities toward sharks during certain months of the year. However, **97.14**% (102) of the fishermen told us that there were occasions where they would accidentally catch sharks while trying to capture other kinds of fish. **Map 1**. in Appendix 8 shows the distribution of shark fishing activities in the Pacific Coast of Panama from the province of Veraguas to the province of Panama including some of the islands of the archipelago of Las Perlas. This map only talks about shark catch coming from fishing activities directed towards sharks, it does not say anything about sharks being captured as by-catch from other kinds of fishing activities.

Of the 84% of the interviewees who answered the question about if they were selling the sharks that they were fishing, either voluntarily or as a by-catch, **93.4**% (85) answered yes. While only **5.04**% (4) of the 68.5% who answered the next question said that they were selling their product directly to a processing plant. All of the fishermen who answered yes to this question are situated in the port of Remedios, Chiriqui. The above **Figure 1** shows the percentage of the 40.7% who gave us information regarding whether they were selling the whole carcase to one unique buyer or to specialized buyer such as one who exclusively buys fins and another one who would only buy the meat. It is possible to see that 80.0% of the fishermen who answered sell their meat to one general buyer, whereas the other 20.0% sell it to two different buyers. The 46.6% of the fisherman who answered the next three questions were unanimous on the fact that they would not sell sharks directly to the public, **12.8**% (6) of them said that they would throw back the shark in the water and **53.6**% (30) of them said that they would eat it. It is important to note that one answer does not exclude the other. Therefore a same fisherman might answer yes to more then one of these choices.

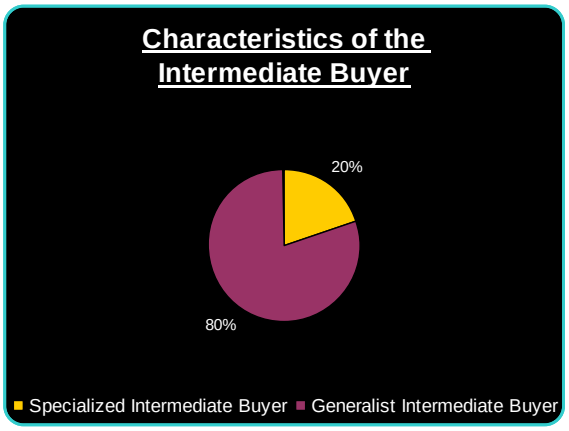


Figure 1: Number of intermediate buyers
This figure shows the percentage of fishermen who sell their product to one general buyer who buys everything that is commercially valuable (purple), in opposition to the percentage of fishermen who sell specific parts of the body to specialized intermediate buyers, usually the fins (yellow).

The following results about species abundance and distribution come from the **91.6**% (99) of the fisherman who were able to give us answers when asked about what

kind of sharks were present in their fishing area. **Figure 2** is a bar chart of species abundance for the whole region of Panama, while **Figure 3** is a comparison of abundance of each species for the Gulf of Panama versus the Gulf of Chirirqui. The abundance is based on the number of times in total that they had been mentioned by fishermen divided by the number of fisherman who answered the question in the Gulf of Chiriqui (43), or in the Gulf of Panama (56). It is possible to see that at the national scale, the Hammerhead Shark (Tiburón Martillo) is the most abundant of all (92) followed by the Blacktip Shark (Tiburón de Puntas Negras) (34), the Bull Shark (Tiburón Toro) (24), the Tiger Shark (Tiburón Tigre) (18), the Whitetip Shark (Tiburón de Puntas Blancas) (17), the Great White Shark (Tiburón Blanco) (7), unidentified small sharks (Tiburón Tollo and Cazón) (8) and finally, the Smooth hound Shark (Tiburón Mamón) (6).

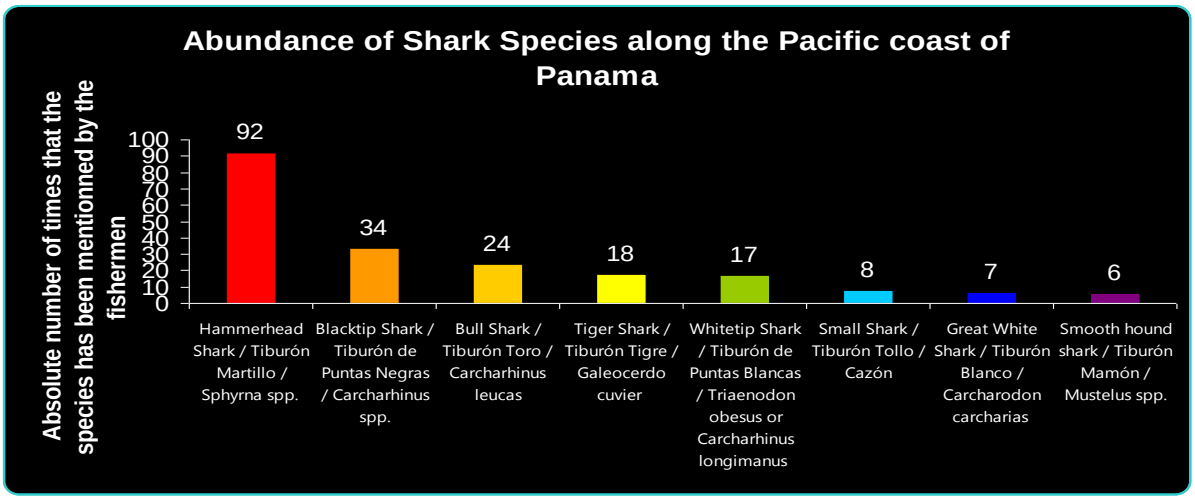


Figure 2: Bar chart of shark species abundance along the pacific coast of Panama
The columns are grouped per species and the names of the species are presented in English, Spanish and Latin. The abundance is measured with the number of times in total during the interviews where a specific species has been mentioned. Each interviewee counts for maximum of one vote for each species.

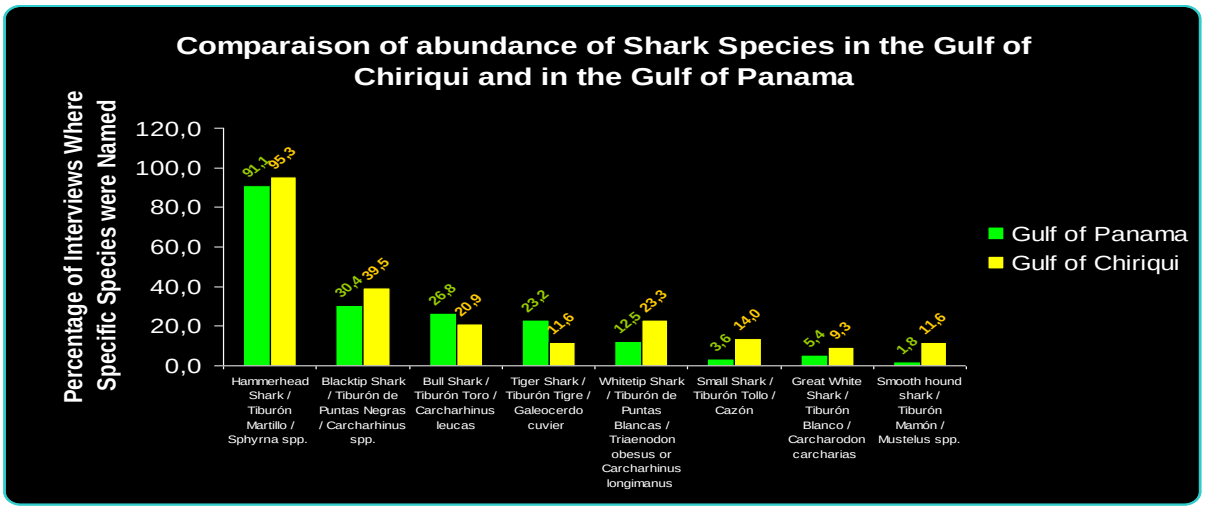


Figure 3: Comparison between the abundance of specific shark species in the Gulf of Panama and in the Gulf of Chiriqui
The green columns show the abundance of each specific shark species in the Gulf of Panama, while the yellow columns show the abundance of each specific shark species in the Gulf of Chiriqui.

The total percentage of people who answered the question is **12.7%** lower in Panama (87.30%) then in Chiriqui (100%). No difference was made between someone naming more than one species of sharks and someone naming only one, to be counted as a participant of this question, the fisherman had to name at least one species. There are **5.9%** more Bull Sharks in the Gulf of Panama than in the Gulf of Chiriqui, and **11.6%** more Tiger Sharks. On the other hand, the waters of the Gulf of Chiriqui seem to be home to **2.2%** more Hamemerhead Sharks, **9.1%** more Blacktip Sharks, **10.8%** more Whitetip Sharks, **10.4%** more unidentified small sharks, **3.9%** more Great White Sharks and **9.8%** Smooth hound Sharks than the Gulf of Panama.

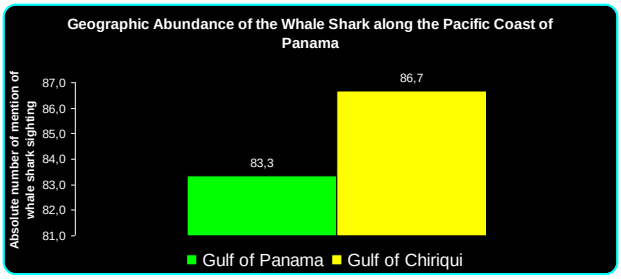


Figure 4: Comparison between the abundance of the Whale sharks in the Gulf of Panama and in the Gulf of Chiriqui
The green column shows the abundance of the whale shark in the Gulf of Panama, while the yellow column shows the abundance of the whale shark in the Gulf of Chiriqui. In order to eliminate the difference for the size of the sample for each gulf, we used percentage of interviewed fishermen who confirm having seen the whale shark close to their fishing ground to measure the abundance.

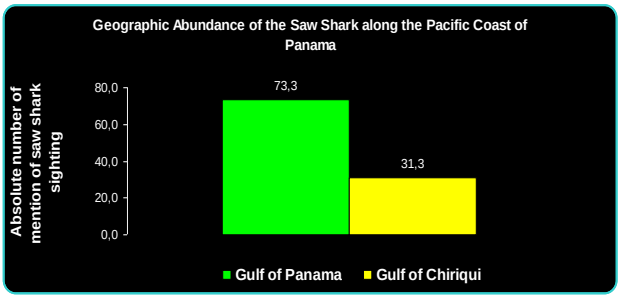


Figure 5: Comparison between the abundance of the Whale sharks in the Gulf of Panama and in the Gulf of Chiriqui
The green column shows the abundance of the saw shark in the Gulf of Panama, while the yellow column shows the abundance of the saw shark in the Gulf of Chiriqui. In order to eliminate the size of the sample for each gulf, we used percentage of interviewed fisherman who confirm having seen the saw shark close to their fishing ground to measure the abundance.

Figure 4 and **Figure 5** respectively represent the geographic abundance of the whale shark and the saw shark in the pacific waters of Panama. These two species are in different graphs and their abundance should not be compared with the abundance of the species present in Table 2 and Table 3. This is due to the fact that the persons in charge of the interview directly asked for information about the whale shark and the saw shark, while the other species were not suggested to the interviewees. Table 4 suggests that the presence of Whale Sharks might be approximately the same in the Gulf of Panama and in the Gulf of Chiriqui, since there is only a difference of **3.4%** between the two areas. However, there seems to be a bigger difference in distribution for the Saw Shark, where it is reported to be **42.0%** more abundant in the Gulf of Panama.

Regarding shark location as of in which kind of habitats they might be found, there were four choices, estuary, river mouth, close to the shore/beaches and open sea.

Each choice was treated as a yes/no question, therefore, participants had the possibility to choose more than one of the above habitats. The participation rate for the four questions ranges from 68.5% to 71.3%. With a positive answer rate for the whole country of **79.9%,** the open sea is the habitat in which fisherman see and fish the biggest quantity of sharks. This is followed by the beaches, where **25.3%** of the participant answered positively. The estuary comes in third, followed by the river mouth, with **4.0%.** The percentages specific for the Gulf of Panama and the Gulf of Chiriqui show little variation between them and maintain the same order in relatively the same proportion (**Figure 6**).

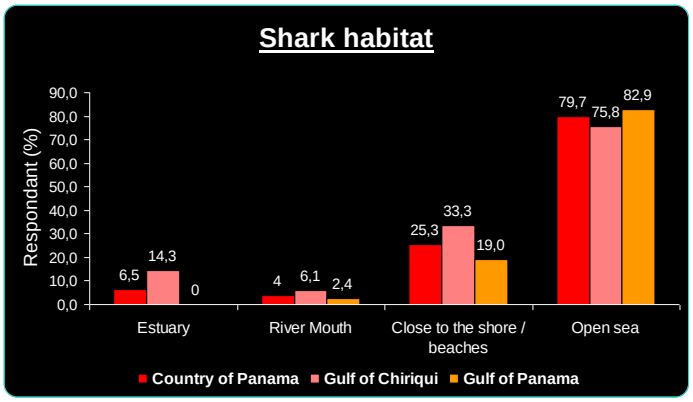


Figure 6. Shark Habitats
This figure shows where sharks are the most likely to be found in terms of the different habitats. The possibilities are "estuary", "river mouth", "close to the shore/beach" and "open sea". The results are available for the whole country (red) as well as specifically for the Gulf of Panama (orange) and for the Gulf of Chiriqui (pink). The percentages of people who answered that a specific habitat was most likely to host shark populations are present. Since the interviewees had the opportunity to choose more then one habitat, the total does not add up to a hundred.

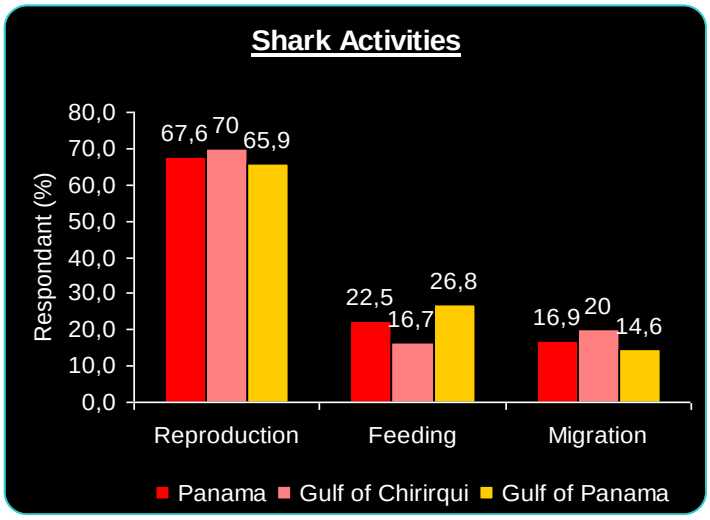


Figure 7: Shark Activities
This figure shows what kind of activities and motives might push sharks toward Panamanian waters. The possibilities are "reproduction", "feeding" and "migration". The results are available for the whole country (red) as well as specifically for the Gulf of Panama (orange) and for the Gulf of Chiriqui (pink). The percentages represent the amount of people who answered yes to each of the specific shark activity questions. Since the interviewees had the opportunity to choose more then one activity, the total does not add up to a hundred.

The question concerning the activities of the sharks present in Panamanian waters worked the same way as the question on the types of habitats. Therefore, the participants were free to choose more then one answer. The participation rate for this question is 65.7%. From **Figure 7**, it is possible to see that at the national level, **67.6%** of the participants answered positively to whether or not the sharks would come to reproduce. This trend seems a bit stronger in the Gulf of Chiriqui where **70.0%** of the participants answered positively, in comparison to **65.9%** in the Gulf of Panama. Feeding and migration seem similar, even tough feeding comes second at the national level with **22.5%**, it comes third at the level of the Gulf of Chiriqui, with **16.7%,** 10.1% less then the Gulf of Panama (**26.8%**). Finally, migration obtained **16.9%** of positive results at the national level, while it obtained **20.0%** in the Gulf of Chiriqui and **14.6%** in the Gulf of Panama.

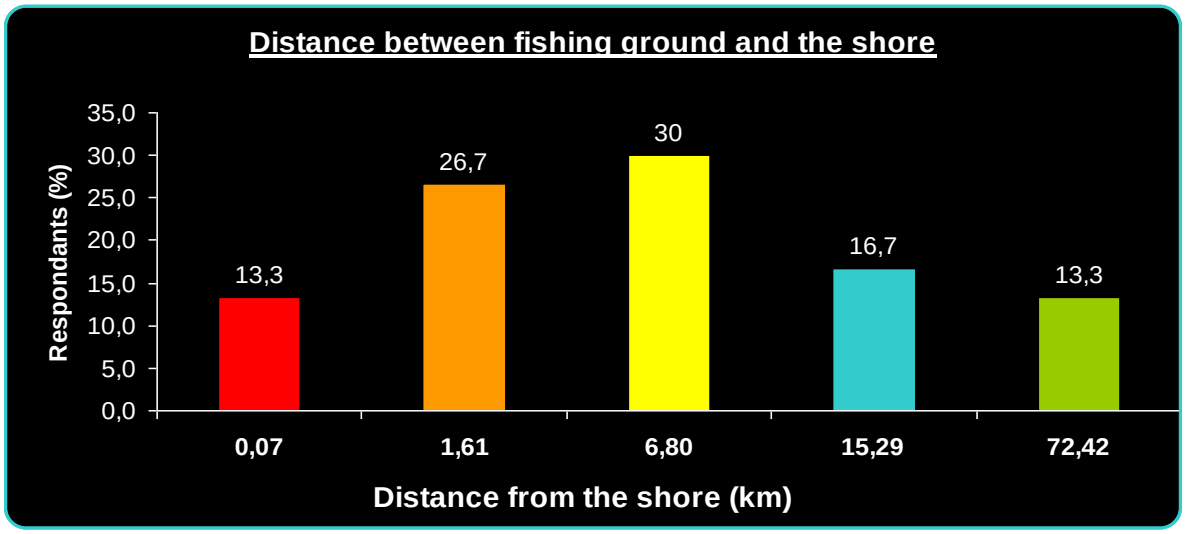


Figure 8: Averages of distance between fishing grounds and the shore
This bar chart shows the repartition of the distances from the shore that fishermen have to travel to reach their fishing ground. The X axis shows the average value taken from all the results for five different distance ranges: 0-1 km, 1-2 km, 2-10 km, 10-20 km, 20 km +. The Y axis shows the percentage of the total respondents to the question whose answer fits into each specific distance range.

Figure 8 shows the distribution of the distance between the shore and the places where fisherman fish. The participation rate is 27.8% (30), the minimum distance is 0.02 kilometres, while the maximum distance is 80.5 kilometres. It is possible to see that a low majority of fisherman (30.0%) fish at an average distance of 6.80 kilometres off the shore, while a minority fish really close to the shore, at an average of 0.07 km (13.3%) or really far, at an average of 72.42 km (13.3 %). The rest of the fishermen either fish around 1.61 km from the shore (26.7%) or at 15.29 km off the shore (16.7%).

Even though the participation rate is low for the question about sex ratio (18.51%), the results are presented below in **Figure 9.** Since 90.0% of the participants were situated in the Gulf of Panama, only the results at the national level are available. The latter can be applied to the Gulf of Panama, but nothing can be concluded for the Gulf of Chiriqui. The majority of the participants (40.0%) answered that in their opinion there were more females than males entering in their fishing ground. The idea that there were more males present got the support of 35.0%, and the final 25% thought that there was an equal quantity of males and females in Panamanian water.

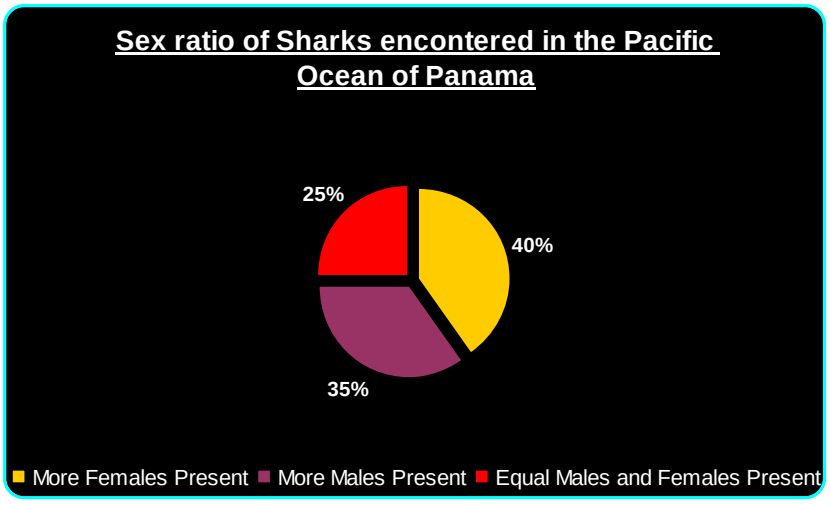


Figure 9: Sex ratio of sharks in Panamanian waters
This figure shows, on a total of a hundred, the proportion of fisherman who think that there are more females then males presents in their fishing areas (yellow), the proportion who think there are more males then females present in their fishing areas (purple) and finally, the proportion who believe that males and females are both present in the same quantity.

The participation rate for the question concerning the months of the year where sharks would be more present is 77.8%. **Figure 10** gives us the opportunity to note that, at the national level, the positive responses are as follows in an order of decreasing importance: April (59.5%), March (56.0%), February (45.2%), May (34.5%), January (32.1%), October (25.0%), June (23.8%), July (20.2%), August and November are at equality (17.9%) and finally September (16.7%) and December (15.5%).

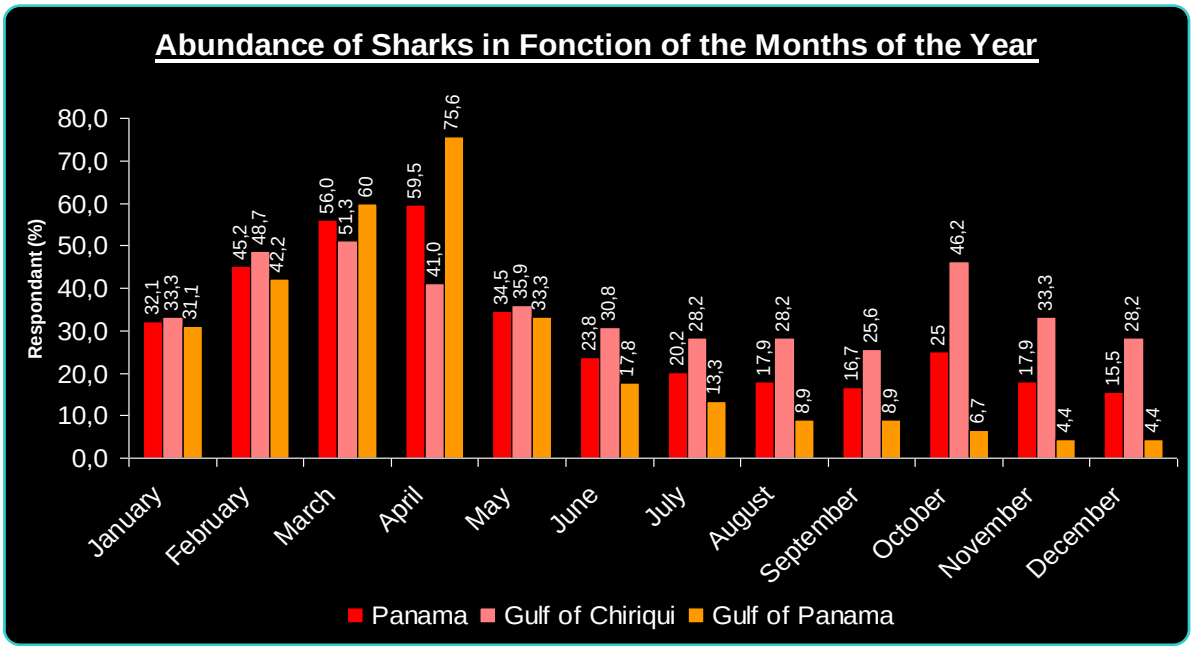


Figure 10: Abundance of shark in function of the months of the year
The bar chart represents how the abundance of sharks varies with the time of the year. The results are available for the whole country (red) as well as specifically for the Gulf of Panama (orange) and for the Gulf of Chiriqui (pink). The percentages represent the fishermen who answered that during specific months they were more likely to encounter sharks. Since the interviewees had the opportunity to choose more then one month, the total does not add up to a hundred.

The pattern is relatively the same for the Gulf of Panama for the first 5 months, but then contrary to the national trend, it slowly decreases from June to December, going from 75.6% of positive answer for the month of April, to 17.8% for the beginning of the winter in June and finally to 4.4% for the end of the winter in December. The situation is different for the Gulf of Chiriqui where the month with the highest positive answer rate is March (51.3%), followed by February (48.7%) and then in third position, October with

46.2% of positive answer. July, August and December are together in last month with 28.2% of positive answers.

Part 2- Technical Aspects

At the national scale, 46.2% of the fishermen interviewed use longlines during at least some part of the year (96.3% participation). Of those who do direct their fishing activities on sharks at some period of the year, 71.0% use long-lines. In the Gulf of Chiriqui, 63.6% of fishermen use long-lines (100% participation) and 87.5% of fishermen who directly catch sharks use longlines. In the Gulf of Panama, 33.3% of interviewed fishermen use longlines (93.8% participation). Of the fishermen that do direct their fishing on sharks at some period of the year, 65.2% use longlines during the year.

At the national scale, 16.7% of the fishermen who use long-lines, use superficial lines, 93.3% use bottom lines and 3.3% use vertical lines. The average number of hooks per line is 450.4 (33.3% participation). The average hook size is 9.2 inches (10.2% participation). 39.0% of the interviewees fish using a hand line (76.9 participation). 60.3% of fishermen interviewed use bait (62.3% participation). In the Gulf of Chiriqui, 15.8% of the fishermen who use long-lines, use superficial lines, 94.7% use bottom lines and 5.3% use vertical lines. The average number of hooks per line is 360.2 (52.3% participation). The average hook size is 9.18 inches (18.2% participation). 24.2% of interviewees use hand lines during the year (75% participation). 20% of the direct shark fishermen use a hand line during the year. 79.2% use bait (95.5% participation). In the Gulf of Panama, 18.2% of the fishermen who use long-lines use superficial lines, 90.9%

use bottom lines and none use vertical lines. The average number of hooks per line is 610 (20.3% participation). The average hook size is 11.5 inches (4.7% participation). 48% use hand-lines during the year (78.1% participation). 41.2% of direct shark fishermen use hand-lines at some point during the year. Half of the interviewed fishermen use bait (68.8% participation). A list of the different types of bait used in order of how often they were mentioned at all of the ports visited follows: Bonito (16); Sardine (16); Calamar (5); Pongo (4); Guanto (2); Coulevra (2); Lisa (2); Perro (1); Agayona (1); Tembladero (1); Raya (1); Preyentia (1); Manta (1).

Throughout Panama, 79.4% of fishermen use nets during at least some period of the year (89.8% participation). Of the fishermen who directly fish shark, 89.0% use nets during the year. In the Gulf of Chiriqui, 76.2% of fishermen use nets during a period of the year (95.5% participation). Of the fishermen who directly fish sharks, 85.7% use nets during the year. In the Gulf of Panama, 81.8% of fishermen use nets (85.9% participation). Of the fishermen who directly fish shark, 90% use nets during the year.

The average size of the mesh that the fishermen use is 4.4 inches (65.7% participation). The average size of the mesh for those who directly fish sharks is 5.1 inches and for those who do not directly fish sharks is 4.0 inches. A t-test found that there was a significant difference between these 2 mesh sizes (P-value: 0.017). In the Gulf of Chiriqui, the average size of the mesh is 4.0 inches (65.9% participation). The average size of the mesh for those who directly fish sharks is 5.4 inches and for those who do not is 3.8. A t-test found that there was no significant difference between the 2 (P-value: 0.125). In the Gulf of Panama, the average size of the mesh that fishermen use is 4.58

inches (65.6% participation). Direct shark fishermen use on average a mesh size of 5.0 inches and fishermen who do not directly fish sharks have an average mesh size of 4.3 inches. The difference between the 2 was not found to be significant (P-value: 0.080).

The average boat size of the fishermen interviewed is 27.1 feet (72.2% participation). The average boat size for those who directly fish shark is 25.5 feet and for those who do not directly fish shark it is 27.9 feet. A t-test found that there was not a significant difference between boat sizes (P-value: 0.105). In the Gulf of Chiriqui, the average boat size is 25.4 feet (75% participation). The average boat size for those who directly fish sharks is 20.8 feet and for those who do not directly fish shark it is 26.4 feet. A t-test found that this difference was significant (P-value: 0.046). In the Gulf of Panama, the average boat size is 28.3 feet (70.31% participation). The average boat size of direct shark fishermen is 26.9 and of other fishermen is 29.5 feet. This was not found to be significant using a t-test (P-value: 0.147).

The average size of the motor for the boats was 40.1 (65.7% participation). The average size of the motors of fishermen who directly fish sharks is 43.9 and for those who do not directly fish shark, it is 38.2. A t-test found that this difference was not significant (P-value: 0.113). In the Gulf of Chiriqui, the average size of the motor for the boats is 33.4 (84.09% participation). For those who directly fish sharks the average motor size is 27.1 and for those who do not fish sharks it is 34.8. A t-test found that this difference was not significant (P-value: 0.162). In the Gulf of Panama, the average size of

the motor is 47.4 (53.1% participation). For direct fishermen, it is 50.7 and for others it is 44.11. A t-test found that this difference was not significant (P-value: 0.172).

The average capacity of the boats at the national scale is 3200 pounds (15.7% participation). In the Gulf of Chiriqui, the average capacity of the boats is 1320 pounds (22.7%), while in the Gulf of Panama the average capacity of the boats is 5885 pounds (10.9%).

The average number of persons per boat is 3.0 (82.4% participation). The average number of persons per boat for those who directly fish sharks is 3.1 and for those who do not directly fish sharks, it is 3.0. A t-test found that this difference was not significant (P-value: 0.199). In the Gulf of Chiriqui, the average number of people per boat is 2.8 (88.6% participation). The average number of people per boat for those who directly fish shark is 2.8 and for those who do not directly fish sharks it is 2.77. A t-test found that this difference was not significant (P-value: 0.162). In the Gulf of Panama, the average number of persons per boat is 3.2 (78.1% participation). The average number of persons per boat who directly fish sharks is 3.3 and the average for other fishermen is 3.1. This difference was not found to be significant (P-value: 0.261).

At a country scale, 51.8% of people interviewed owned their own boat (78.7% participation). In the Gulf of Chiriqui, 56.4% of the fishermen interviewed own their own boat (88.6% participation). In the Gulf of Panama, 47.8% of fishermen interviewed own their own boat (71.9% participation).

In the whole country, 77.9% of fishermen say that their fishing activities are negatively affected by industrial boats (63.0% participation). This represents 80% of the shark fishermen and 76.7% of the fishermen who do not directly fish sharks. In the Gulf of Chiriqui, 84.4% of fishermen believe that industrial boats affect their practices (72.7% participation). This represents 71.4% of direct shark fishermen and 88% of those who do not directly fish sharks. In the Gulf of Panama, 72.2% of fishermen say that their fishing activities are affected by industrial boats (56.3% participation). This is comprised of 83.3% of shark fishermen and 61.1% of other fishermen.

Throughout Panama, 54.1% of people interviewed answered that they fish during the day (68.5% participation) and 76.7% of them answered that they fish at night (67.6% participation). Fishermen had the possibility to answer that they fish at night and during the day. 40% of shark fishermen fish during the day and 61.2% of those who do not directly fish sharks fish during the day. 70.8% of those who directly fish sharks fish during the night while 79.6% of those who do not directly fish sharks fish during the night. In the Gulf of Chiriqui, 50% of fishermen fish during the day (86.4% participation) and 89.5% of fishermen fish at night (86.4% participation). 37.5% of shark fishermen fish during the day and 53.3% of those who do not directly fish shark fish during the day. 75% of direct shark fishermen fish at night and 93.3% of those who do not directly fish shark fish at night. In the Gulf of Panama, 58.3% of fishermen fish during the day (56.3% participation). 41.2% of the ones who directly fish shark, fish during the day. 73.7 of those who do not directly fish shark, fish during the day. 54.9% of fishermen fish at

night. Out of those who directly fish shark, 68.8% fish during the night. Out of those who do not directly fish shark, 58.0% fish at night.

The average number of days that a fisherman goes out fishing in a row is 3.56 (73.14% participation). The average number of days that a direct shark fisherman spends out at sea is 3.77 and for those who do not directly fish sharks, it is 3.48. A t-test found that this was not significant (P-value: 0.344). In the Gulf of Chiriqui, the average number of days that fishermen go out at sea is 3.28 (84.09% participation). The average number of days that a direct shark fisherman fishes is 1.78 while a fishermen that does not directly fish sharks is 3.63. A t-test shows that this difference is not significant (P-value: 0.079). In the Gulf of Panama, the average number of days that a fisherman goes out fishing is 3.82 (65.62% participation). The average number of days that a direct shark fisherman spends at sea is 4.58 and the average number of hours that other fishermen spend on water is 3.30. A t-test found that this difference was not significant (P-value: 0.170).

In Panama, the average day of fishing activities lasts 10.0 hours (29.6% participation). In the Gulf of Chiriqui, the average day of fishing lasts 9.9 hours. In the Gulf of Panama, 10.1 hours is the average duration of a daily fishing expedition (26.56% participation).

Part 3 - Historical Aspects

The average number of years that the fishermen interviewed have been fishing is 18.5 (76.9% participation). Specifically in the Gulf of Chiriqui, 17.8 is the average

amount of years that the interviewed fishermen have been fishing (81.8% participation). In the Gulf of Panama, the average is 19.0 years (73.4% participation).

In Panama, 5.8% of the fishermen interviewed say that there are more sharks today than there were before, 83.7% say that there are less sharks today than there were before and 10.5% say that there has not been a change (79.6% participation). In the Gulf of Chiriqui, 15.6% say that there are more sharks today than before, 75% say that there are less and 9.4% say that there has not been a change (72.7% participation). In the Gulf of Panama, 0% say that there are more sharks today than before, 89.0% say that there are less sharks today than before and 11.1% say that there has not been a change (84.4% participation).

For the whole country, 12.7% of fishermen say that there are less artisanal boats at the ports from which they leave to go fishing, 81.0% say that there are more boats at the ports and 6.3% say that there has been no change (58.3% participation). In the Gulf of Chiriqui, 28% say that there was more competition before, 64% say that there is more competition now and 8% say that there has not been a change (56.8% participation). In the Gulf of Panama, 2.6% of fishermen say that there is less competition today when compared with before, 92.1% say that there is more competition today and 5.3% say that there has not been a change (59.4% participation).

At a national scale, 34.8% of the fishermen say that their sons will be fishermen (63.9% participation). 42.9% of direct shark fishermen say that their sons will be

fishermen and 31.3% of those who do not directly fish shark say that their sons will be fishermen. In the Gulf of Chiriqui, 33.3% of fishermen say that their sons will be fishermen (54.5% participation). This includes 60% of direct shark fishermen and 26.3% of fishermen who do not directly fish sharks. In the Gulf of Panama, 35.5% say that their sons will be fishermen (70.3% participation). 37.5% of direct shark fishermen say that their sons will be fishermen and 34.5% of other fishermen say that their sons will be shark fishermen.

Moreover, 64.09% of Panamanian fishermen say that their father was or still is a fishermen (76.9%). In the Gulf of Chiriqui, this is 54.8% (70.5% participation). In the Gulf of Panama, 69.6% say that their fathers were or still are fishermen (81.3% participation).

Part 4 - Regulations

In Panama, 62.0% of interviewees want more regulations on shark fishing (65.7% participation). 73.9% of direct shark fishermen want more regulations while 56.3% of those who do not directly fish sharks would like to see more regulation. In the Gulf of Chiriqui, 75.9% of fishermen would like to see more regulations on shark fishing (65.9% participation). This includes 100% of direct shark fishermen and 69.6% of fishermen who do not direct their fishing towards sharks. In the Gulf of Panama, 52.4% believe that there should be more regulations. This includes 64.7% of those who directly fish sharks and 44% of the rest of the fishermen.

Moreover, 74.2% of Panamanians want a ban on shark fishing for the period of the year that sharks are reproducing (57.4% participation). 70% of direct shark fishermen would like to see this ban for reproduction while 76.2% of those who do not directly fish sharks would like to see the same. In the Gulf of Chiriqui, 76.9% of fishermen would like to see a ban on the months where sharks are reproducing (59.1% participation). This includes 100% of direct shark fishermen and 70% of fishermen who do not directly fish sharks. In the Gulf of Panama, 44.4% would like to see a ban on shark fishing during the months when sharks are reproducing (56.3% participation). This includes 57.1% of the direct shark fishermen and 36.4% of the other fishermen.

Throughout Panama, 38.9% of fishermen would like to see a minimal size of shark that is allowed to be caught (50% participation). This represents 42.9% of direct shark fishermen and 37.5% of fishermen who do not directly catch shark. In the Gulf of Chiriqui, 70.8% of fishermen would like to see a minimal size imposed for shark capture (54.5% participation). This represents 100% of shark fishermen and 63.2 % of fishermen who do not direct their fishing towards sharks. In the Gulf of Panama, 13.3% of the interviewed fishermen want a minimum size implemented (46.9% participation). This includes 11.1% of direct shark fishermen and 14.3% of other fishermen.

18.0% of fishermen interviewed would like to see regulations on the number of boats at each port (36.1% participation). This represents 22.2% of shark fishermen and 16.7% of fishermen who do not directly fish shark. In the Gulf of Chiriqui, 50% would like to see a regulation on the number of boats (31.8% participation). This represents

66.7% of shark fishermen and 45.5% of fishermen who do not directly fish sharks. In the Gulf of Panama, 0% would like to see limitation on the number of boats (39.06% participation).

Part 5 - Economic Aspects

The average investment per trip among the fishermen interviewed is 273.69 B/.00 (63.0%). The average investment per day is 67.52 B/.00 (52.8% participation). In the Gulf of Chiriqui, the average investment per trip is 225.39 B/.00 (75% participation). The average investment per day is 63.15 B/.00 (72.7%). In the Gulf of Panama, the average investment for a fisherman is 319.24 B/.00 (54.9% participation). The average investment per day is 73.12 B/.00 (39.1% participation).

For a bad trip, the average amount of money brought back per fishermen is 5.74 B/.00 (38.0%). This was an average of 1.35 B/.00 per day (14.8% participation). In the Gulf of Chiriqui, the average amount of money brought back on a bad trip is 6.02 B/.00 (56.8% participation). This was about 1.76 B/.00 per day (13.6% participation). In the Gulf of Panama, the average amount of money made on a bad trip per fisherman is 5.31 B/.00 (25% participation). The average per day is 1.1 B/.00 (15.6% participation).

For a normal trip, the average amount of money brought back is 78.98 B/.00 (34.3% participation). This comes out to 17.21 B/.00 per day (13.0% participation). In the Gulf of Chiriqui, 64.03 B/.00 is the usual amount of money that is brought in after a fishing trip (59.1% participation). The amount made per day is 17.06 B/.00 (18.2%

participation). In the Gulf of Panama, the normal per trip average is 114.31 B/.00 (17.2% participation) and the per day average is 17.41 B/.00 (9.4% participation).

On a good trip, the average amount of money that fishermen said that they would make is 208.96 B/.00 (48.1% participation). This is about 68.80 B/.00 per day (21.3% participation). In the Gulf of Chiriqui, on a good trip, a fishermen can make 149.50 B/.00 per trip (63.6% participation). He can make about 44.55 B/.00 per day. In the Gulf of Panama, the good per trip average is 278.33 B/.00 (37.5% participation) and the good per day average is 84.39 B/.00 (21.9% participation).

DISCUSSION

Before going into a discussion about the results, it is important to discuss the sample size of the data and the power that can therefore be associated with the results obtained. As was previously mentioned, the sample size is question-specific as the number of respondents' to each question varies. This was due to many different factors. Interviews were often cut short if the interviewee had to leave for example. People also sometimes refused to answer certain questions or just simply were not able to answer certain questions. In addition only about a third of the people actually direct their fishing activities towards sharks so therefore all of the questions that involve isolating only the direct shark fishermen consist of even lower sample sizes. This is why the percentage of people who answered and/or the number of people who answered is present with each of the answers in the results. Because of the nature of the data, a lot of the information that was included might not necessarily be very significant at all. All information was incorporated irrelevant of how powerful it could be considered though because it might still be able to point towards a certain trend.

It is also important to note that there seems to be a pretty strong movement of fishermen into the tourism domain. This is due to the fact that, according to them, this is a more steady/reliable, less dangerous, and more profitable way of life. Fishermen who work some of the year in tourism or have completely moved to tourism told us that with tourism they are always certain not to lose the money that they invest in gas, which often happens when they go out fishing. They know for example that the tourist that they are driving to an island will pay for the gas that they use up for the trip.

Biological

As can be seen in the results, the hammerhead is probably the most common shark along the pacific coast of Panama, but we were told several times that because of the fact that this shark consists of dark meat, the latter does not have a great commercial value since it is known to not taste that good.

However, in terms of the fishermen actually being able to name the different species of shark that they catch, there was definitely a problem. They often used names for the species that were very area-specific and never used scientific names or very rarely used common names. The fishermen would tell us the names of those that they were aware of which most often probably consisted of the most common species, but they were not able to identify many of the species. Many fishermen would give us a few names and then would tell us that they know more but that they did not have a name for them. Also we believe that in many cases species were named not necessarily because they were more present in the area but because they were more recognizable. For example, the Hammerhead shark and the Tigre shark have characteristics that make them stand out and very easy to recognize.

As can be seen in the results, many fishermen believe that sharks come to the coast of Panama for reproductive purposes. During their time spent near the coast when they are fished most, fishermen have testified to catching pregnant females with babies in their stomachs and also a lot of small baby sharks.

Many fishermen have told us that the market for sharks has only recently been present. In the past, no one in Panama fished sharks. They, of course, caught them as by-catch but there was not much that one could do with them.

We encountered very few fishermen who actually told us that they used sharks for bait, but however there were a few. A man from Puerto Mutis, for example, told us that he used Hammerhead Shark as bait for Cherna.

Also it was very commonly brought up that most sharks come out dead which will be discussed a little in the regulation section of the discussion. Sharks come out alive when the fishing gear is only left for a very short period of time in the water. After a certain amount of time, it is very unlikely to expect any sharks to be alive. The problem with this is that a lot of fishermen leave their nets in for very long periods of time. Some even go out and leave their nets overnight. We were told that releasing sharks that are still alive becomes more of a possibility when certain types of fishing practices are being used like those that are specific to fishing shrimp for example. Many shrimp fishermen told us that they leave their nets in the water only for about half an hour and that this gives them the possibility of throwing back baby sharks that are still alive and are not economically worth bringing back to shore.

Technical

In general, it can be seen in the results that shark fishermen use either longlines or nets to seek out sharks. Those who use nets utilize the higher mesh sizes. Smaller mesh sizes are also responsible for taking the lives of sharks but this occurs as by-catch when the fishermen are targeting something else. In these cases, it is usually babies or very young sharks that are caught. Fishermen have testified to catching sharks as by-catch with hand-lines but this only happens very rarely and is probably not very significant.

Most fishermen use more than 1 fishing technique during the year because they fish different things in different periods of the year. So fishermen who directly fish sharks also fish other things as well. For example, many shark fishermen use long-lines to fish sharks during 'shark season,' and use nets during other periods of the year and with these nets also catch sharks but as by-catch. This causes a problem in our data when we are isolating shark fishermen and looking at the different fishing techniques that they use. All of the fishing techniques used that catch sharks either directly or indirectly must be included in the data but with the way that our data was set up there was no way of separating techniques used by a fisherman and specifying whether the technique was directly used to catch sharks or not. In the results, mesh size was compared between direct fishermen and other fishermen for example. This comparison therefore includes net sizes that shark fishermen use during the year but that are not necessarily used to catch sharks. This difference was found to be significant but it would have been even more significant had we have been able to solely focus on the mesh sizes that direct shark fishermen use to fish sharks and exclude the mesh sizes that catch sharks as by-catch. It would therefore have been very useful to create some sort of way of isolating this in excel.

As was shown in the results, a large percentage of fishermen interviewed believe that their fishing activities were affected by large industrial boats. Those who opposed this idea said that the industrial boats fish much further away from the shore than they do and that therefore the industrial boats activities do not cause them problems. The majority of fishermen, however, believe that industrial boats severely affected their fishing

activities. According to many artisanal fishermen, the industrial boats kill everything, even very young babies of different marine species that are not used and do not have a chance to get to a reproductive stage or at least a stage when they could be economically usable. Many people believe that the industrial boats should be the ones who are regulated, but that regulations never apply to them. A fisherman from the Conception port said that while an artisanal fisherman might fish 100 sharks in 1 year, an industrial boat could fish the same quantity in a day. A fisherman from Agallito said that industrial boats can get 200 sharks a day. Many artisanal fishermen blame shark disappearance on the industrial boats. Many also say that it is them who do all of the shark fining.

Through the interviews, we have also been made aware of the increase in damage potential that has been happening due to technological improvements in fishing equipment. Bigger nets, boats, motors, etc. are making it more possible than ever to efficiently exploit marine resources.

Historical

Most of the fishermen told us that they have been fishing since they are very young. A lot of them started out when they were kids and went out to help their dad or their uncle for example. Most were only able to tell us an approximation of how long they have been fishing but it could usually be assumed that they have started at a very young age.

Most of the fisherman interviewed would prefer that their sons do not become fishermen. Some fishermen like their job, but always repeat that it is hard, unsure and dangerous. Therefore, they would prefer their sons get educations and become

professionals as they say. This trend is present everywhere along the Pacific coast, except in Las Perlas, where secondary school is not accessible, making it hard for young people to study. It seems really more accepted and normal there to follow the step of everyone you know and become a fisherman.

We can also see the trend in the results of decreasing shark populations and increasing artisanal competition. Just to give an example of how intense the change in competition has been, the fishermen at Boca de Parita told us that years ago there were only 10 boats at this port and that now there are around 200 boats.

Regulations

People who are against any kind of shark regulation would usually fall into one of two categories: those who believe sharks are dangerous and should therefore be exterminated which was a very common belief in the Las Perlas Archipelago, and those who believe that this type of regulation was not possible. There is generally a feeling amongst fishermen, even those who are against regulations, that there is a need for shark conservation because they are disappearing. Many fishermen who use nets oppose regulation because, according to them, they have no choice in terms of what they catch and they must be allowed to continue fishing. They say that if shark fishing is banned they will not be able to fish at all. Also many believe that the income that comes out of shark fishing or even of shark by-catch is an important sum and that this money is necessary to support their families. A fisherman from the Juan Diaz port said that there should not be a ban because already as it is shark fishermen only direct their fishing towards sharks for a few months a year and the rest of the year is dedicated to other

species. For specific regulations like a minimal size for example, some fishermen told us that this would be impossible because the sharks almost always come out dead. Also some opposed the ban because, although they thought that shark preservation was a positive thing, they said that, in Panama, implemented regulation always affects the poor and the rich are either unaffected or they benefit. They believe that if laws that will affect fishing practices are implemented, artisanal fishermen must be consulted and be involved in the decision making because ultimately they are the ones who will be most affected. Some people also just simply refused to answer questions about regulation because they were scared or thought that we might be working for some sort of ARAP type organization.

The fishermen who agree with regulations for shark fishing, in general, understand that there is a problem and that, if nothing is done, species will go extinct. Some seemed to believe in the intrinsic value of sharks while others were focusing more on the economic implications of the reducing populations of sharks. One of the wiser fishermen that we spoke to told us that preserving sharks so that they can reproduce is like preserving a chicken so that it can produce more chicks and, ultimately, you can continue to eat chicken.

Time Organisation

The way our schedule was built made it impossible to go to a port more than once. It could have been really useful to revisit ports because there were ports visited that were empty, and we unfortunately could not return to get information. This contributes to

our data being incomplete along with the fact that we did not go to the Darien and that a greater number of interviews at each port would have been better.

Relationship between the interviewee and the interviewers

We had to make it clear that we were not linked to the government, ARAP or ANAM people. They were still scared of us sometimes we think. (Ex: contradicting information about the presence of sharks or not, within the same port and even during a single interview).

Duration of Interviews

The interviews varied in duration from about 15-45 minutes. A short interview would consist of the interviewee responding to the questions very precisely and briefly without going off on tangents. The length of an interview was also directly related to the amount of information that the interviewee knew about the questions or perhaps that he was willing to give up. Interviews also lasted a little longer sometimes because, instead of just simply asking questions and ticking off answers, the interviewers attempted to develop a conversation in order to be more respectful as well as the fact that this creates a great level of trust and could potentially lead to more truthful answers or perhaps simply more information.

Problems with questionnaire

In Appendix 5, there are comments directly on a questionnaire. The results to question 4E had to be thrown out completely because the purpose of the question was not understood until after the interviews were completed. Most of the questions in the

historical section of our questionnaire have to be thrown out as well because the fishermen were not able to answer them. Their answers were all very imprecise and vague.

CONCLUSION

The information gathered in the field over these past months straightforwardly point to the fact that sharks are being fished along the Pacific Coast of Panama. All artisanal fishermen partake in the reduction of shark populations in the Pacific whether this is done directly or indirectly through by-catch. Artisanal fishermen suggest that the industrial fishing boats in this area are also playing a role, but the importance of this role has not been quantified nor has it been compared with artisanal fishing itself. More data must be gathered on both the biological as well as the social side in order to properly assess the situation. Ultimately, the proper measures need to be applied in order to remedy the situation as much as is humanely possible considering the different parties involved.

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APPENDIX 1: *List of the ports visited*

Gulf Of Chiriqui (19)

Chiriqui (8)
Bellavista
Boca Chica
Charco Azul
El Salado (NI)
Limones
Pedregal
Puerto Armuelles
Remedios

Veraguas (11)
Arenas (NI)
Hicaco
Malena
Mariato
Palo Seco
Playa Banco
Puerto Mutis
Puerto Nancy, Quebro
Salado (NI)
Santa Catalina
Torio

Gulf Of Panama (29)

Coclé (3)
Aguadulce (NI)
Faraillon
Puerto Gago (NI)

Herrera (2)
La Boca de Parita
Paris (NI)

Las Perlas (3)
La Ensenada
Las Esmeralda
Pedro Gonzalez

Los Santos (11)
El Agallito
Bellavista (NI)
Búcaro
La Candelaria
La Concepción / La Yeguada
El Arenal
El Ciruelo
La Enea (NI)
Mensabe
Rio Pedasi (NI)
Punta Mala

Panama (10)
Puerto Caimito
Chichina
Coquitra
Gorgona
Chepillo
Juan Diaz
Mulle Fiscal
Punta Chame
San Carlos
Veracruz

NI : The ports were visited, but no interview was conducted

APPENDIX 2: *Additional information on the visited ports*

The ports are listed in alphabetical order by provinces first and then by the name of the ports.

Some ports are not present in this list because we did not have any additional information to add.

Chiriqui

Armuelles

- # of artisanal fishing boats: 19-25
- All the interviewees told us that there were no fisherman in this town who were targeting sharks. They also all seem to think that in order to fish shark/sell the fins, you need a permit (Cost = 5.00 $). The president of the fisherman association of the town shared this view and thought that it was the case for the whole country.

Bellavista

- # of artisanal fishing boats: 4-5
- They only fish for commercial purposes during the summer. They either sell to someone in their family who then sells in Puerto Armuelles or they directly sell their fish in Puerto Armuelles.

Boca Chica

- # of artisanal fishing boats: 6
- Buyers are in David and they have to get there. There use to be 20 artisanal boats in this town, but now, only 7 of these still fish, the others have converted to tourism.

Charco Azul

- # of artisanal fishing boats: 5-7
- They are really close to the petrol pumping station. This influences their fishing activities since they cannot fish close to the docks when big boats are present.

El Salado

- # of artisanal fishing boats: 2
- No interviews conducted at this port. The number of fisherman was told to us by the wife of one of the fisherman.

Limones

- # of artisanal fishing boats: 8-18
- All the interviewees told us that there were no fisherman in this town who were targeting sharks.

Pedregal

- # of artisanal fishing boats: Unkown

- A few small and sparsely dispersed landing sites. One of them is called *La Estrella* and another one is called *El Mullecito.*

Remedios

- # of artisanal fishing boats: 60-100
- Some of the fisherman fish in the river mouth, some fish outside of it, but still close to the beaches and some of them go really far into the sea. There is a general feeling in this port that it is prohibited by *Mar Viva* to fish sharks. Apparently, three years ago there were people directing their fishing activities toward sharks, but they stopped when it became prohibited.

Herrera

Boca de Parita

- # of artisanal fishing boats: 200
- In Boca de Parita, people are not dedicated to shark fishing.

Los Santos

Agallito

- # of artisanal fishing boats: 100

Bucaro

- # of artisanal fishing boats: 100
- There are three companies present in the town, for whom the majority of the fishermen work.

Candelaria

- # of artisanal fishing boats: 3
- 1 of the 3 boats directly fish sharks.

La Conception/ La Yeguada

- # of artisanal fishing boats: 30
- 4 of the 30 boats directly fish sharks.

El Arenal

- # of artisanal fishing boats: 24
- The following comments are based on visual observations around 6h30 in the morning when all the boats were leaving for the day. Two tanks of gas per boat were being used. They were bringing hand lines and some had longlines which, we were told, are used to fish sharks. No nets were seen. When the fishing activities are not successful enough, some fisherman dedicate their time to activities related to tourism. Ex: One man was leaving to go fishing for tuna with tourists. When fishing is bad at this port, people turn to tourism. Many of the fishermen go out fishing with tourists (tuna).

Puerto Rio Pedasi

- # of artisanal fishing boats: 4

Punta Mala

- # of artisanal fishing boats: 2

Panama

Chimina

- # of artisanal fishing boats: 8
- Seems to be only accessible by boat at high tide. The fishermen categorize themselves as shrimp fisherman.

Coquitra

- # of artisanal fishing boats: 100
- At this port, we actually witnessed fins being transferred from one bag to another. There were very small fins and medium sized ones as well. The bodies of the sharks were nowhere to be seen. A lot of the men here are dedicated to shark fishing. They receive 50$/pound for the large fins (5-6 pds), 11$/pound for the smaller fins, but it seems that the most valuable/profitable item was the nose of a saw shark. One man was very open about the fact that he did, in fact, fin sharks. He did not seem to be aware or perhaps he did not care that this practice was illegal. There is an ARAP station in this port but it was closed and there was not one official to be seen.

Juan Diaz

- # of artisanal fishing boats: 45
- This port seemed more like a port with industrial boats.

Faraillon

- # of artisanal fishing boats: Unknown
- 22 boats dedicated to shark fishing. They receive 27$/pound for the fins of sharks and 0.10$/pound for the meat (this is for dark meat though which is considered less flavourful). The baby sharks are believed to taste better. Some fishermen also work in tourism.

Gorgona

- # of artisanal fishing boats: 60
- This port has a cooperative. Not a lot of shark fishing present here.

Isla Chepillo

- # of artisanal fishing boats: + of 100
- There is no buyer on Isla Chepillo. The fishermen here specialize in shrimp.

Mulle Fiscal (Panama)

- # of artisanal fishing boats: 500

Bahia Chame (Punta Chame)

- # of artisanal fishing boats: Unkown

- Fishermen at this port get 1$/pound for shark fins and 0.20$/pound for shark meat.

Veracruz
- # of artisanal fishing boats: 30-35
- There are not a lot of sharks around this area and there never were.

Perlas (las)

La Ensenada
- # of artisanal fishing boats: Unknown
- Fishermen at this port used to fish shark but they do not dedicate their time to this practice anymore. There is a buyer who comes to the island in February and March. Those who fish the rest of the year must travel to Panama City to sell their catch. For some of the people here fishing is more of a sport and they use it more for subsistence purposes during a certain part of the year. When they do not fish, they work in other domains such as agriculture. Sometimes they remain on the island but they also other times work in other towns or cities.

La Esmeralda
- # of artisanal fishing boats: 40-120
- Their main commercial fishing activities are directed toward fish of the *Snapper* spp. They only take place during four months a year (January, February, March and April) where a boat from Panama comes to buy the catches. The rest of the year, they practice fishing for subsistence purposes only. No one directs their fishing towards sharks in this town. Some fishermen who do not fish here all year around go to work in Panama City to work for the rest of the year in construction or other occupations.

Pedro Gonzalez
- # of artisanal fishing boats: 40
- A fisherman from this town told us that he fins sharks on the shore due to the fact that this is all that he can sell and that the meat add extra weight to his boat. He does not sell the shark meat.

Veraguas

Aguadulce
- # of artisanal fishing boats: 30

Arenas
- # of artisanal fishing boats: Unkown
- Really small port

Hicaco
- # of artisanal fishing boats: Unkown

- There are mostly shrimp fishermen. There are 4 buyers present at the port most of the time. The fishermen have a problem with the fumigation that is taking place in nearby rice fields. They think that the chemicals from this process contaminate the water and harm marine fauna.

Malena

- # of artisanal fishing boats: Unkown
- The fishermen have a problem with the fumigation that is taking place in nearby rice fields. They think that the chemicals from this process contaminate the water and harm marine fauna.

Mariato

- # of artisanal fishing boats: Unkown
- The fisherman have a problem with the fumigation that is taking place in nearby rice fields. They think that the chemicals from this process contaminate the water and harm marine fauna.

Puerto Mutis

- # of artisanal fishing boats: Unkown
- Three boats are directly fishing sharks. The fishermen also have problems with agricultural fumigation: they no longer find baby shrimps where they used to before and dead fish often wash up onto the shore. There have been some fishermen at this port who have started working in tourism. There was an ARAP officer working at this port when we visited.

Santa Catalina

- # of artisanal fishing boats: 6
- There has been a major decrease in the number of fisherman at this port due to conversion to tourism (Coiba).

APPENDIX 3: *GPS point of the ports*

Name of the Port	Latitud_y_DMS	Latitud_y_DD	Longitude_xDMS	Longitude_DD
GULF OF PANAMA				
Boca de Parita	80105,7	8,01825	802713,9	-80,4538611
Paris	80656,2	8,115611111	803144,3	-80,5289722
El Agallito	75927,2	7,990888889	802402,8	-80,4007778
Bellavista	75030	7,841666667	801515,9	-80,2544167
Bucaro	72113	7,353611111	802310,2	-80,3861667
La Candelaria	74517,9	7,754972222	800957,3	-80,1659167
La Conception/La Yeguada	74032,3	7,675638889	800519,3	-80,0886944
El Arenal	73331,1	7,558638889	800111,1	-80,01975
El Ciruelo	72525,5	7,424583333	800836,2	-80,1433889
La Enea	75149,7	7,863805556	801410,1	-80,2861389
Mensabe	74523,7	7,756583333	801006,6	-80,1685
Rio Pedasi	73350,8	7,564111111	800136,5	-80,0268056
Punta Mala	72821,2	7,472555556	800006,4	-80,0017778
Puerto Caimito	85205,1	8,88475	794242,3	-79,71175
Chinina	85845,8	8,979388889	790140,1	-79,0278056
Coquitra	90735,8	9,126611111	790340,7	-79,0613056
Faraillon	82116,3	8,354527778	800819,9	-80,1388611
Gorgona	83309,8	8,552722222	795206,8	-79,8685556
Isla Chepillo	85721,6	8,956	790727,1	-79,1241944
Mulle Fiscal	85716,5	8,954583333	793211,7	-79,5365833
Punta Chame	83836,9	8,643583333	794235,6	-79,7098889
Veracruz	85318,8	8,888555556	793723,2	-79,6231111
Puerto Gago	82052,1	8,347805556	802400,8	-80,4002222
Aguadulce	81435,5	8,243194444	802954,9	-80,4985833
La Ensenada	82157,55	8,365986111	785047,49	-78,846525
La Esmeralda	81602,61	8,267391667	785524,84	-78,9235667
Pedro Gonzalez	82416,48	8,404577778	79060616	-79,1017111
San Carlos	83322,46	8,556238889	795544,98	-79,9291611
Juan Diaz	90117	9,021388889	792614,5	-79,4373611
GULF OF CHIRIQUI				
Arenas	72058,1	7,349472222	805336,7	-80,8935278
Hicaco	73916,85	7,654680556	811208,25	-81,2022917
Malena	73426,8	7,574111111	805748,9	-80,9635833
Mariato	73714,4	7,620666667	805932,9	-80,9924722
Puerto Mutis	75533,2	7,925888889	810320,7	-81,05575
Palo Seco	73547,6	7,596555556	805829,4	-80,9748333
Playa Blanco	73938	7,660555556	811835,8	-81,3099444
Puerto Nancy (Quebro)	72557	7,4325	805501	-80,9169444
Salado	81211,1	8,203083333	802901,1	-80,4836111
Santa Catalina	73802,8	7,633888889	811529,6	-81,2582222
Torio	73251	7,5475	805656,9	-80,9491389
Boca Chica	81309,93	8,219166667	921311,02	-92,2197778
Bellavista (Ch)	80309,4	8,052611111	825205,1	-82,8680833

Limones	80607,9	8,102194444	825151,7	-82,8643611
Charco Azul	81322,3	8,222861111	825235,2	-82,8764444
Pedregal	82154,15	8,365041667	822605	-82,4347222
Puerto Armuelles	81654,7	8,281861111	825057,1	-82,8491944
Remedios	81257,7	8,216027778	814837,3	-81,8103611
El Salado (Ch)	81329,4	8,224833333	814520,9	-81,7558056

APPENDIX 4: *Questionnaire*

Fecha: _____ **No: _____**
Nombre del poblado/provincia: _____ **Coordenadas:**
_____

Información personal
Edad_____ Sexo: H / M
Profesión: Comprador / Pescador / Capitán / Otro: _____

Recursos marinos
¿Hay un periodo del año donde su pesca esta dirigida a los tiburones? Si ☐ No ☐
¿Usted pesca incidental (revoltura)? Si ☐ No ☐
¿Qué hace con los tiburones?
¿Los comercializa? Si ☐ No ☐
¿Los vende a una *planta procesadora directamente / a un comprador intermediario*?
¿Hay un comprador para la aletas y uno para la carne, o uno para todo? _____
¿Los vende directamente al público? Si ☐ No ☐
¿Los utiliza como carnada? Si ☐ No ☐
¿Los devuelve al mar? Si ☐ No ☐
¿Los come usted? Si ☐ No ☐
¿Cuales partes utiliza? *El cuerpo entero / las aletas /los hígados /el cartílago* / cualquier parte: _____?

¿Cuál especie(s) o tipo de tiburón pesca? _____
¿Cuál tipo o especie de tiburón es la que usted más pesca?
¿En que lugar los encuentra? *esteros /desembocadura de ríos / cerca de las playas / mar afuera*
¿A cuantas millas de la orilla/playa? _____
¿Qué piensa usted el porque los tiburones llegan a esa zona? *reproducirse / comer / están de paso (migración) / limpieza,* otro: _____
¿Donde los pesca? (con Mapa)_____
¿Usted sabe si hay mas hembras, mas machos o si hay el mismo numero? Si ☐ No ☐ *macho / hembra*
¿En qué época o meses del año usted pesca estas especies de tiburón?
_____
_____
¿Hay veces que usted ve a tiburones ballena (pintado)? ¿Dondé? _____
¿Hay veces que usted ve a tiburones sierra (serrucho/pece espado)? ¿Dondé?
_____
¿Cuántos tiburones pesca al mes durante la temporada de pesca? _____
¿Cuál sería más o menos el peso total? _____

Aspectos técnicos
¿Qué técnica de pesca usa para atrapar los tiburones?
¿Palangre? Si ☐ No ☐
¿Qué tipo? *superficie / fondo / vertical*
¿De qué tamaño es la línea? _____ (*millas* / *brasas*)
¿Cuántos anzuelos por línea? _____
¿Cuál es el tamaño de los anzuelos? _____
¿Línea con anzuelo? Si ☐ No ☐
¿Utiliza carnada? Si ☐ No ☐

¿Qué tipo de carnada? _____
¿Redes? Si ☐ No ☐
¿Cuál es el tamaño del paño o red? _____
¿Cuál es el tamaño de la apertura de la malla?_____
¿Qué tipo de embarcación usa?
¿De qué tamaño es? _____
¿Tiene motor, cual? Si ☐ No ☐ _____
¿Cuántas libras usted puede transportar cada viaje (en su bote)? _____
¿Cuantos pescadores por embarcación? _____
¿Es dueño del bote Si ☐ No ☐
¿Usted cree que su pesca es afectada por los barcos industriales? Si ☐ No ☐
¿Cuantos días por mes pesca? _____
¿Pesca de *día / de noche*?
¿Cuantas horas es la faena de pesca? _____

Aspectos históricos
¿Hace cuanto tiempo que pesca? _____
¿Pesca usted ahora mas tiempo que antes? Si ☐ No ☐
¿Cuantos días por semana pescaba? *1 / 2 / 3 / 4 / 5 / 6 / 7*
¿Cuantas horas de faena de pesca? _____
¿Cuantas horas necesitaba para llegar al área de pesca? _____
¿Pescaba los tiburones en las mismas áreas? Si ☐ No ☐
¿Pescaba las mismas especies? Si ☐ No ☐
¿Las pescaba en las mismas cantidades? Si ☐ No ☐ *Mejor / Peor*
¿Eran del mismo tamaño? Si ☐ No ☐ *Más grande / Más pequeño*
¿Recibía el mismo precio por su pesca? Si ☐ No ☐ *Mejor / Peor*
¿Había más competencia, más o menos botes? Si ☐ No ☐
¿Sus hijos pescan? Si ☐ No ☐
¿Su padre era un pescador? Si ☐ No ☐

Regulaciones
¿Usted piensa que debería haber más regulación o vigilancia sobre la pesca de tiburones?
Si ☐ No ☐
¿Apoyaría una veda sobre la pesca de tiburón? Si ☐ No ☐
¿Apoyaría una veda sobre la pesca de tiburón durante los meses donde los tiburones se reproducen?
¿Apoyaría una regulación de la talla mínima de captura? Si ☐ No ☐
¿Apoyaría una regulación que limite el número de botes pescando tiburón? Si ☐ No ☐
¿Apoyaría limitar la pesca de algunas especies? Si ☐ No ☐

Gracias por su tiempo. Nos quedan otras preguntas sensitivas que si usted quiere responderlas se lo agradecemos mucho.

Aspectos económicos
¿Cuál es su inversión para cada viaje/semana? (hielo, combustible, carnada) _____
¿Cuánto usted gana por *cada viaje/ semana*? _____
¿Cuánto de su ganancia por viaje/semana viene de la pesca de tiburones?
_____

Additional Comments

_____
_____
_____
_____
_____

APPENDIX 5: *Questionnaire with constructive comments*

Fecha: _____ **No: _____**
Nombre del poblado/provincia: _____ **Coordenadas:**
_____

Información personal
Edad_____ Sexo: H / M
Profesión: Comprador / Pescador / Capitán / Otro: _____
Have to be careful, because "fisherman" and "captain" might overlap. Someone might be a fisherman only, which means that he is working on the boat, but not directing the operation, while a captain could be on the boat fishing, but also be the director of the operations.

Recursos marinos
¿Hay un periodo del año donde su pesca esta dirigida a los tiburones? Si ☐ No ☐
¿Usted pesca incidental (revoltura)? Si ☐ No ☐
¿Qué hace con los tiburones?
¿Los comercializa? Si ☐ No ☐
¿Los vende a una *planta procesadora directamente / a un comprador intermediario*?
¿Hay un comprador para la aletas y uno para la carne, o uno para todo? _____
¿Los vende directamente al público? Si ☐ No ☐
¿Los utiliza como carnada? Si ☐ No ☐
It might be interesting to transform the question to ask if they sell it to someone who is going to use it as bait, rather that if them personally are going to use t as bait.
¿Los devuelve al mar? Si ☐ No ☐
Maybe it should first be asked if they come out alive or dead and then, if they throw them back and maybe ask why.
¿Los come usted? Si ☐ No ☐
¿Cuales partes utiliza? *El cuerpo entero / las aletas /los hígados /el cartílago* / cualquier parte: _____?
Be carefull to take the time to suggest each of the 4 choices to the fisherman.

¿Cuál especie(s) o tipo de tiburón pesca? _____
¿Cuál tipo o especie de tiburón es la que usted más pesca? *Take the time to make that clear.*
¿En que lugar los encuentra? *esteros /desembocadura de ríos / cerca de las playas / mar afuera Again, be careful to take the time to suggest each of the 4 choices to the fisherman*
¿A cuantas millas de la orilla/playa? _____
¿Qué piensa usted el porque los tiburones llegan a esa zona? *reproducirse / comer / están de paso (migración) / limpieza*, otro: _____ *A choice that could be add is "They live here…"*
¿Donde los pesca? (con Mapa)_____ *Really difficult they seem to change where they fish and to do be familiar with maps.*
¿Usted sabe si hay mas hembras, mas machos o si hay el mismo numero? Si ☐ No ☐ *macho / hembra*
It might be a good idea to validate the answer by asking them how they differentiate the males from the females.
¿En qué época o meses del año usted pesca estas especies de tiburón?
_____
_____
¿Hay veces que usted ve a tiburones ballena (pintado)? ¿Dondé? _____
¿Hay veces que usted ve a tiburones sierra (serrucho/pece espado)? ¿Dondé?
_____
¿Cuántos tiburones pesca al mes durante la temporada de pesca? _____

¿Cuál sería más o menos el peso total? _____
Really, really hard to get answers from the fisherman who do not target sharks but who do get some sometimes.

Aspectos técnicos
¿Qué técnica de pesca usa para atrapar los tiburones?
Be sure to wright reside each techniques if it is use to target sharks
¿Palangre? Si ☐ No ☐
¿Qué tipo? *superficie / fondo / vertical*
¿De qué tamaño es la línea? _____ (*millas* / *brasas*)
¿Cuántos anzuelos por línea? _____
¿Cuál es el tamaño de los anzuelos? _____
¿Línea con anzuelo? Si ☐ No ☐
Be careful because in certain regions they use this term for long lines, and in other regions
¿Utiliza carnada? Si ☐ No ☐
¿Qué tipo de carnada? _____
¿Redes? Si ☐ No ☐
¿Cuál es el tamaño del paño o red? _____
Maybe it World be more relevant to ask for how many nets they use. Because the size of the net seems to be standard since they all buy them at the store. What may change is how many nets they use.
¿Cuál es el tamaño de la apertura de la malla?_____
¿Qué tipo de embarcación usa?
¿De qué tamaño es? _____
¿Tiene motor, cual? Si ☐ No ☐ _____
¿Cuántas libras usted puede transportar cada viaje (en su bote)? _____
¿Cuantos pescadores por embarcación? _____
¿Es dueño del bote Si ☐ No ☐
¿Usted cree que su pesca es afectada por los barcos industriales? Si ☐ No ☐
¿Cuantos días por mes pesca? _____
Really hard because they seem to be dependant of the weather and it also seem to be changing with the months of the year.
¿Pesca de *día / de noche*?
¿Cuantas horas es la faena de pesca? _____
Maybe ask for how long they leave the lines or the nets in the water, since this will influence if the sharks come out alive or not.

Aspectos históricos
¿Hace cuanto tiempo que pesca? _____

¿Pesca usted ahora mas tiempo que antes? Si ☐ No ☐
¿Cuantos días por semana pescaba? *1 / 2 / 3 / 4 / 5 / 6 / 7*
¿Cuantas horas de faena de pesca? _____
¿Cuantas horas necesitaba para llegar al área de pesca? _____
¿Pescaba los tiburones en las mismas áreas? Si ☐ No ☐
¿Pescaba las mismas especies? Si ☐ No ☐
¿Las pescaba en las mismas cantidades? Si ☐ No ☐ *Mejor / Peor*
¿Eran del mismo tamaño? Si ☐ No ☐ *Más grande / Más pequeño*
¿Recibía el mismo precio por su pesca? Si ☐ No ☐ *Mejor / Peor*
They seem to have real difficulties answering these questions. They stayed really vague.

¿Había más competencia, más o menos botes? Si ☐ No ☐
¿Sus hijos pescan? Si ☐ No ☐

Maybe the question is more: Would you like that your sons become fisherman? It tells more about their own feeling toward the job of fisherman.
¿Su padre era un pescador? Si ☐ No ☐

Regulaciones
¿Usted piensa que debería haber más regulación o vigilancia sobre la pesca de tiburones?
Si ☐ No ☐
¿Apoyaría una veda sobre la pesca de tiburón? Si ☐ No ☐
¿Apoyaría una veda sobre la pesca de tiburón durante los meses donde los tiburones se reproducen?
¿Apoyaría una regulación de la talla mínima de captura? Si ☐ No ☐
¿Apoyaría una regulación que limite el número de botes pescando tiburón? Si ☐ No ☐
¿Apoyaría limitar la pesca de algunas especies? Si ☐ No ☐

Gracias por su tiempo. Nos quedan otras preguntas sensitivas que si usted quiere responderlas se lo agradecemos mucho.

Aspectos económicos
¿Cuál es su inversión para cada viaje/semana? (hielo, combustible, carnada) _____
¿Cuánto usted gana por *cada viaje/ semana*? _____
¿Cuánto de su ganancia por viaje/semana viene de la pesca de tiburones?
_____
Really hard too

APPENDIX 6: *Questionnaire for the interpretation of the data base*

Fecha: _____ **No: _____**
Nombre del poblado/provincia: _____ **Coordenadas:**
_____

Información personal
Edad_____ Sexo: H / M
(Q.1) Profesión: Comprador / Pescador / Capitán / Otro: _____

Recursos marinos
(Q.2) ¿Hay un periodo del año donde la pesca de usted esta dirigida sobre los tiburones? Si ☐ No ☐
(Q.3) ¿Usted pesca incidental (revoltura)? Si ☐ No ☐
(Q.4) ¿Qué hace con los tiburones?
A ¿Los comercializa? Si ☐ No ☐
¿Los vende a una *planta procesadora directamente* a / *a un comprador intermediario* **b**?
¿Hay un comprador por las aletas y un por la carne a, o un por todo b?
_____
¿ **c** Los vende directamente al público? Si ☐ No ☐
B ¿Los utiliza como carnada? Si ☐ No ☐
C ¿Los devuelve al mar? Si ☐ No ☐
D ¿Los come usted? Si ☐ No ☐
E ¿*El cuerpo entero* **a** */ las aletas /los hígados /el cartílago* / cualquier parte: _**b**_____?

(Q.5) = ¿Cuál especie(s) o tipo de tiburón pesca? _____
(Q.5.5) = Ballena?
(Q.5.6) = Serucho ¿
(Q.6) = ¿Cuál tipo o especie de tiburón es la que usted más pesca?
(Q.7) ¿En que lugar los encuentra? *esteros /desembocadura de ríos / cerca de las playas / mar afuera*
(Q.8)¿A cuantas millas de la orilla/playa? _____
(Q.9) ¿Qué piensa usted el porque los tiburones llegan a esa zona? *reproducirse / comer / están de paso (migración) / limpieza*, otro: _____
(Q.10)¿Donde los pesca? (con Mapa)_____
(Q.11)¿Usted sabe el sexo de los tiburones que pesca? Si ☐ No ☐ *macho / hembra*
(Q.12) = ¿En qué época o meses del año usted pesca estas especies de tiburón?
_____
_____
(¿) ¿Cuántos tiburones pesca al mes durante la temporada de pesca? _____
(¿) ¿Cuál sería más o menos el peso total? _____

Aspectos técnicos
¿Qué técnica de pesca usa para atrapar los tiburones?
(Q.13) ¿Palangre? Si ☐ No ☐
¿Qué tipo? (a) *superficie / (b) fondo /(c) vertical*
¿(d) De qué tamaño es la línea? _____ (*millas* / *brasas*)
¿(e) Cuántos anzuelos por línea? _____
¿(f) Cuál es el tamaño de los anzuelos? _____
(Q.14) ¿Línea con anzuelo? Si ☐ No ☐
(Q.15) ¿Utiliza carnada? Si ☐ No ☐
(Q.16) ¿Qué tipo de carnada? _____
(Q.17)¿Redes? Si ☐ No ☐

¿(a)Cuál es el tamaño del paño o red? _____
¿(b)Cuál es el tamaño de la apertura de la malla?_____
¿Qué tipo de embarcación usa?
¿(Q.18)De qué tamaño es? _____
¿(Q.19)Tiene motor, cual? Si ☐ No ☐ _____
¿(Q.20)Cuántas libras usted puede transportar cada viaje (en su bote)?
_____
¿(Q.21)Cuantos pescadores por embarcación? _____
¿(Q.22) Es dueño del bote Si ☐ No ☐
¿(Q.23) Usted cree que su pesca es afectada por los barcos industriales? Si ☐ No ☐
¿(Q.24) Cuantos días por mese pesca? _____
¿(Q.25) Pesca de *día / de noche*?
¿(Q.26) Cuantas horas es la faena de pesca? _____

Aspectos históricos
¿(Q.27) Hace cuanto tiempo que pesca? _____
¿(Q.28) Pesca usted ahora (a)mas/(b)menos tiempo que antes? Si ☐ No ☐
¿(Q.29) Cuantos días por semana pescaba? *1 / 2 / 3 / 4 / 5 / 6 / 7*
¿(Q.30) Cuantas horas de faena de pesca? _____
¿(Q.31) Cuantas horas necesitaba para llegar al área de pesca? _____
¿(Q.32) Pescaba los tiburones en las mismas áreas? Si ☐ No ☐
¿(Q.33) Pescaba las mismas especies? Si ☐ No ☐
¿(Q.34) Las pescaba en las mismas cantidades? (c) Si ☐ No ☐ (a) *Mejor / (b)Peor*
¿(Q.35) Eran del mismo tamaño? Si ☐ No ☐ *Más grande / Más pequeño*
¿Recibía el mismo precio por su pesca? Si ☐ No ☐ *Mejor / Peor*
¿(Q.36) Había más competencia, más o menos botes? Si ☐ No ☐
¿(Q.37)Sus hijos pescan? Si ☐ No ☐
¿(Q.38)Su padre era un pescador? Si ☐ No ☐

Regulaciones
¿(Q.39)Usted piensa que debería haber más regulación o vigilancia sobre la pesca de tiburones?
Si ☐ No ☐
¿Apoyaría una veda sobre la pesca de tiburón? Si ☐ No ☐
¿(Q.40)Apoyaría una veda sobre la pesca de tiburón durante los meses donde los tiburones se reproducen?
¿(Q.41)Apoyaría una regulación de la talla mínima de captura? Si ☐ No ☐
¿(Q.42)Apoyaría una regulación que limite el número de botes pescando tiburón? Si ☐ No ☐
¿Apoyaría limitar la pesca de algunas especies? Si ☐ No ☐

Gracias por su tiempo. Nos quedan otras preguntas sensitivas que si usted quiere responderlas se lo agradecemos mucho.

Aspectos económicos
¿(Q.43)Cuál es su inversión para cada viaje/semana? (hielo, combustible, carnada) _____
¿(Q.44)Cuánto usted gana por *cada viaje/ semana*? _____
¿Cuánto de su ganancia por viaje/semana viene de la pesca de tiburones?
_____
¿)Durante los meses que no pesca tiburones, que pesca? _____
¿)Durante los meses que no pesca, que hace? _____

APPENDIX 7: *Chronogram of activities*

January

25: First meeting with our supervisor Héctor M. Guzmán
- Discuss about the possible projects;
- Choice of the project that consists of interviewing fisherman and taking biometrics measurements of sharks at the landings;

26: Construction of the questionnaire
- Redaction of the questions
- First revision of the questions with Héctor M. Guzmán

27: Work on the questionnaire
- Send the questionnaire to three researchers working in the field of social sciences to receive the opinion and advice of professionals.

28: Testing of the questionnaire and of our abilities to interview fisherman.
- One-day trip to San Carlos and Punta Chame to interview fisherman of the region.

29: Work on the questionnaire
- Discuss the things to improve in the questionnaire
- Integrate the feedbacks from the three professionals

February

4-5-6: Field trip: Veraguas (*Hicaco, Santa Catalina, Malena, Palo Seco, Torio, Arena, Puerto Mutis*)
- Start the collection of data;
- Interview fisherman in fishing towns;
- Learn how to take biometrics measurements;

10 Hand-in the work plan

11-12: Work on our own
- Reading related to the subject;
- Redaction work and data entry work;
- Think about how data will be analysed for final product

25-28: Field trip: Herrera, Los Santos

March

11-12: Data entry and work on the final report for the host institution

18: Informal presentations

18-21: Field trip: Coclé, Panama

April

5-8: Data entry and work on the final report for the host institution

9-12: Field trip: Pearl Islands
- Aided Javier Pinzon with his thesis by digging for turtle eggs on Isla del Rey

13-16: Work on the final report for the host institution

18-21: Field trip: Chiriqui

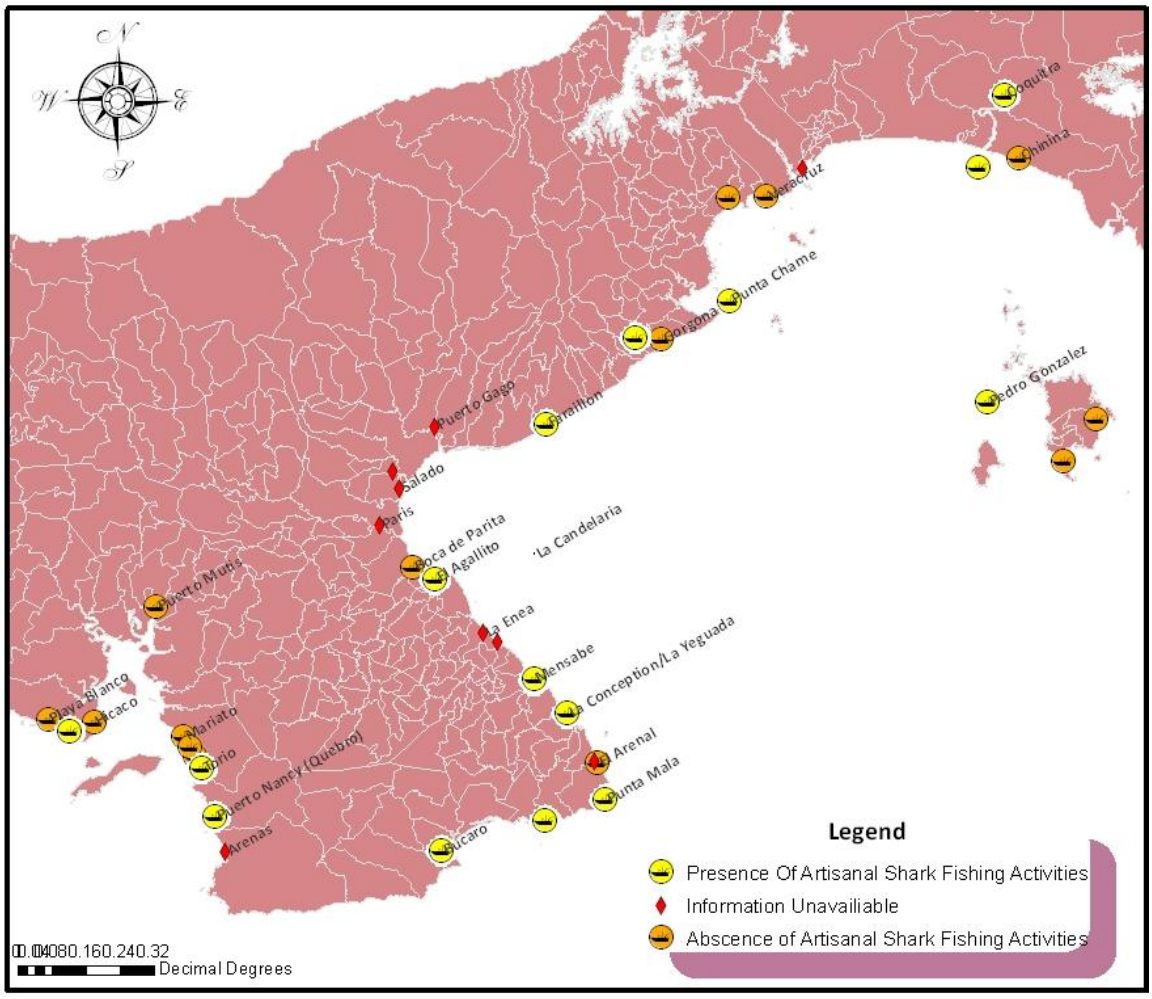
22: Work on Symposium presentation

23: Symposium presentations

24-26 Finish and hand-in final internship report

APPENDIX 8: ***Map of Shark Fishing Activities for the Provinces of Panama, Las Perlas, Coclé, Herrera, Los Santos and Veraguas***

Artisanal Shark Fishing activity along the Pacific Coast of Panama



The ports in red are the ones where no one was present; therefore, we did not collect information in these ports;
The ports in yellow are the ones where at least one fisherman told us that he directed his fishing activity towards sharks for at least some months of the year;
The ports in orange are the one where no one of the interviewees directed his fishing activities toward sharks