Improving Traceability Systems:

A Study of the Fishing Communities of Palito and Costa de Pájaros

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A Study of Fisheries in Palito and Costa de Pájaros

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Abstract

The goal of this project was to generate recommendations to improve a fish traceability system. This system was piloted by MarViva, a non-profit marine protection organization in Costa Rica. We conducted field work in the communities of Palito and Costa de Pájaros to gather opinions from the participants about this pilot program and made observations on its implementation. We concluded that the current system is prone to human error, leading to inaccurate documentation. An electronic database was designed to reduce this error and expedite the data entry process. We also updated current traceability materials based on feedback we collected during our field work. Additionally, we determined that increased communication is necessary between the fishermen, the supply chain participants and the consumers for the system to function effectively.

Executive Summary

Costa Rica's rich waters, host to a multitude of fish species, have allowed the fishing industry to flourish. Unfortunately, through overfishing and the use of non-responsible fishing practices, Costa Rica's fish populations have become increasingly scarce over the past decades. Recognizing this change, some fishermen have decided to practice responsible fishing techniques to preserve coastal habitats for future generations. While these fishing methods are more beneficial for marine ecosystems, they are not economically favorable for the fishermen. With responsible fishing practices, fewer fish are caught, leading to decreased incomes. Many artisanal fishermen live in poverty and are forced to seek additional employment opportunities to supplement their incomes. Decreased revenue from responsible fishing has increased financial pressures on these fishing families.

Currently, there is no reliable way for consumers to distinguish responsibly-caught fish from other products at market. A traceability system would allow for information to flow through the supply chain so that the fish can be traced from catch to the consumer. Responsibly-caught fish will appeal to the environmentally conscious consumer who may be willing to pay more to support efforts to maintain coastal ecosystems. These increased prices will allow for more revenue to be distributed throughout the supply chain. As a result, it is expected that fishermen will earn higher incomes for their conscious effort to preserve their coasts.

MarViva, a non-profit marine protection organization, has created a traceability system that is currently being introduced in the fishing community of Palito. MarViva has also piloted this program in Costa de Pájaros for the past seven months. Due to the short period of time that the system has been in use, it contains many flaws. The goal of this project was to improve this traceability system by examining the pilot program, identifying its shortcomings, and subsequently developing recommendations for MarViva for how to address these issues.

To accomplish this goal, we conducted field work to identify aspects of the program that required improvement. We began this research in Palito to gauge how well fishermen understood the traceability system and if they knew what role they played in the supply chain. In these interviews, we desired to determine if the fishermen were invested in the program and eager to utilize the system. This knowledge helped us understand if the fishermen were willing to participate in the traceability program. In our discussions, we discovered that most were generally unknowledgeable about the program and about how the supply chain functions. Most fishermen seemed unconcerned about this fact. We believe this lack of awareness restricts the fishermen in their ability to seek more profitable options to sell their fish, which gives the receiving centers significant pricing power.

We conducted additional field work in Costa de Pájaros by interviewing and distributing self-evaluation forms to the personnel of two receiving centers. The purpose of this field work was to obtain knowledge about the traceability system directly from the employees who were familiar with it. The participants provided feedback regarding the design of the traceability forms as well as additional suggestions for improvement of the system. From this feedback, we learned that much of the information on the traceability forms was redundant, but that overall, the system was functioning well. We did, however, find areas of concern. For instance, employees at the centers reported that forms often were not completed until days after the catch, which called into question the validity of some of the data. This indicated to us that important temperature recordings of the fish were not conducted frequently. In speaking with the employees from the receiving centers, we found that all participants would prefer an electronic data entry system or simpler traceability forms.

The final aspect of our field work was to conduct a simulated reverse recall. This recall was performed to evaluate the flow of information in the supply chain by attempting to trace several batches of fish from a receiving center to their final destination. We were only able to trace one of seven batches during our recall. This demonstrated that the traceability system currently in place is not accurate enough to allow for information to flow properly throughout the supply chain.

From our interviews and the simulated reverse recall we discovered that, excluding the fishermen, the constituents of the supply chain were knowledgeable about the traceability program. At the receiving centers, the personnel demonstrated a good understanding of the system despite the mistakes we noticed in the documentation. We concluded that when we encountered problems, they could not be attributed to the constituents, but rather to the complexity of the current system. With so many workers using a paper-based system, information can easily be lost, miscommunicated, or incorrectly transferred.

To address the problems discovered through our field work, we developed five recommendations. Our first recommendation was to further educate the constituents of the supply chain. For the fishermen, more knowledge about how the supply chain functions and how a traceability system works would likely empower them to take control of whom they sell their fish to. This would give them greater control over the price that they receive for their fish. For the employees completing the documentation for the traceability system, increased education will allow them to complete paper work more thoroughly and accurately.

Our second recommendation was to implement simplified traceability forms and procedure documents. Based on the feedback that we obtained at the receiving centers in Costa de Pájaros, we created alternate versions of the traceability documentation. The purpose of this was to increase the efficiency and accuracy of the traceability system. We revised these forms

and documents to be consistent with each other in order to ensure that the system functions efficiently.

A major problem we identified was the frequent errors created through the use of the paper-based traceability system. To remedy this, our third recommendation was for MarViva to convert to an electronic database system. This would eliminate the possibility of information being lost, misinterpreted, or copied incorrectly. The database that we designed not only included a way to input data into the system, but also established an archiving system. This way, supply chain constituents could use the database to directly input traceability information. The archived information can subsequently be used for several purposes. For supply chain constituents this feature could be used for their internal record keeping. Employees of MarViva can benefit from this tool when conducting research in marine biology or fishing demographics of the receiving centers. During our field work, all participants confirmed that they had access to computers, which would allow them to utilize the database. Therefore, implementation of the database system would not incur any additional cost for equipment. The database was designed to parallel the format of the traceability forms; therefore employees would not need any additional training.

Our fourth recommendation was for MarViva to incorporate new technologies into its traceability system. We conducted research into two alternative technologies that could be used in the program. One technology that we examined was Quick Response, or QR codes. These codes would allow for every batch of fish to be traced using an electronic system. A smartphone application could be used by consumers to learn from whom, where, and how their fish was caught. This creates a possible marketing advantage that is not feasible with the use of the electronic database alone. The second option that we researched was a potential partnership with *ThisFish*. *ThisFish* is an organization that has developed an online traceability system. The system not only provides a way for fish to be traced through the supply chain, but it also contains a website that customers can use to discover where their fish came from. Although *ThisFish* works mostly with large supply chains, they are exploring the possibility to expand and become involved with artisanal fisheries. *ThisFish* developed a variety of technologies that are applicable to different supply chains. We recommended for MarViva to pursue a partnership with *ThisFish*.

Our fifth and final recommendation was for MarViva to investigate co-operatives. We believe that a co-operative system could be economically beneficial for the fishermen. Currently, there is an incomplete receiving center located in Palito. The completion of this receiving center could facilitate the development of a co-op of fishermen. This new opportunity could create a competitive market environment. Currently, the fishermen rely on a single receiver for the sales of their catches. This has resulted in the owner of the receiving center having complete control

over the price of fish. We recommended that MarViva further investigate the potentials of a new receiving center to facilitate a co-operative for the community.

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Authorship

Anna – Anna contributed by translating documents and interview questions into Spanish. She also conducted interviews in Spanish. She contributed to the writing and editing of the report as well as the documentation changes for a deliverable. She also inputted traceability forms into the database.

Cy – Cy contributed to the writing and editing of the report. Cy also contributed to the translation of documents. He also inputted traceability forms into the database.

Lina – Lina contributed majorly by designing the excel database. She also worked further to communicate with Oliver Schulze. This allowed him to create the online web application. She inputted traceability forms into the database. She also contributed to the writing and editing of the report.

Tessa – Tessa contributed to major writing and editing of the report. She inputted traceability forms into the database. She contributed to the documentation changes for a deliverable. She also contributed by compiling and formatting the report.

From the left: Tessa Hulburt, Anna Civitarese, Lina Tran, and Cy Ketchum

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AMPR – Áreas Marinas de Pesca Responsable (Costa Rican Responsible Marine Fishing Areas)
ASOPECUPACHI – Asociación de Pescadores Cuerderos de Palito de Isla Chira
GUI – Graphical User Interface
INCOPESCA - Costa Rica's Institute of Fishing and Aquaculture
MPA- Marine Protected Area
NGO – Non-Governmental Organization
NMS – National Marine Strategy

Chapter 1: Introduction

Costa Rica, a country surrounded by rich coastal waters, is home to a vibrant fishing industry. Fishing creates livelihoods for many residents and provides a main food source for the people of Costa Rica. Unfortunately, decades of fishing irresponsibly by catching non-target species or immature fish have caused a large problem for those who depend on the fishing industry. Overfishing has begun to exhaust this resource and has severely strained local fish populations. It is necessary to find a solution that reduces overfishing in order to preserve this resource for future generations. This solution, however, must be economically feasible for the impoverished fishermen. Many communities rely heavily on fishing as a way of life. In the Gulf of Nicoya, overfishing challenges the livelihoods of an estimated 2,300 local fishermen and their families (Fischer and Wolff, 2006). The loss of this livelihood will push these fishermen further into poverty. Community members and nonprofit organizations, as well as the local government, are struggling to implement and maintain responsible fishing practices while simultaneously addressing economic needs of the fishing communities.

A consequence of overfishing is that fish are unable to reproduce quickly enough to supply the large demand. Without further attention to this issue, the industry will continue to decline. Some communities in the Gulf, however, have taken the initiative to fish responsibly. The use of hand lines instead of gill nets has provided a more selective and responsible method of fishing. While this method is more responsible, it also reduces the amount of fish that the fishermen are able to catch. It is important for these impoverished fishermen to earn an income that is proportional to both their efforts to fish responsibly and to the high quality fish they catch. This is also crucial because, as their main livelihood, fishermen need to earn a substantial income through fishing to support themselves and their families.

Our research involved two fishing communities located in the Gulf of Nicoya. The first was Palito, a small fishing community located on Chira Island. Palito is one area in Costa Rica that has experienced a decline in the fishing industry due to the effects of overfishing (Alfaro, 2014). This is because fishing is the only major industry on the island. Even families who do not fish for a living are impacted by the success of the fishermen. Residents of the community of Palito live in extreme poverty and have been forced to pursue cattle ranching, oyster farming, or tourism to supplement their income (Babeu et. al, 2012). Other fishermen fish illegally (out of season) or receive governmental aid to make enough money to live (Alfaro, 2014).

The second community involved in our study was Costa de Pájaros, which is located on the northern coast of the Gulf of Nicoya. Like Palito, the fishermen of Costa de Pájaros also live in significant poverty and are heavily dependent on fishing. It is vital for fishing to remain a reliable and profitable endeavor for the future of these fishermen.

A number of organizations have been working diligently to improve fishing methods in Costa Rican communities. INCOPESCA (Costa Rica's Institute of Fishing and Aquaculture) is the government agency responsible for enforcing the fishing regulations in the country. In response to overfishing, INCOPESCA has promoted Marine Areas for Responsible Fisheries (AMPRs) to restore fish populations. AMPRs are more effective than Marine Protected Areas (MPAs) because they include local residents and stakeholders (Eastern Tropical Pacific Seascape, 2011). Community and stakeholder involvement is most effective in reducing overfishing because enforcement of AMPRs and MPAs in Costa Rica appears to be minimal, if not non-existent.

The fishermen of the Asociación de Pescadores Cuerderos de Palito de Chira (ASOPECUPACHI) took the initiative to establish Costa Rica's first AMPR in the community of Palito in April of 2008. The association was formed when fishermen began to recognize the decline in size and quantity of fish in their region. Concerned about the future of their community, they have chosen to change their fishing practices. Specifically, they have limited themselves to the use of hand lines because it is a low impact and selective form of fishing. Today, fish in Palito are larger, healthier, and more abundant than ever (Babeu, Cabral, Hartmann, and Poti, 2012). Their decision to fish responsibly has paved the way for the creation of future AMPRs in Costa Rica. Unfortunately, the improved quality of the fish has not led to increased incomes for fishermen. Similar to Palito, fishermen of Costa de Pájaros have also taken the initiative to fish responsibly to save their fish populations.

La Fundación MarViva, a non-profit, non-governmental organization, is working with fishermen of both Palito and Costa de Pájaros. MarViva focuses its efforts on responsible fishing, environmental regulation, management plans, education, campaigns, marketing, and commercialization (MarViva, 2012). In the communities of Palito and Costa de Pájaros, MarViva is working to create a traceability system to help fishermen earn more for their responsible fishing efforts. MarViva believes that, at market, high quality fish that are caught responsibly can be sold for higher prices to a more upscale market.

In our study we analyzed the traceability system designed by MarViva from two different perspectives. First, we spoke with fishermen from Palito who had just been introduced to the system; we investigated their first impressions of the program. Second, in Costa de Pájaros, we met with supply chain constituents who have been using the traceability system for seven months (Alfaro, 2014). We discussed the system with them in order to obtain their thoughts on possible improvements, as well as to analyze how well they have understood and implemented the process.

To analyze the existing traceability system and explore its advantages and disadvantages, we conducted a simulated reverse recall with informed participants in the supply chain beginning

in Costa de Pájaros. This entailed attempting to trace products forward through the supply chain using documentation to ensure that the flow of information was functional and complete.

With this information, we generated three deliverables for MarViva. First, we conducted a critical review of the presently existing traceability system and generated a report containing our five recommendations for improvement. Second, we updated the traceability forms and their corresponding procedure documents using information obtained from our field work. Third, we created a database to electronically compile information from the traceability system.

Chapter 2: Literature Review

In the literature review we present background information that frames the context of our project. We first provide general information about overfishing, specifically in the Gulf of Nicoya. This is followed by pertinent background information about the communities of Palito and Costa de Pájaros. Next, we examine Marine Protected Areas (MPAs) in Costa Rica and Marine Areas for Responsible Fishing (AMPRs) in Palito and Costa de Pájaros. We then focus on the concept of supply chain management in the fishing industry, including the relevant roles involved and the issue of exploitation. Finally, we narrow our focus on traceability systems and their technological applications in different supply chains.

2.1 Overfishing and its Effects in the Gulf of Nicoya

Citizens of developing countries, such as Costa Rica, have limited access to advanced technologies. As a result, they are heavily dependent on natural resources to sustain their livelihoods. Centuries of environmental destruction through improper farming and fishing techniques have threatened these resources (Tenebaum, 1996). These vital resources will be depleted if they are overused, leaving nothing for the future. Fish are relied on heavily as a resource in communities of the Gulf of Nicoya. When overfishing occurs in the Gulf, it damages the fishing industry and the livelihoods of the surrounding communities.

In the Gulf of Nicoya, fishermen are forced to seek their catch farther offshore as coastal resources are depleted. According to Wehrtmann (2009), it is estimated that the average depth at which fish are caught increases by 13 meters per decade. Deep-water species typically have longer life spans and later sexual maturity than shallow water species. When fish are caught before they can reproduce, populations are more easily exhausted (Wehrtmann, 2009). In recent years fishery landing statistics of one shrimp species, S. agassizii, have decreased by 90% from their highest recorded numbers in 1989 (Wehrtmann, 2009). In August of 2013, Costa Rica made the use of shrimp trawling nets illegal (Fendt, 2014). Trawling nets cause severe damage to marine ecosystems and fish populations because, the nature of the nets causes many immature and non-target species to be caught along with the shrimp. From 2000 to 2003, 44% of shrimp catches were non-target species that were then discarded (Davies et al., 2009). Few studies have been conducted to discover why deep-water populations have decreased so drastically, but overfishing and destructive fishing practices have been recognized as a major contributor to this problem.

2.2 Socioeconomics of Palito and Costa de Pájaros

In our project, we focused our research on the communities of Palito and Costa de Pájaros, located in the Gulf of Nicoya. Palito is located on Chira Island, the largest island in Costa Rica. The populations in the Gulf of Nicoya are not recorded, but it is estimated that around 3,500 residents occupy Chira Island. Of the population on Chira Island, approximately 1,000 people reside in Palito. The Gulf of Nicoya can be seen in Figure 1 and the location of Palito and Costa de Pájaros are depicted in Figure 2.

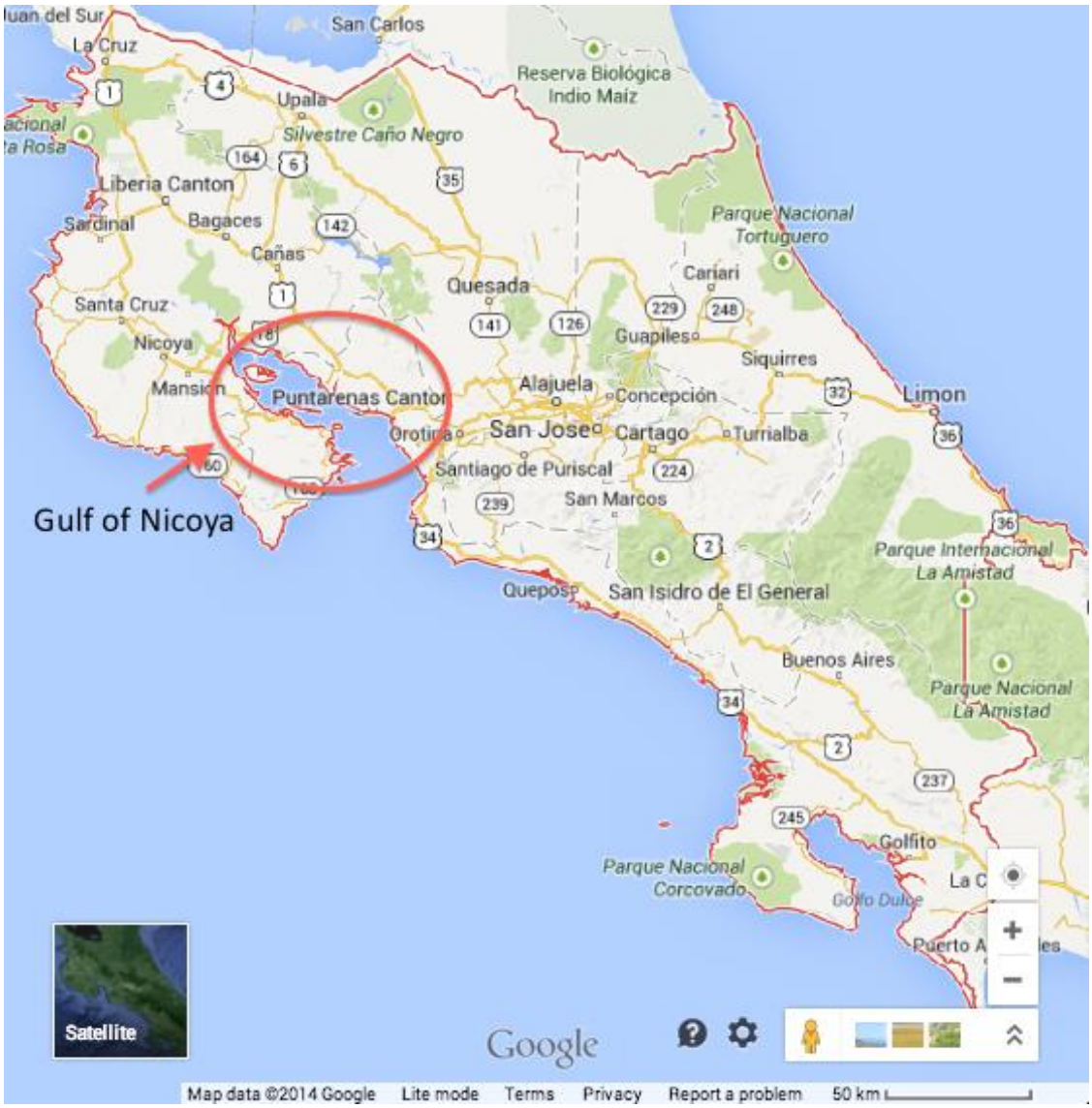

Figure 1. A map of Costa Rica highlighting the Gulf of Nicoya (taken from Google Maps, 2014)

Figure 2. A map of Palito and Costa Pájaros (taken from Google Maps, 2014)

When working with small communities, it is important to consider socioeconomic factors. Socioeconomics is an area of study that considers the effects of economic changes on social customs and practices in a community. If the population is heavily reliant on one profession, even a slight change could cause a great impact. Fishermen in Palito and Costa de Pájaros are especially vulnerable to changes in the fishing industry due to their income dependence on this industry. Understanding socioeconomics in Palito and Costa de Pájaros will help to evaluate the potential influence that a change in the supply chain can make on the communities involved. In addition, observing community fishing traditions and ways of operation may lead to understanding the communities' way of managing the fishing areas.

A group of WPI students previously examined the fishing community of Palito on Chira Island (Babeu, Cabral, Hartmann, and Poti, 2012). The group found that the community is very poor, and many residents predominantly support their families by fishing. The waters in which they fish are part of the first AMPR established in Costa Rica. As a result, they must enforce and practice responsible fishing in the area to make a living and ensure that there will be fish in the future.

The community of Costa de Pájaros is in a situation similar to that of Palito. Many families in this community are also impoverished and rely on fishing to make a living. Due to the importance of these livelihoods, it is necessary to approach the issue of overfishing carefully so that fishing can remain a profitable endeavor for fishermen (Alfaro, 2014).

2.2.1 Palito

After a socioeconomic analysis, Babeu et al. (2012) concluded that Palito is "in a vulnerable position". This seems to be the result of several factors: fish prices are too low to support all fishermen, income from fishing is too low to allow fishermen to recover from debt, and few other job opportunities are available in Palito. The average monthly incomes of fishermen are insufficient to support the average family size. This relates to the second problem; most fishermen fall into debt and have little to no savings to rely upon. The lack of job opportunities implies that there is little incentive for young residents to return to the island after receiving higher education. Altogether, this could result in a dwindling population of elderly fishermen who are trapped in debt (Babeu, Cabral, Hartmann, and Poti, 2012).

2.2.2 Costa de Pájaros

The fishermen of Costa de Pájaros are in a similarly vulnerable situation. Income from fishing is not lucrative enough to create a substantial living. Community members encourage tourism as a side business. The area is very popular with birdwatchers, and local residents offer boat tours for the observation of Isla de Pájaros, a nearby island heavily populated with various species of birds (Baker, 2013). Aside from this, there is little other information known about the socioeconomics of Costa de Pájaros (Alfaro, 2014).

2.2.3 Socioeconomics and Management of Fishing Areas

In addition to its importance in communities, socioeconomics is also relevant in the way fishing areas are managed. A case study by Salas et al. (2007) was examined to further understand the role of socioeconomics in the case of managing fishing areas. Salas et al. observed prevalent challenges to the assessment and management of fisheries in Latin America. They found that problems arose from the lack of a socioeconomic framework, including "social, bio-ecological and economic considerations". For example, many fishermen lived in isolated areas and lacked skills that were marketable in urban settings. This limited their range of opportunities heavily; fishing was all they could do to reliably earn an income. Additionally, complex market structures resulted in fishermen struggling to find better options when selling their fish, especially when they were already in debt. These factors, which demonstrate the major importance of fishing in these small communities, were often neglected in fishery policies.

2.3 Management of Fishing Areas

Due to community dependence on resources and strained fish populations, it is crucial for Costa Rica to improve the management of its fishing areas. In addition to Costa Rica, other fishing areas around the globe experience social and political conflicts when there are limited resources in marine ecosystems and the use of these areas is restricted (Agardy, 2011). A

critical step in fishing area management "requires resource users to recognize that only by regulating the use of natural renewable resources will it be possible to sustain such use over time" (Alpizar, 2006). Unfortunately, traditional government intervention in management and conservation of fishing areas has proven to be unsuccessful. Community empowerment of local fishermen and stakeholders to control fishing areas has, however, demonstrated increased success. Therefore, management of fishing areas has transformed from the traditional "top-down" (command to control) to a "bottom-top" approach (Alpizar, 2006). It has proven to be more successful when local fishermen, community members, and stakeholders delegate management responsibility. It proved vital to keep the interests of the local community in mind in order to ensure the longevity of the fishing areas.

To further understand current fishing area management strategies, a case study was examined. Jennings and Polunin (1996) looked at fishing practices in several *qoliqoli* (fishing grounds) in Fiji. These areas were fished almost exclusively by indigenous people, according to guidelines set in place by village elders. These traditional policies preserved fish populations by means of limiting spear fishing and use of scuba equipment. Jennings and Polunin concluded that these traditional rules set in place by village elders were far more widely obeyed than government regulations. With important stakeholders in the village participating in the program, community members were more likely to follow suit.

2.3.1 Challenges to Marine Protected Areas (MPAs)

MPAs are designated areas where human activity is restricted for the protection of the environment. They are one of the most powerful tools available to reduce overfishing and restore oceanic biomes. In theory, MPAs provide a valuable solution to overfishing; however, there is a balance that needs to be achieved regarding the degree of implementation of regulations. On the one hand, under-implementation does not hold locals accountable for following the regulations put in place to preserve the marine life. This causes MPAs to appear beneficial when in reality they are ineffective in protecting these areas. On the other hand, over-implementation of regulations prevents people who depend on these resources from fishing. Tensions can then arise between the government and the community because "MPA management strategies can be viewed as an attempt to police the local community" (Agardy, 2011). Currently, there are 21 MPAs in Costa Rica (Alvarado, 2012). Of these MPAs, only 12 have management plans, many of which need updating (GEF, 2012).

2.3.2 Marine Area for Responsible Fisheries (AMPRs)

In April 2008, Costa Rica's INCOPESCA created a Marine Area for Responsible Fisheries (AMPR) with the help of the ASOPECUPACHI (Asociación de Pescadores Cuerderos de Palito de Chira) in Palito. AMPRs are established so that fishermen can fish responsibly while allowing the marine

ecosystem to recover. Requirements for AMPRs include the use of responsible fishing gear, respect for marine areas that are closed, the capture of fish at the minimum size and maturity, proper handling of fish, and implementation of a fish traceability system (Salazer, Ross, Alfaro, 2013). Implementation of these standards also ensures the conservation of fish in the long term with the involvement and management of the local community and organizations such as MarViva. The success of AMPRs mainly depends on enforcement by local communities. AMPRs differ from MPAs because MPAs prohibit all fishing in addition to regulating activities that include conservation, tourism, environmental education, navigation, and research (Alvarado, 2012). Although AMPRs are fairly new and have only been declared in Palito-Montero, Tarcoles, San Juanillo and Golfo de Dulce, many local communities are seeking to promote the development of AMPRs in their fishing areas (Guerrero 2013). A map of the AMPRs in Costa Rica can be found in Figure 3 and a map of AMPRs in the areas where we focused our efforts in our project is seen in Figure 4.

Figure 3. A map of MPAs and AMPRs in Costa Rica (provided by MarViva, 2014)

Figure 4. A map of Responsible Marine Fishing Areas (highlighted in purple) relevant to this project (provided by MarViva, 2014)

AMPRs are effective because they are acknowledged and managed by the local communities. They have helped communities ensure the future of their fishing industries. Palito adopted responsible fishing methods in 2008 and has since seen an increase in fish stock (Babeu, Cabral, Hartmann, and Poti, 2012). In addition, fish are larger and of better quality because they are given appropriate time to mature. Fishermen are also now seeing an increased abundance of fish species that were once rare. There is increased demand for sustainably-caught fish in Costa Rica, especially within the tourist population who are willing to support fishermen who fish responsibly (Alfaro, 2014). This demand may allow local fishermen to earn more for their catch and encourages them to fish in a responsible manner

Conflicts between stakeholders develop over time through the management of AMPRs and MPAs. Stakeholders are defined as "…those individuals, groups or organizations who are interested, involved, or affected by a management or development project…" such as MarViva (Alpizar, 2006). Whether they are government organizations or Non-Government Organizations (NGOs), stakeholders have different approaches and goals for AMPR and MPA management. In addition to NGOs, government organizations such as INCOPESCA are working to implement responsible fishing. With so many organizations working to make the fishing industry more sustainable, the lack of coordination and adequate mechanisms for stakeholder participation are the main institutional threats (Alvarado, 2012).

AMPR in Palito

The members of ASOPECUPACHI in Palito began their responsible fishing practices in 2002. The community worked with INCOPESCA to create the first AMPR, which was established in 2008. In the case of Palito, government enforcement of MPAs has been minimal at best (Alfaro, 2014). This means that if the community is not enforcing regulations itself then no one is. The empowered "bottom-top" approach incentivizes community members to self-regulate so that, despite a lack of government enforcement, the AMPR will still be effective.

Currently in Palito, there are an estimated 200 fishermen. It is likely that half of these fishermen fish responsibly. In addition, there are an estimated 12 active members in ASOPECUPACHI (Elizondo, 2014).

AMPR in Costa de Pájaros

In the case of Costa de Pájaros, a marine area for responsible fishing is in the process of being established. Although the AMPR is not in effect, there are a group of fishermen who took the initiative to fish responsibly. These fishermen fish on the Gulf of Nicoya using only hook and line for their catch (Alfaro, 2014).

2.3.3 Fishing Ban in Gulf of Nicoya

In addition to using AMPRs to regulate fishing, the government has taken additional measures to address the issue of overfishing, by creating a short-term fishing ban. According to Arias (2013), in July of 2013, INCOPESCA implemented a temporary ban on all fishing in the Gulf of Nicoya due to the severely diminished fish populations. This ban, also known as "veda", lasted for three months in order to allow species time to reproduce. Licensed fishermen were financially compensated during this period of time (Arias, 2013).

2.4 Supply Chain Management

2.4.1 The Structure of the Supply Chain

It is necessary to examine the many steps involved in a supply chain. First, fish are caught by fishermen and delivered to a receiving center. Here, the receiving center classifies, weighs, ices, and loads the fish onto its delivery truck. From here, transporters bring the fish to a distribution center where it is processed and then delivered to retailers. Finally, the retailers sell the product to the consumer.

A general fishery supply chain is depicted in Figure 5. It includes fishermen, receiving centers, transporters, distributors, retailers, and consumers. Supply chains vary and can be more

complex; for instance there can be multiple receiving centers and distribution centers as well as a large variety of retailers.

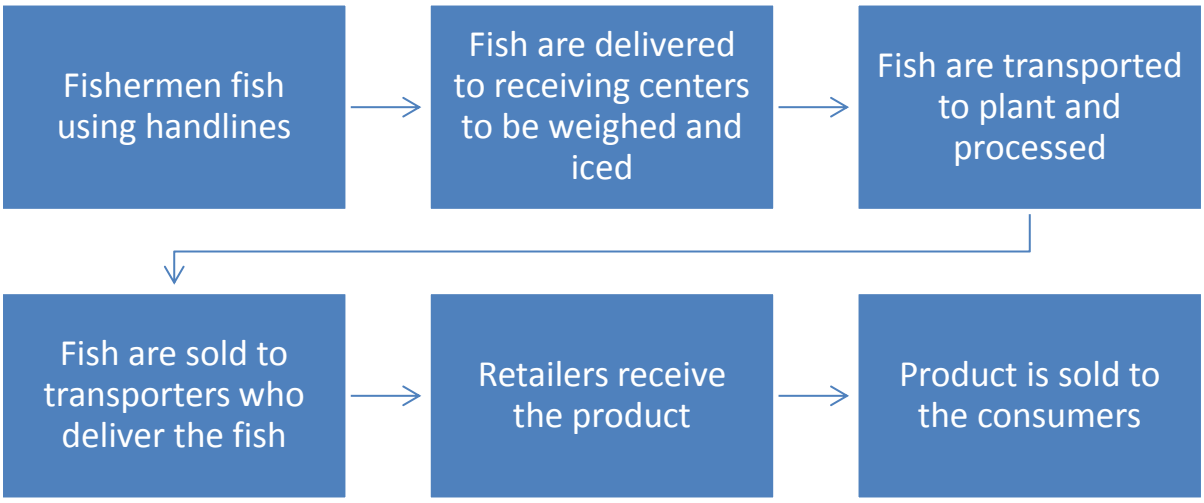

Figure 5. Flow chart of general fishery supply chain (Adapted from Arias et. al, 1978)

2.4.2 The Role of Receiving Centers

A major constituent in the fishery supply chain is the receiving center. Due to its pivotal role, the receiving center has the potential to have a positive or negative impact on the supply chain. Scheid and Sutinen (1979) gathered information in 1979 that pointed to two distinct roles of the receiving center. Essentially, owners of receiving centers can make the process easier, fairer, and more beneficial for the fishermen, or they can greatly exploit them. One opinion is that receiving centers have a bad reputation, but they are still a critical component of the supply chain. More often than not, the receiving center is seen as a problem due to its blatant exploitation of the fishermen. These traders can obtain exclusive knowledge of the market and use it to create monopolies, unfairly set fish prices, hold poor fishermen in debt, and generally abuse their positions of power (Scheid and Sutinen, 1979). An ideal situation, however, occurs when a mutually beneficial partnership is created. This partnership occurs when receiving centers incentivize fishermen, offer secure credit, and provide various services to the fishermen (Jacinto, 2011).

2.4.3 Exploitation Throughout the Supply Chain

As mentioned in the previous section, receiving centers have the ability to negatively impact the supply chain. Exploitation occurs when a product is sold for a high price to consumers while the constituents of the supply chain, such as the fishermen, do not receive a proportional profit. In the case of Palito and Costa de Pájaros, the fishermen are in a vulnerable position due their inability to influence fish pricing. If the fishermen knew more about the supply chain, they

could have more options to sell their fish to. This creates a competitive market and helps the fishermen obtain a better price for their catch.

The incentive for the traceability system is for the responsibly-caught fish to be sold at a higher price at market. In order to examine if the responsible fishermen are being paid more, it is critical to know the fish prices in Costa Rica. Each year INCOPESCA collects recorded fish prices from the receiving center, distribution site, and supermarkets. The fish prices are organized by fish species and location. The prices found on the INCOPESCA site can be used to find the percent of increase in profit for the fishermen. In addition, it can be used to hold receiving centers accountable for the rate at which they buy responsibly-caught fish from responsible fishermen (INCOPESCA, 2014).

2.5 Traceability

Traceability is the ability to verify the origin of a product by means of documentation. This practice is important for marketing, bookkeeping, and for safety reasons. The structure of a traceability system allows for examination and evaluation of a product at multiple intervals along a supply chain. In addition, each step involves documentation of the product. This ensures that any problems or defects can be traced to when and where they occurred. At the market, traceability provides consumers with a guarantee that the products they have purchased were handled and monitored properly. A guarantee such as this will potentially encourage consumers to choose responsibly-caught products and increase consumer confidence in these products. Furthermore, a second benefit to a traceability system is in the ability to keep records pertaining to where, when and from whom batches of fish originate from. In the event of identifying a contaminated/spoiled fish at any point in the supply chain, a recall can be implemented using this information. A recall will remove all unsafe products from the supply chain.

The first step in evaluating a traceability process is to ensure that the fundamental structure is in place. A 1998 report by Moe divides the focus of traceability into two main categories: products (the goods in question) and activities (the processes in the supply chain). Important information in regards to both categories (see Figure 6) must be recorded in order for a traceability system to fully function. The report also mentions two principle ways to document traceability information along the supply chain. One method involves storing some information locally at each step in the supply chain, while product identification information is sent to the next member in the supply chain. The other method is to send all information to the next member in the supply chain. The first method makes reverse traceability easier, because identification can be taken one step at a time. The second method, however, allows for the vendors to directly identify to the consumers where and how the product was caught and

processed. This can be used for targeted marketing. Each method provides a means of record keeping that can be used for different purposes.

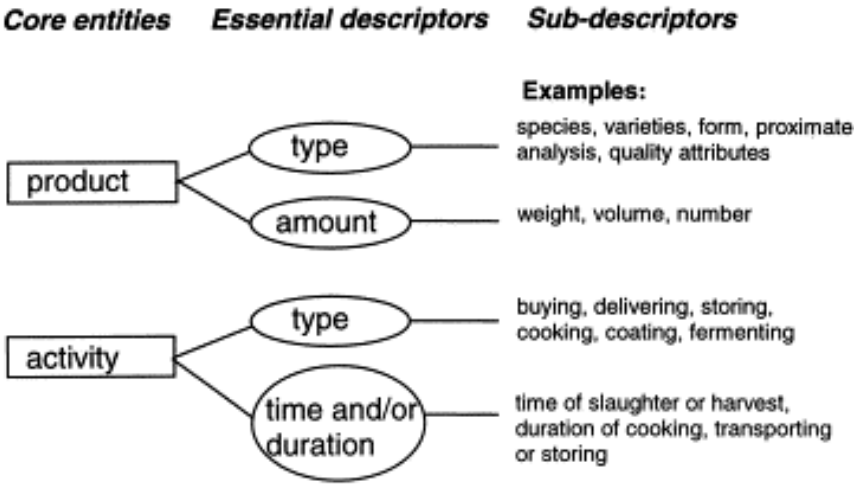

Figure 6. Fundamental traceability structure (Moe, T. 1998)

In addition to this traceability report, two case studies were examined to study traceability systems in fishing industries. Karlsen and Senneset (2006) performed a simulated recall of fish products in Norway in an effort to evaluate traceability methods. A model of the flow of the supply chain from this study can be seen in Figure 7. The "material flow" arrow shows the direction which product travels in the supply chain. The "focus" arrow shows the direction that information was tracked during the study, beginning with fish products.

The goal was to test the documentation processes and preparedness of companies in the event of an emergency recall. The study attempted to work backwards through the supply chain in order to trace a product from market to catch. The results showed that six out of fifteen (40%) products could not be traced to their source. Karlsen and Senneset concluded that this was unsatisfactory. This study illustrated a large problem in the Norwegian supply chain: if a tainted product was unable to be recalled successfully, or the source of the problem was unable to be identified, consumer confidence would be severely reduced and public health could be endangered.

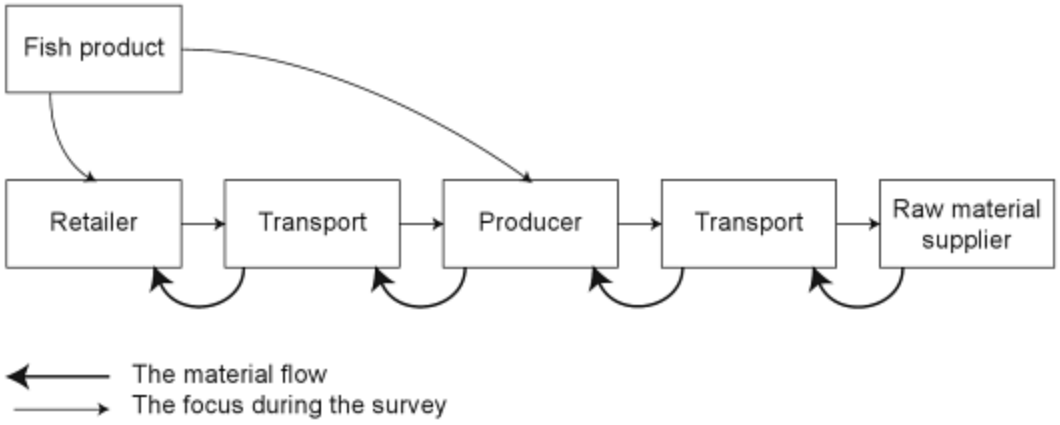

Figure 7. Norwegian Supply Chain (Karlsen and Senneset, 2006)

Hastein et al. (2001) examined methods of tracking fish products. Whole fish caught for consumption can have gill tags that indicate their source. The packaging is marked with information such as "the slaughterhouse, destination, and freight bill number, as well as the trademark of the exporting company". Some fish are processed into other products before shipment. In those cases, the documentation of the fish's source provides the traceability. Without proper bookkeeping and organization, it is very difficult to track the product in the supply chain. Unorganized and undocumented products from different sources may become mixed, making it impossible to determine where they originated. Digitalizing traceability information organizes the data and develops transparency within the entire supply chain.

2.5.1 Technologies used for Traceability

Advanced technologies have helped modernize various traceability systems around the world. These traceability systems can include, but are not limited to, mail services, fresh produce, and warehouse inventories. Each industry is different; therefore, there are many different ways to implement traceability. When utilizing a traceability system, it is always crucial to keep information organized so that it is able to flow through the system. Through the use of technology, the organization and operation of a traceability system can be facilitated.

The Use of Two-Dimensional QR Codes

Quick Response (QR) codes are a technology containing a specialized ID number that can be printed onto paper, plastic, or other materials. The specialized ID number is displayed in the form of a single-cell bar code that may be scanned using an application on a smart phone or other device. Once the code is scanned, the application will run a simple Java program that displays a web page linked to the bar code. For example, many companies display QR codes on

billboards and advertisements for consumers to learn more about promotions and products (Ashford, 2010).

QR codes can be easily photocopied for record keeping. They are also unique to the individual item. The information contained in the codes is encrypted and cannot be tampered with once created. The code is generated on a computer to include data for an individual fish. This information is then stored on the internet. An illustration of this process can be seen in Figure 8. In this form, this data is accessible to other members of the supply chain. This information can also be accessible to the consumer, who can obtain the information on the fish by scanning the QR code as depicted in Figure 9 (Seino et. al, 2004). With all of this in mind, it can be seen why QR codes could be a viable option for use in a traceability system. QR codes would also be useful specifically with fish because the codes are created to resist distortion using an alignment pattern. They have a 30% error correction rate. This means that the QR code can be read if part of the code is covered, smudged, missing, or otherwise damaged. A main draw to this system is that anyone can easily generate a QR code because its creator company, Denso, released the patent to the public domain (Soon, 2008).

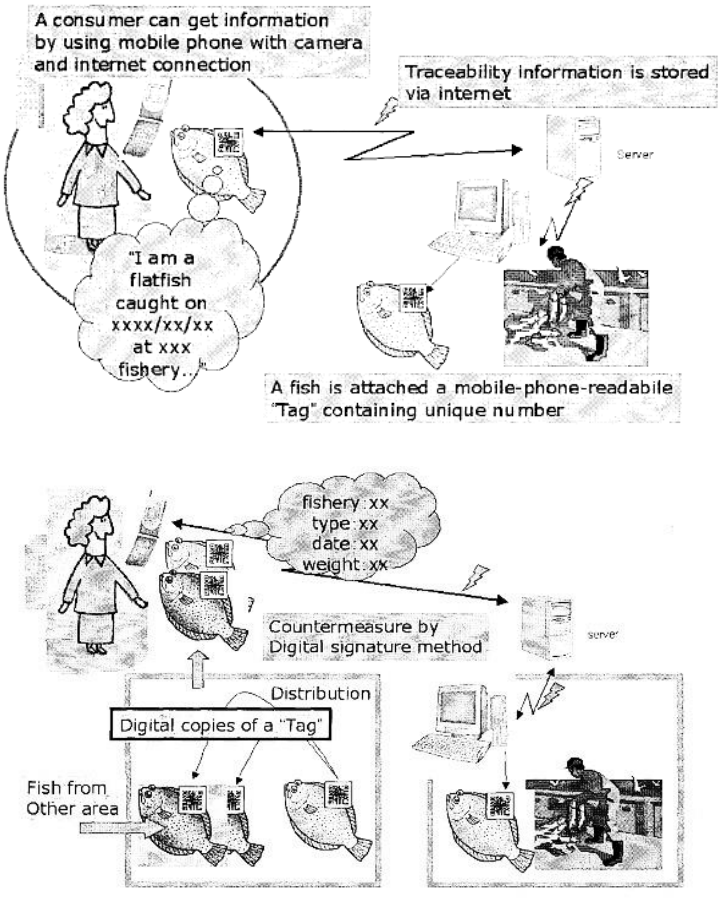

Figure 8. Illustration of the use of a QR code in a flounder traceability system

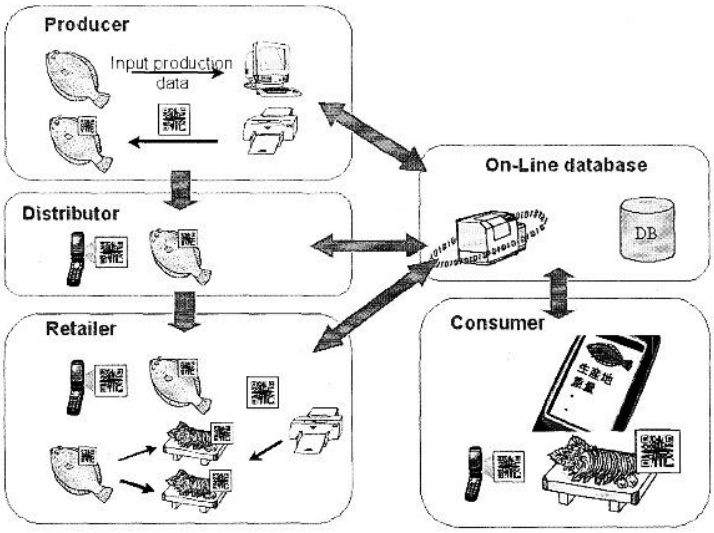

Figure 9. Illustration of the use of QR code at every step in the supply chain

QR codes have been used in a variety of ways including horse track betting tickets, produce traceability, sushi freshness, and patient identification in hospitals. Many advantages of QR codes can be seen from these uses. For example, sushi dishes in Japan can be equipped with a QR codes that, when scanned, show how long it has been since the sushi was made. If the sushi was made more than 55 minutes prior, it is no longer considered fresh and is thrown out. This concept could be applied to fish; if the QR code revealed that the fish was past expiration date, it could be removed from sale. It is also useful that these codes can hold a substantial amount of information. In a hospital, a QR code on a patient's bracelet can hold the patient's name, identification number, date of birth, gender, ward, bed number, and more. Since QR codes can hold over 10,000 characters worth of information, they would be quite useful in storing traceability information. Additionally, QR codes can be extremely small, down to 1.5mm, and still be recognized by the application. This could be especially helpful in regards to fish; a smaller tag would appear less obtrusive than a larger tag when making a purchase (Soon, 2008).

A case study by Seino et. al was examined to further investigate the application of QR codes in fish traceability systems. In 2002, a pilot experiment with live flounder was performed in Hakodate, Japan to test how easily a QR system could be used for traceability. In this process, the fish was first weighed. This, along with other information such as the size and species of the fish, was entered into a QR code generator on a laptop that was connected to a printer. This printer printed out a QR code unique to this fish. The tag was then affixed to the fish using a small thread, and the fish was sold to the distributor. The distributor then accessed the fish's information using a cell phone application to scan the QR code. When the distributor sold the fish to the retailer, a receipt was created using the information from the QR code. The QR code remained tagged on the fish until it was purchased by a restaurant and selected by patrons.

Next, the tag was removed and scanned by the consumers to access the information about the fish. This pilot system proved to be effective in this case because it allowed for transparent information flow from catch to consumer (Seino et. al, 2004).

In addition to QR codes, the most popular option and immediate thought for a digital traceability system would be the use of Radio Frequency ID (RFID) tags. RFID tags are more widespread but cost significantly more than barcoding systems. Additionally, these tags are less resistant to dust, smudging, water, and other damage, which make them less useful. Another concern is that RFID tags are made with metal and silicone, which is not safe to affix to the surface of a fish product (Seino et. al, 2004).

Overall, the technology of a QR code allows for the consumer to be directly connected to the traceability information. This enables the consumer to make a confident and knowledgeable choice when selecting their fish (Seino et. al, 2004).

Auto Mercado

Auto Mercado is a private supermarket chain based in Costa Rica. The company's purpose is to offer their customers the best consumer experience through quality, variety, and services (Auto Mercado, 2014). Recently, Auto Mercado's marketers have developed a free smartphone application to enhance their customers' shopping experiences. One feature on the application is a bar code scanner that can be used to learn more about a product available at Auto Mercado. The scanner allows the consumer to scan the bar code on a product. Once the bar code is scanned, information about the product is instantly displayed on the phone application. This feature allows users to learn more about the origin of a product. This feature could also be used as a traceability tool for fish sold at Auto Mercado locations. For example, the responsibly-caught fish sold at Auto Mercado can have a code attached to them. Consumers can then scan this code using a smartphone application. Once the code is scanned, information about the fish, such as, who caught the fish, where it was caught, and when it was caught, can be displayed on the application for consumers. This technology has the potential to be a great marketing tool for responsibly-caught fish sold at Auto Mercado locations.

ThisFish

ThisFish is a company that provides a traceability program and technologies to various supply chains internationally. This program allows consumers to trace the origins of their seafood. EcoTrust Canada is a non-profit, non-governmental organization that collaborated with fishermen, processors, and distributors in order to develop the technology for *ThisFish* (EcoTrust Canada, 2014). The organization is focused on using technology to solve tough social, economic, and ecological challenges. The tool was designed to manage sustainable fisheries, show the transparency in fishing practices, and hold members in value chains fully accountable.

The program also allows consumers to create a personal connection with the fishermen by giving them the opportunity to learn about them as well as additional information about the product, and other workers involved in the process (EcoTrust Canada, 2014).

ThisFish functions on a web interface. It begins with placing a coded tag on each fish or batch of fish at the time of catch. When the fish are brought to the receiving center, the individual fish or entire batch are given a unique code. This unique code is linked to information such as who caught it, when it was caught and how it was caught. This information is then uploaded onto ThisFish.info. As the fish travels through the supply chain, other constituents of the supply chain can upload more information about the handling and processing of the fish. Eventually, consumers receive the unique code at the time of their purchase and are able to input this code into Thisfish.info to learn more about their seafood or to get in contact with those who handled their fish.

This tool was designed to focus on traceability, verification, and standards. *ThisFish* organizes all of the traceability information in an online system that is visible to everyone. The data entered into the system is also verified by site visits and contains a clear paper trail. Finally, the program sets standards for coding, labeling, and quality control. The three principles that the program operates on develop a level of trust and transparency in the value chain. The consumers are also able to develop a connection with the people involved in the supply chain through the provided information about their seafood, recipes, nutritional facts, and more. This sophisticated tool develops a personal connection between the consumer and members of the supply chain. Through this experience, the consumer can appreciate the effort that is put into ensuring the quality of their product. This transparent process shown in the interface verifies to the consumer that they are paying a higher price for a valuable product.

ThisFish involves all members of the value chain. For consumers, the program helps them learn more about their seafood in regards to its origins and sustainability. For fishermen, processors, and distributors, *ThisFish* helps them to connect with the consumers and allows them the opportunity to market their product with their personal stories. This will appeal to the upscale market that will be willing to pay more to support, not only responsibly-caught fish, but also small-scale fishermen. Finally, for the restaurants and retailers, *ThisFish* ensures the quality and sustainability of the products. The transparency of the system enhances the relationship between all members involved in the value chain.

2.6 Summary

A review of the literature has revealed that fishing areas in the Gulf of Nicoya are being overfished. In the communities of Palito and Costa de Pájaros there is a heavy reliance on the fishing industry. The depletion of fish has motivated fishermen in these areas to fish responsibly

to allow the fish more time to mature. Government designated AMPRs have been created to protect areas that are overfished in an effort to allow the fish to repopulate. The AMPR requires adequate communication and collaboration between the government and the community. One benefit of fishing responsibly is that the fishermen are able to catch larger, more mature and higher quality fish. Unfortunately, exploitation exists in supply chains and fishermen are unable to receive economic benefits from catching higher quality fish. A full understanding of the supply chain and its functionality may help bring increased profits for fishermen. To assist fishermen who are catching higher quality and responsibly-caught fish, it is helpful to implement a traceability system. Such a system can provide proof to consumers that the fish are caught responsibly. Different technologies can be used to develop a traceability system to ensure the flow of information throughout the supply chain. Overall, a traceability system may help communicate the quality and origin of the fish to consumers and benefit all members involved in the supply chain.

Chapter 3: Goals and Deliverables

Our goal was to analyze the existing traceability system created by MarViva and make recommendations for its improvement. This system is being introduced in Palito, while in Costa de Pájaros the system has been piloted for seven months. We completed field work in these two communities to determine if the system is easy to understand and functioning properly where it has been piloted. We also obtained feedback from supply chain constituents on the traceability program. Finally, using our background research and the information collected from our field work, we created three deliverables: a report for MarViva, revised traceability forms and procedure documents, and an electronic traceability database.

The first of these deliverables, the report for MarViva, was a compilation of our observations and information collected from supply chain constituents regarding the functionality of the current traceability system. This information was gathered in three steps. First, we interviewed the fishermen of Palito in an effort to gauge their understanding of the traceability system. Our second step involved receiving centers in Costa de Pájaros. We distributed self-evaluation forms and interviewed the employees responsible for the documentation to collect their opinions about the traceability forms. Third, we conducted a simulated reverse recall to determine how well the pilot system was functioning. Throughout these steps, we recorded field observations to gather more information. All of this data was then analyzed to identify weaknesses that could be improved upon in any or all parts of the process. We then used this analysis to provide recommendations to MarViva on how to improve the traceability system. These recommendations included ways to minimize error and inefficient processes in the traceability system.

Our second deliverable was a set of revised procedure documents and traceability forms. First, we revised the traceability forms based on the feedback we received from employees involved in the documentation process for the system. This was done to ensure that the forms suited the needs of the constituents of the supply chain. Additionally, we modified the procedure documents that were distributed to the supply chain participants. These documents were modified to improve clarity on the concept of lot numbers, what to do during a recall, and how to fill out the traceability forms. Part of our research consisted of identifying any portions of these documents that were confusing to the participants and then editing the documents to make them clearer. The documents were also changed so that they would correspond with the revised traceability forms.

Our third and final deliverable was an electronic database to compile information collected from the traceability forms. This database was designed to be simple and intuitive so that it could be easily used by those unfamiliar with the software. The electronic database establishes

an archiving system because all traceability information is compiled and saved to a single location. This allows traceability data to be easily accessed whenever it is needed. Having information stored in one location will eliminate the human error associated with transcribing forms that are transferred from one place to another in the supply chain. MarViva plans to use our recommendations to make the traceability system more accessible to fishermen and other supply chain constituents. Namely, they aim to create the simplest and most effective system possible. This will help demonstrate to consumers that fish are responsibly-caught and ensure the long-term survival of the fishing industry in Palito and Costa de Pájaros.

Chapter 4: Methodology

In Palito and Costa de Pájaros some fishermen are currently using responsible fishing practices. Presently, at the point of sale, it is impossible to distinguish what fish are caught responsibly and what fish are not. It is vital for a traceability system to be put in place to provide proof that fish are caught responsibly. Responsibly-caught fish appeal to an environmentally conscious consumer group who will pay more to support responsible fishing practices. MarViva is currently piloting a traceability system in these communities. The goal of our project is to analyze and improve the efficiency of this fishery traceability system in Palito and Costa de Pájaros.

Our goal has four objectives:

1. Conduct pertinent background research on supply chains and the current traceability system designed by MarViva.
2. Gauge the understanding and interest of the responsible fishermen in Palito regarding the newly introduced traceability system.
3. Observe how the traceability system is used in Costa de Pájaros.
4. Design an electronic database for data entry and archiving of traceability forms.

For this project, we worked in both San José and the Gulf of Nicoya. We took two trips with our sponsor to collect data in Palito and Costa de Pájaros. The first trip took place from March 19th to March 20th, 2014, and the second took place from April 3rd to April 4th, 2014. On our first trip, we were introduced to the communities so that the residents could become familiar with us. We began this visit at the headquarters of ASOPECUPACHI in Palito where we observed an interactive presentation on the traceability program. This presentation was designed to introduce the system to the fishermen of Palito and Montero for the first time. During the presentation, we informed the participants that we would be working with them in the coming weeks to gather their thoughts on the program.

On the second day of our first trip we traveled to Costa de Pájaros to meet Luis D. Herrera. Mr. Herrera is the owner of Recibidor de Mariscos Don Chino, one of the receiving centers in Costa de Pájaros. During our visit, he allowed us to see his receiving center, including the r where he separates the responsibly-caught fish from other fish. This trip to Recibidor de Mariscos Don Chino was MarViva's first visit since implementing the traceability program at this center. We collected 312 completed traceability forms at this receiving center, which is 57% of the total - forms that we obtained from the receiving centers in Costa de Pájaros. Before we left the center, we informed Mr. Herrera that we would be returning to seek opinions about the system and learn more about how the receiving center uses the program. Lastly, we traveled to Z&M

del Pacífico S.A., a distribution center in Puntarenas. This visit allowed us to become familiar with how a distribution center operates.

During our second trip, we traveled to Palito to conduct interviews with fishermen who fish responsibly. We were able to find participants for our interviews with the help of Sergio Elizondo, a socioeconomic scientist who works with MarViva. With his help, we interviewed ten fishermen who fish responsibly. This group of fishermen included the President of ASOPECUPACHI. In addition to the fishermen, we also interviewed Abelardo Brais, the owner of the receiving center in Palito. After working in Palito, we traveled to Costa de Pájaros to interview the owners and employees in charge of completing the traceability forms at the receiving centers. The two receiving centers that we visited were Recibidor de Mariscos Don Chino and Cama-Pez de La Costa.

We worked further with the staff at Recibidor de Mariscos Don Chino, where we organized and completed a simulated reverse recall. In addition to Mr. Herrera's receiving center, this reverse recall included the Total Seafood distribution center as well as four Auto Mercado supermarket locations. First, we contacted Mr. Herrera to confirm that he has record of the specific traceability forms selected for the recall. Next, we visited Total Seafood to see if this distribution center had a record of the selected lot numbers for the recall. In addition, we worked with Total Seafood to understand their traceability system and how it could be used with the program designed by MarViva. Finally, we traveled to the four Auto Mercado locations that Total Seafood sells to. This was done to discover if employees of Auto Mercado had a record of the lot numbers that we traced at Total Seafood. We also visited these locations to learn how they utilize the traceability information that they receive from Total Seafood. The purpose of this simulated recall was to evaluate how completely fish can be traced with the current traceability system.

We made observations and gathered relevant data during our trips to improve the traceability program designed by MarViva.

Objective 1: Conduct pertinent background research on supply chains and the current traceability system designed by MarViva.

In order to enhance the traceability system, we found it necessary to conduct background research on the fundamentals of this project: MarViva's traceability program, as well as the existing supply chains where it would be implemented. It was essential to research how each step of the supply chains in Palito and Costa de Pájaros functions. We did this to understand how the fish need to be traced from catch to consumer. The next step to complete this objective was to become familiar with the traceability program created by MarViva. The program included a thorough review of procedure documents that explain the process to trace

fish. Knowledge of the current traceability system gave us a basis to begin collecting ideas for improvement of the program.

Objective 2: Gauge the understanding and interest of the responsible fishermen in Palito regarding the newly introduced traceability system.

Prior to conducting our field work, fishermen of Palito had only received one training seminar to introduce them to the traceability system. This seminar took place during our first visit on Chira Island and was presented by a representative of MarViva. The presentation showed fishermen how to fill out traceability documentation and how to follow the procedure documents. Although the fishermen do not have the responsibility of completing the forms themselves, MarViva intends to educate them on the entire traceability program to draw more interest and increase participation in the program. MarViva also wishes to establish a system that is transparent so that the fishermen feel comfortable providing their personal information on the traceability forms. With this goal in mind, we conducted interviews with the fishermen to evaluate their level of understanding and enthusiasm about the system. With our findings from these interviews, we were then able to determine if further measures such as increased education or communication were necessary.

After speaking with the fishermen, we interviewed Mr. Brais, the owner of the receiving center in Palito. We designed a unique set of interview questions for Mr. Brais because he has a large role in the traceability program. The purpose of this interview was to measure his interest in the program and to find ways for MarViva and Mr. Brais to work together in the future. Results from this interview gave us insight into how the traceability system could be implemented in Palito.

Objective 3: Observe how the traceability system is used in Costa de Pájaros.

MarViva has been working with the fishermen in Costa de Pájaros for the past seven months to pilot their traceability program. The main purpose of our visit was to observe how the system is currently operating. To do so, we conducted interviews and distributed self-evaluation forms to the owner and the employees responsible for traceability documentation at each receiving center. We also carried out a simulated reverse recall to observe the functionality of the traceability system. We adopted this approach to gather the opinions of the supply chain constituents currently using the program. These opinions were valuable because they provided suggestions for improvement from those who are experienced with the system. We also collected information from the participants regarding how well they follow and use the traceability system so that we could identify any problems that needed to be addressed.

After gathering the opinions from the workers at the receiving centers, we utilized a simulated reverse recall to test how well the system functions. Overall, we looked for inadequate communication, carelessness or false reporting, or lack of accurate documentation. To identify possible areas for improvement, we asked each member of the supply chain what happens to the fish at the next step in the chain. If they were unable to provide a detailed and accurate answer then we concluded that increased communication or education may be necessary. Carelessness and false reporting were identified by analyzing how and when documentation was completed. Lack of accurate documentation can be seen when the fish is no longer able to be traced. Through these approaches, we obtained valuable insight on the functionality of the traceability system. Using the feedback from the constituents and observations from the reverse recall, we identified and evaluated the strengths and weaknesses of the system. Finally, we used this information to generate feedback for MarViva on how they could optimize the traceability system.

Objective 4: Design an electronic database for data entry and record keeping of traceability forms.

Through our field work in Palito and Costa de Pájaros we were able to gain a thorough understanding of how to improve the current traceability system. The current system utilizes paperwork that is completed by hand. To complete the forms, one person fills out the form and another verifies. With only two employees handling the forms, it is challenging to identify possible mistakes. This paperwork is then collected by another person (either an employee of MarViva or the distribution centers) who is left to interpret the paperwork, allowing for the possibility of misinterpretation in the handwriting. In each of these steps there is a large opportunity for human error that could render the system ineffective. To address this major concern, we developed a software database to compile the traceability data. We created this system so that ultimately, members of the supply chain can directly input traceability information. The use of paper forms can be eliminated with an electronic system. The database allows for retrieving, archiving, and processing documentation for responsible fish. This is valuable for both employees of MarViva and supply chain participants. Employees of MarViva can use different portions of the data for their own research of responsible fishing. Supply chain constituents can use the database to keep track of their own fishing records.

Challenges and Limitations to Field Work

In the process of completing our fieldwork, we discovered certain challenges and limitations to our research. When conducting an interview it is important to recognize the possibility that the interviewee may provide untruthful or distorted answers. For the fishermen, we addressed this by assuring them that their responses were anonymous and participation in our study was

voluntary. In the case of the receiving centers, we attempted to mitigate the possibility of receiving dishonest answers with anonymous self-evaluation forms. A second limitation was the language barrier between us and the participants of our study. Due to our limited Spanish speaking skills we had to create and rehearse specific interview questions. When the participants of our study responded in an unexpected way, it was difficult to improvise more questions to obtain further information. A third limitation was the small sample size. We interviewed ten fishermen, which is approximately 10% of the responsible fishing community of Palito. Our goal was to obtain general opinions on the receiving center and the traceability system. Although our sample size was smaller than originally projected, we felt that the sample pool represented a large distribution of viewpoints. In our opinion, this variety is representative of the community.

Chapter 5: Results

To analyze and improve the traceability system established by MarViva, we conducted field work in the San José area and in the Gulf of Nicoya. We also designed an electronic database to increase accuracy of traceability records. To accomplish this, we first researched the existing pilot program and relevant supply chains. In addition, we spoke with the individuals involved in the program in order to collect their thoughts and recommendations for the system. In this section we discuss both our research findings and the results obtained from our field work. We begin with the information acquired through our research on the current traceability system and the supply chains of Palito and Costa de Pájaros. We include a description of the results from our interviews with the fishermen and the receiving center in Palito. Next, we explain the data gathered through our field work in Costa de Pájaros. This included interviews and self-evaluation forms for the employees and owners of the receiving centers. We then present results from the reverse recall involving one of the supply chains. Lastly, we detail the results obtained from analyzing our electronic database.

5.1 Examination of Supply Chains and Current Traceability System

5.1.1 Supply Chains of Palito and Costa de Pájaros

Our first step in understanding the supply chains was to diagram them with our sponsors Irene Morales and Jorge Felix Alfaro. We used this information to assemble a list of key individuals and companies involved in each of the supply chains.

We examined three existing supply chains: one in Palito and two in Costa de Pájaros. First, we worked first with the supply chain that originates in Palito. This chain starts when fishermen of Palito bring their catch to the receiving center of Mr. Brais, located on the island. From there, the fish are transported to the Product C distribution center in Puntarenas. Product C then distributes the fish to various hotels, retailers, and restaurants. This supply chain is shown in Figure 10.

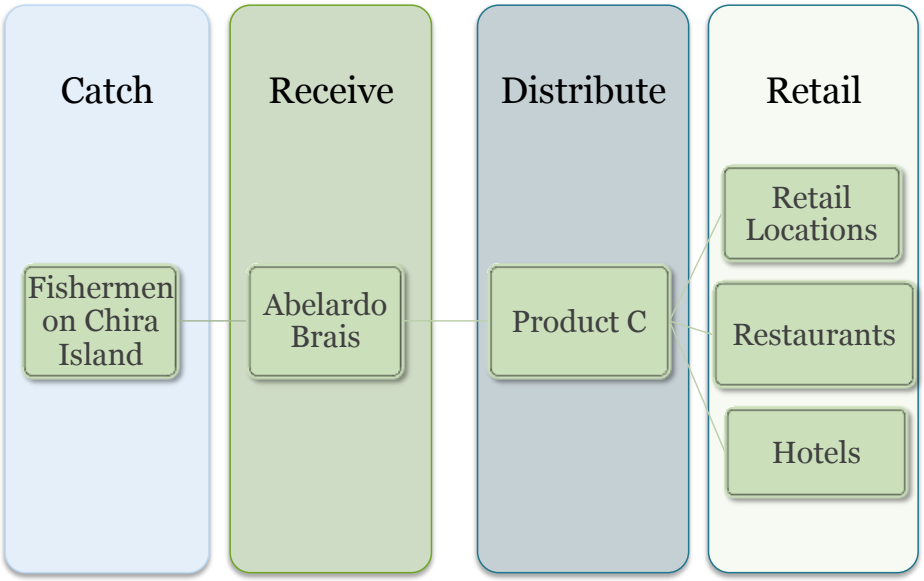

Figure 10. Fishery supply chain originating in Palito on Chira Island

In Costa de Pájaros we focused on two supply chains; we will refer to these supply chains as SC1 and SC2. SC1 begins when the fishermen of Costa de Pájaros bring their catch to the Recibidor de Mariscos Don Chino receiving center. Employees at the receiving center document and transport the fish to the Total Seafood distribution center in Alajuela. After cleaning, processing, and packaging, these fish are delivered to four different Auto Mercado locations in central Costa Rica. This process is detailed in Figure 11.

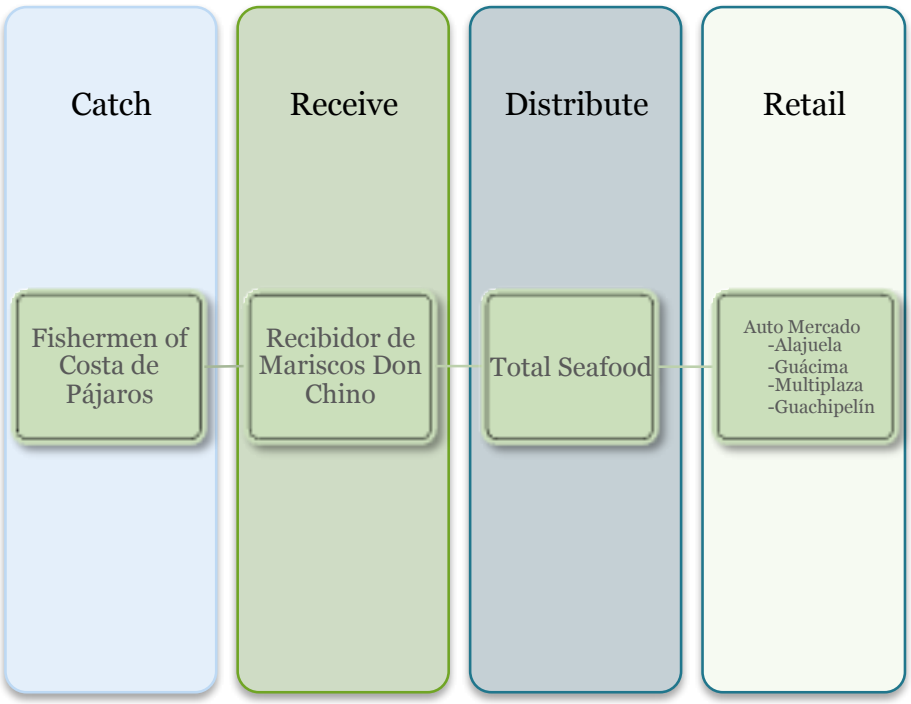

Figure 11. SC1 involving Recibidor de Mariscos Don Chino

SC2 begins when the fishermen of Costa de Pájaros bring their catch to the Cama-Pez de La Costa receiving center. Employees at the receiving center document and transport fish to the Z&M distribution center, run by Mr. Mario Zamora. These fish are then sold to various ocean cruise liners, including National Geographic Cruises. This information is summarized in Figure 12.

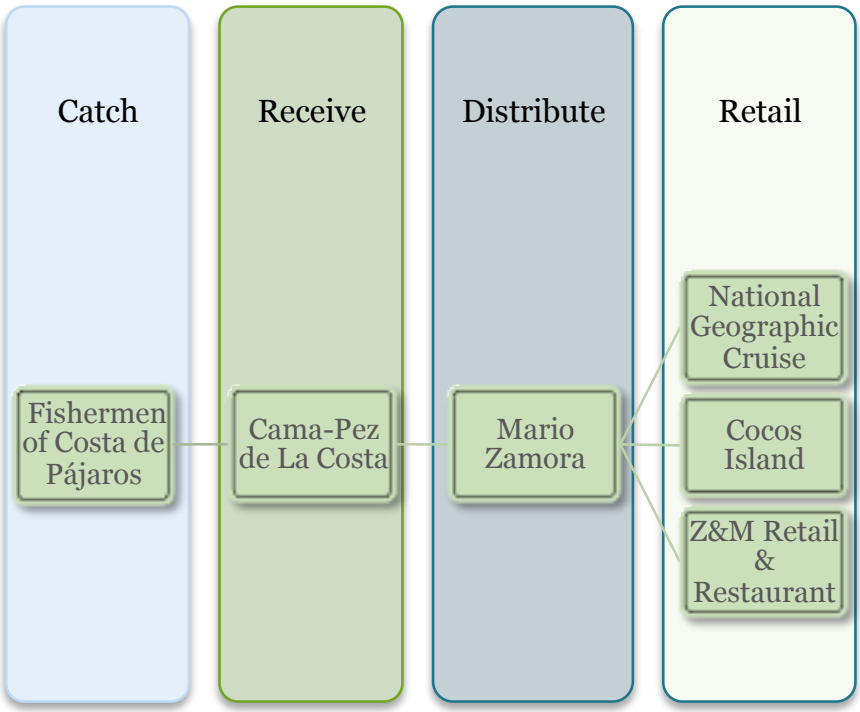

Figure 12. SC2 involving Cama-Pez de La Costa receiving center

5.1.2 Traceability System Designed by MarViva

The traceability system includes multiple procedure documents for constituents of the supply chain. These documents detail how the overall process works and includes instructions on how to complete documentation. It is important to note that these documents were originally written in Spanish. In order to remove any possible discrepancies due to the language barrier, we translated the procedure documents into English. We then studied the information in both sets of the documents to become well versed in the material.

During our examination, we looked at four procedure documents that explain how to complete the three forms used in the traceability program. The first procedure document explains how the overall traceability system operates, including how to conduct a recall if necessary. The second explains how to complete the Receiving Record Forms that provide a record of all fish that are sold to the receiving center. The third procedure document explains how to fill out the Community Fishing Monitoring Forms and the fourth procedure document explains how to complete Sales Record Forms.

The first document, titled “Traceability and Recovery Program for Responsible Fishing”, functions as a manual for the receiving centers. This procedure document begins by showing how each piece of information is recorded in traceability forms from when the fishermen catch the fish to when the fish are delivered to the receiving center. The steps to generate this information are shown in the flow chart in Figure 13. This figure shows that when the fish are

delivered, quality is determined and the fish are grouped by species. From there, the lot number for the product is generated to allow for traceability of the product. The following information is also documented: identification of the fishermen and fishing vessel, description of product and quantity received, fishing zone and technique used, and general information on the receiving center.

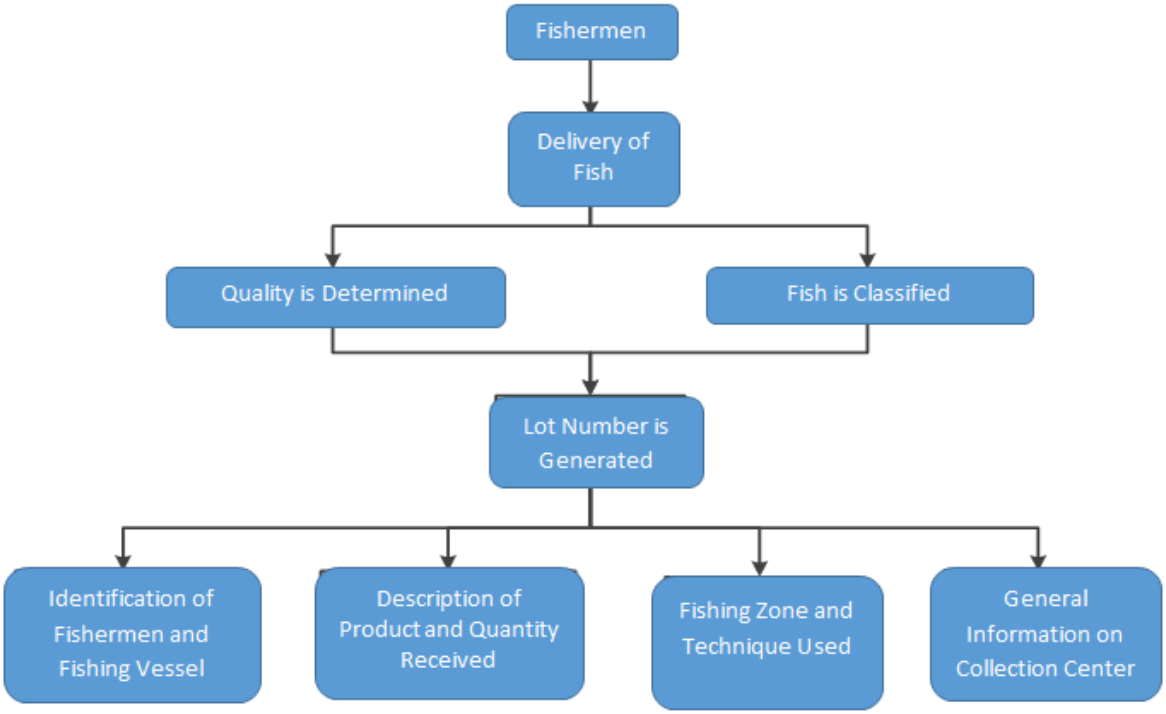

Figure 13. Information flow for traceability systems (source: MarViva, 2013)

In addition to the previous information, this document contains instructions for how to generate a lot number. The lot number is the most important portion of the traceability forms because it is a standardized way to trace the fish throughout the supply chain. A lot number consists of fourteen characters, including three hyphens and four sets of identifying numbers. An example of a lot number can be seen in Figure 14. The first two numbers, seen in red, correspond to the identification of the receiving center. The five digits seen in purple represent the date of the catch in the Julian calendar format. The two digits in blue identify the individual fisherman responsible for the batch. Finally, the digits in green represent the delivery number of the batch; for example, the number “02” indicates that this batch is that fisherman’s second delivery of the day to that receiving center. A unique lot number such as this is generated for every batch and can be seen on each Receiving Record Form.

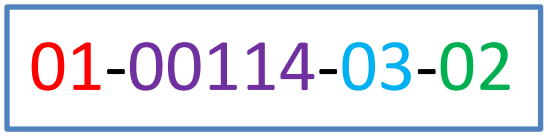

Figure 14. Example of a lot number

The final portion of this document explains how to perform a recall in the event that a fish needs to be traced back to its source. The recall procedure is to be carried out by the receiver and distributor. In this document, performing a recall involves retrieving the lot number of the contaminated product and contacting each member of the supply chain connected with that number to remove all potentially unsafe products.

The second procedure document, titled "Instruction for the Completion of Receiving Record Forms", explains how to fill out the Receiving Record Forms that register the fish sold from the fishermen to the receiving centers. One Receiving Record Form is completed for every batch that is sold to the receiving center by each fisherman. Each form contains information documenting where the product originated and where it was sold to. It also documents the total mass of each species that was caught. Each batch that is documented in these forms receives a lot number that is generated by the person responsible for completing traceability documentation at the receiving center. The Receiving Record Form can be found in Appendix_1.

The third procedure document explains how to complete the Community Fishing Monitoring Forms. This form is completed by the person responsible for the traceability documentation at the receiving center. It records the size and quantity of each fish in every batch corresponding to a lot number. This form allows each individual fish to be documented throughout the process. The Community Fishing Monitoring Form can be seen in Appendix_2.

The fourth and final procedure document explains how to complete the Product Sales Record Form. This form is completed for every batch of fish that is sold to the next step in the supply chain. It includes all pertinent information about the receiving center and the lot number that corresponds to an individual batch. A dispatch number is generated for each Sales Record Form to trace the batches that are sold together. The Sales Record Form can be seen in Appendix_3.

5.2 Palito

We addressed our second objective in the community of Palito on Chira Island. Here we conducted interviews in pairs with ten responsible fishermen (approximately 10% of the responsible fishermen in Palito) and the owner of the receiving center, Mr. Brais, to assess their understanding of and interest in the program. The interview questions used to gather this information are included in Appendix A_4. The first set of questions was designed to be

informal to help subjects of our interviews become comfortable with us. Further into the interview we asked questions more relevant to traceability. These questions asked for information regarding local involvement in fishing associations and the fishermen's knowledge of the newly introduced traceability program. If the fisherman attended the traceability presentation conducted by MarViva, we asked for their impression of it. We also asked questions to evaluate whether or not they believe the program would be helpful and beneficial to them.

There were twenty people in attendance at the MarViva presentation during our first visit. This number, however, included not only responsible fishermen from Palito but also their wives, Mr. Brais, and fishermen from the near-by community of Montero. We used this observation to estimate the number of responsible fishermen who would be aware of the traceability program. Based on this information, we aimed to interview ten of these fishermen in Palito. We found that the responses from the ten interviews we conducted were representative of a variety of opinions from fishermen in the community. We documented our interviews by taking notes and audio recordings of all interviews using a Voice Memo App on an iPhone. The audio recordings helped us retrieve any information that we may have initially missed during the interviews due to the language barrier.

Our interviews were comprised of two major sets of questions. The first set included questions regarding the fishermen's general fishing backgrounds while the second set focused on their thoughts about the traceability system. In the first set of questions we discovered that these fishermen had been fishing anywhere from five to fifty years. We also discovered that they catch a combination of corvina (seabass), pargo (red snapper), robalo (snook), and bagre (catfish). We asked how many kilograms of fish each fisherman catches in a typical week; the average answer was 100-125 kilograms per week. The responses to these questions are represented graphically in Appendix_5.

During the interviews, we also found that nine out of the ten fishermen sell to Mr. Brais every day. Next, we asked the fishermen what they think happens to their fish after they sell them to Mr. Brais. Their responses are depicted in Figure 15. It is important to note that in this figure there are eleven responses because one fisherman gave two answers. It appeared to us that most fishermen knew that their fish were sold, but more than half did not know any details of the sale location.

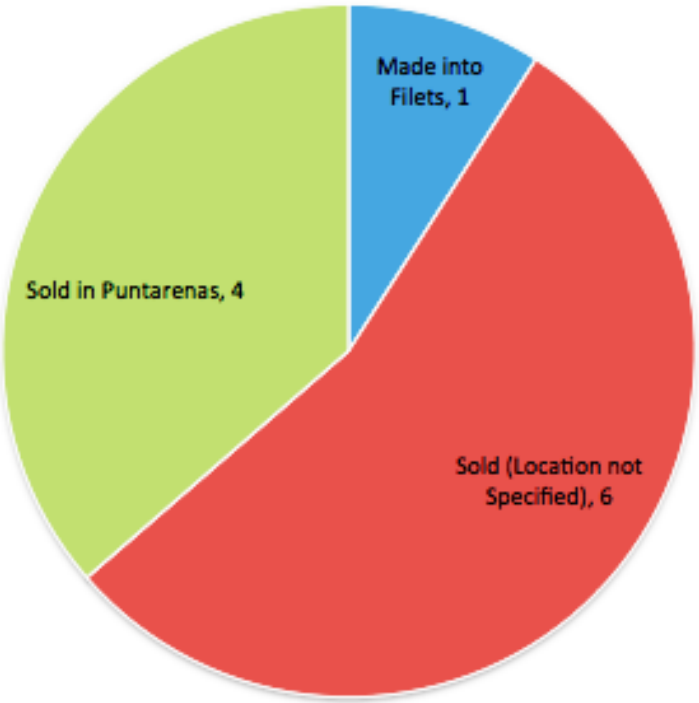

Figure 15. Fishermen responses regarding what happens to their fish after they are sold

Lastly, we asked the fishermen if they would like to have more receivers available to sell to. Nine out of ten fishermen answered yes, while one fisherman said he was content with selling his fish solely to Mr. Brais.

The second portion of our interviews with the fishermen consisted of questions asking about their thoughts on the traceability system. First, we asked why they choose to fish responsibly. The fishermen responded that some wanted better prices and higher quality fish, that using nets was illegal or that they wanted to conserve their fishing areas. Others responded that they preferred the responsible fishing techniques to using nets for personal reasons. These responses are compiled in Figure 16.

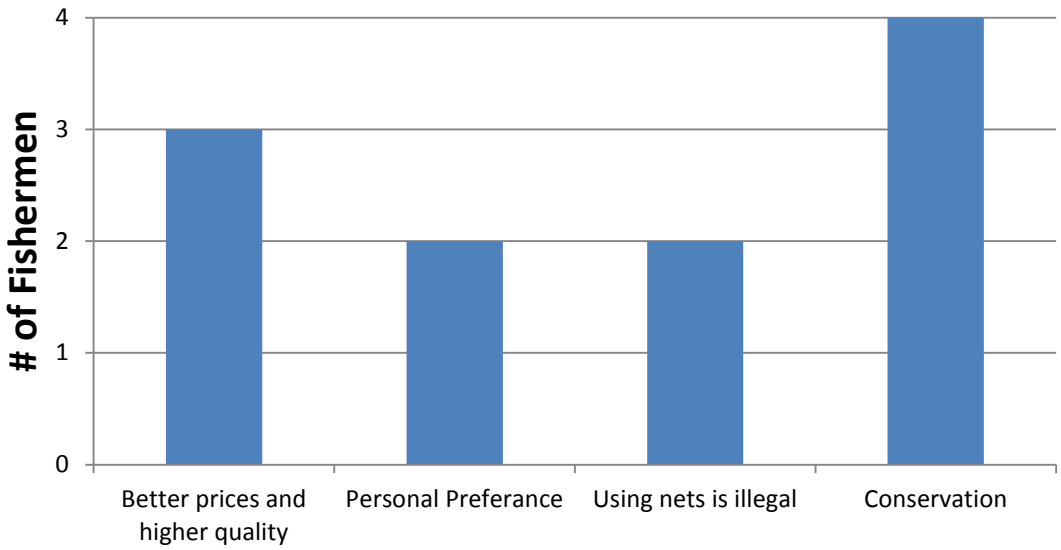

Figure 16. Reasons given as to why the fishermen fish responsibly

In addition, we found that seven out of ten fishermen had attended information sessions about responsible fishing. Three out of these seven, however, did not know about the traceability system.

For those fishermen who knew about the traceability system, we asked them for their thoughts about the program. The majority of these fishermen said that the system is important. Some fishermen responded by saying that the system is "good". Some also said that the program would provide economic benefits. One mentioned that it would be good for his reputation to have a way to prove to consumers that he caught the fish. Few of them, however, were able to include details as to why they felt this way.

We then asked the fishermen who were familiar with the system for their thoughts about the strengths and weaknesses of the program. One fisherman replied that there are benefits for everyone involved. Other fisherman responded by saying that the system is important for their family or that it will improve the conditions of the fishing area as well as the prices for the fish. Another fisherman expressed his doubts that employees of receiving centers would continue to separate the fish properly.

Next, we asked the fishermen in what way they thought this program could help them. Only three out of ten fishermen were able to provide an answer to this question. Their responses included the following statements: the system will help them distinguish which fish is theirs, the system will conserve fish for the future, and people who want responsibly-caught fish will pay more for it.

Lastly, we asked the fishermen why they wanted to participate in the program. Many fishermen replied that they wanted to be a part of the program to receive more profit for their fish. Some said they were motivated to learn more about the new system. Another fisherman said he was interested in having a way to keep track of his fish.

After we completed our interviews with the fishermen, we sat down with Mr. Brais. Similar to the interviews with the fishermen, we first asked questions to make him more comfortable speaking with us. We then asked him questions about his interest in participating in the program. Finally, we asked what technologies and knowledge he already has in order to assess what tools he would need to use the program. We documented this interview by taking notes, as well as obtaining an audio recording of the conversation and photographs of the software that he uses to track his products. The interview questions we asked Mr. Brais can be found in Appendix_6.

We learned that Mr. Brais has been receiving fish from the fishermen for thirty years. He told us that he receives up to 5000 kilograms in a week from daily deliveries. He receives responsibly-caught fish as well as other fish, and stores them separately at the receiving center. He sells his fish to Product C, a distribution center in Puntarenas. He believes the fish are then sold to restaurants. Product C, however, had not been buying responsibly-caught fish from him recently. According to Mr. Brais, this is because they do not want to pay him more money for it. He said that he would like to sell his fish to more companies.

Next, we asked Mr. Brais for his thoughts on the traceability system. Although he is not a member of a fishing organization, he has attended all of MarViva's information sessions. We observed on our first visit to the island that he attended the traceability seminar and was very active and involved in asking questions. He said that he thought the traceability system was a good idea, and that it was not confusing. He believed that the system would result in higher prices for fish, but would also entail more work for all those involved. When we asked why he wants to participate in the traceability program, he said that fishing was his life and he wanted to bring benefits to the community of fishermen. Mr. Brais, however, also stressed that if MarViva does not include him in the traceability program then there will be "problems". He stated that the program will only become successful if he and MarViva can work together. If there is no collaboration, however, he will have to fight to maintain his business with the fishermen. He also stated that the system will not help the community "if nobody helps [him]".

In addition to the interview, Mr. Brais showed us the database that stores all of the sales records for receiving center. MarViva was previously unaware of this database. A photograph of the Graphical User Interface (GUI) of this database is shown in Figure 17. In this figure, a screenshot of the computer program can be seen. While Mr. Brais told us that the program was

designed for him by his son, our sponsor informed us that the program was administered by INCOPESCA.

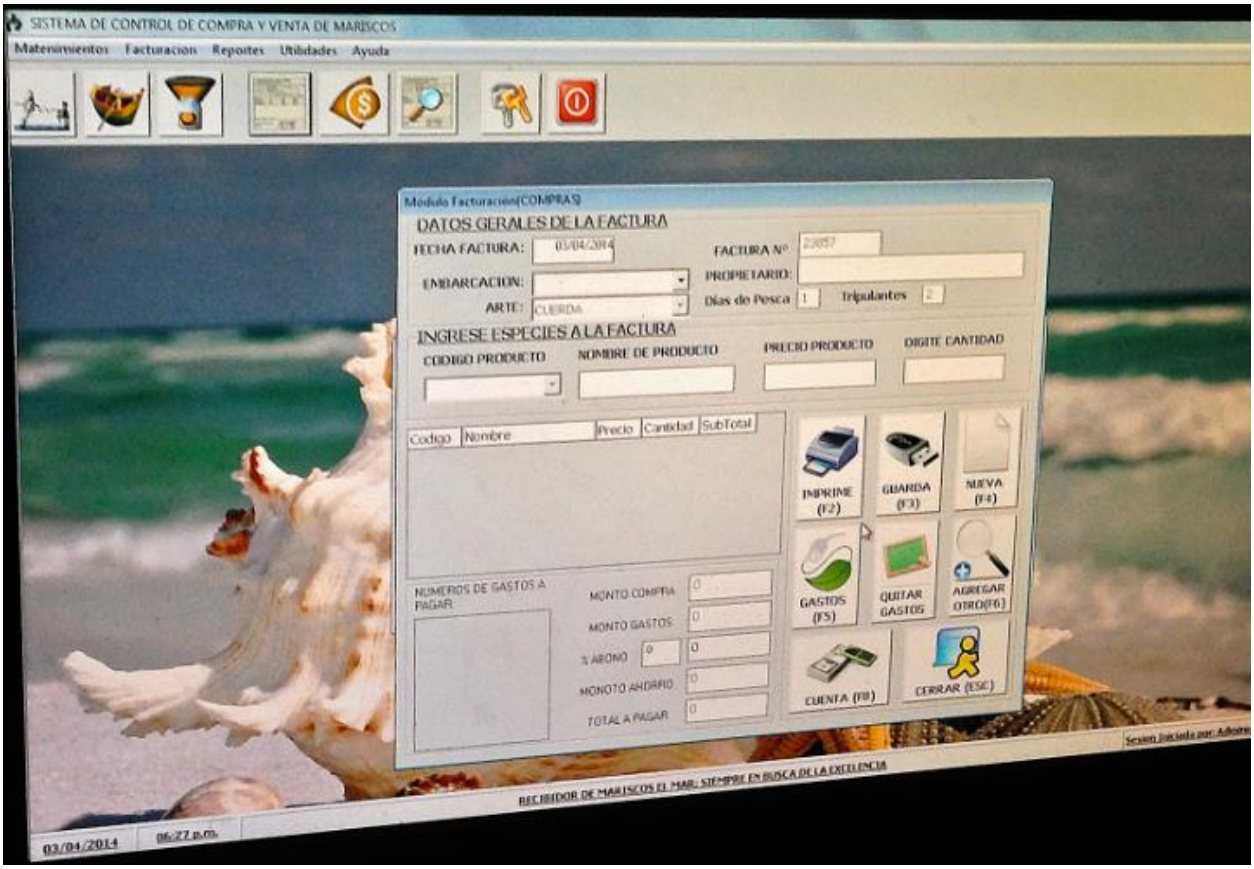

Figure 17. Photo of database program currently used by Abelardo Brais receiving center

During our interviews in Palito, we made note of an important observation. At the headquarters of ASOPECUPACHI we noticed that a new receiving center was in the process of being built. We learned from our sponsor that MarViva has funded the construction of this receiving center. We were told by the president of ASOPECUPACHI, however, that they did not have enough funding so the project has been halted. The completion of this receiving center would provide another option for fishermen to sell to aside from Mr. Brais.

5.3 Costa de Pájaros

MarViva has been working with the fishermen in Costa de Pájaros for the past seven months to pilot the traceability program. During our visit, we observed how the system is currently operating. We conducted interviews and distributed self-evaluation forms to the owner and the person responsible for the traceability documentation at each receiving center. We also asked

the employees responsible for the paperwork to participate in an exercise to generate a lot number based on example information we provided.

5.3.1 Lot Number Exercise

We found this activity to be a major priority due to the great importance of the lot number in the traceability program. For this exercise we provided the name of the receiving center, the date, an example fisherman identification number, and an example delivery number. Using this information, the employees responsible for documentation at both receiving centers were able to generate a lot number quickly and easily.

5.3.2 Alternative Traceability Forms

We presented these participants with two alternative versions of the Receiving Record Form. The first version, referred to as Traceability Form 1 (TF1), included a simplified format of the existing form, omitting repetitive information. The second version, referred to as Traceability Form 2 (TF2), included an entirely new and more visually appealing format. In these forms, we also altered the structure of the lot number by eliminating the use of the Julian calendar and replacing it with a conventional calendar system. We presented these forms to the participants and asked what they liked and disliked about each form, in comparison to the original version of the form. TF1 and TF2 can be seen in Appendix_7.

We asked the participants if they would prefer an electronic database to record their traceability information. Considering the small size of the communities, we also asked them what technology they have accessible to see if an electronic system could be easily implemented. The workers at both receiving centers expressed a desire to switch to a computer-based electronic filing system for traceability record keeping. They mainly attributed this to the fact that the paper forms are more difficult to manage and organize, as well as more prone to damage due to the delicate composition of the paper. Workers at both receiving centers demonstrated a clear preference for the simplified version TF1. The participants liked the differently structured lot number in both TF1 and TF2 because it eliminated the use of the Julian calendar. They also welcomed the idea of eliminating unnecessarily repetitive information about the receiving center and the fisherman in the documentation. This information included the government-issued #CVO, #SIREA, and #INCOPESCA, all identifying numbers specific to a receiving center. The boat name, boat license, and fisherman license, all specific to the fisherman, were also eliminated. One found the option to circle information on TF2 to be more tedious than just writing in the information. The participant interviewed at the other receiving center, however, preferred this option.

5.3.3 Self-Evaluation Forms

We distributed self-evaluation forms to those responsible for the traceability documents at both receiving centers. These forms included questions concerning their receiving process as

well as their understanding of the system and opinions on how to improve it. By using these forms, we hoped participants would be comfortable with answering our questions because the evaluations were anonymous. It was important for this information to be anonymous so that participants would not be concerned about risking their employment if they answered questions honestly. This self-evaluation form is included in Appendix_8.

The self-evaluations helped us understand the participants' opinions of the program, as well as how they use it. First, people at both receiving centers saw the traceability system as important "to control fishing in the Gulf of Nicoya because otherwise it will not last long". Another employee said that "knowing the process that takes the fish from catch to consumer can provide a guarantee of the quality of the fish". Next, employees at both centers agreed that the traceability forms require too much time to fill out. One participant reported that he/she spends three minutes filling out each form and would be willing to spend no more than five minutes per form. The other reported that they spend five minutes filling out each form and would be willing to spend six to ten minutes completing them. We received two different answers in response to how immediately forms are completed when fish arrive at the receiving center. One worker articulated that "I do not fill them out immediately; I create a bill immediately and fill the form out later based on the bill". The receipt that this employee uses to complete the forms can be found in Figure 18. Another worker stated that "I fill out the forms within hours; I receive the fish and put the sheet on the whiteboard for later [use]". Workers at both receiving centers reported that they always fill out their forms, and that they know what happens to their fish after it is sold. Specifically, one participant said that they distribute their fish to a reputable buyer who continues with the traceability system. Both centers store their fish coolers with ice for two to four days before selling them. We also received feedback that the number of spaces allotted to record the fish in the Receiving Record Form was too many. On the Sales Record Form, we were told that this number of spaces was not enough. Finally, we asked for feedback on how to improve the system. One employee responded that information such as the #CVO, #SIREA, and #INCOPESCA was too repetitive. Another worker responded similarly, stating that the repetitive information on the forms was not practical. Our last response was that "the texture of the forms is too sensitive and delicate".

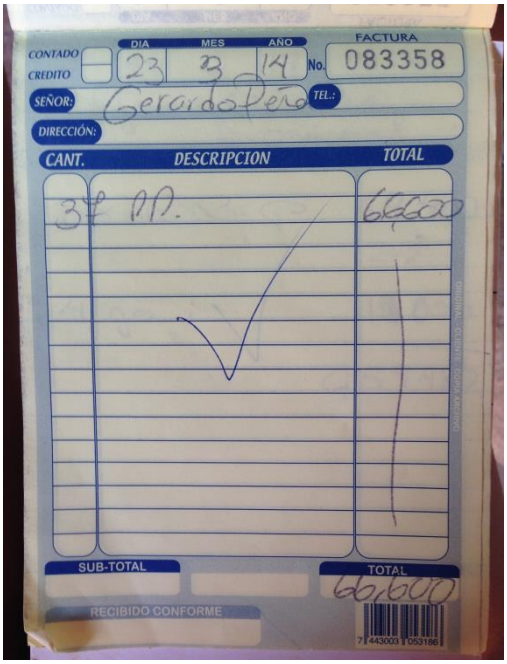

Figure 18. A photo of a receipt used at a receiving center to complete traceability forms

5.4 Reverse Recall

The reverse recall was implemented by following select fish through the supply chain from receiver (where documentation begins) to retailer (where fish are sold to the consumer). This was MarViva's first attempt at a simulated recall. Specifically, the recall included one receiving center, one distribution center, and four supermarkets from SC1 in Costa de Pájaros. By following these portions of the supply chain, we were able to see if there were any faults in the program. This recall determined if each member of the chain maintained a record of when, where, and from whom they received the fish selected for the reverse recall. Figure 19 depicts the steps of the supply chain that were involved.

Figure 19. Supply chain selected for the reverse recall

To conduct the reverse recall, we worked to follow seven different lot numbers through the supply chain. The selected lot numbers were chosen from three Sales Record Forms with complete corresponding Receiving Record Forms. The Sales Record Forms were also chosen by date: one from October, when the program first started; another from January, mid-way through the program; and the third from March, most recent in the program. These three forms contained the seven lot numbers that we used in the recall.

To conduct the recall, we first consulted with Mr. Herrera, the owner of the receiving center, to confirm that he maintained records of the forms that we selected. Specifically, we asked him questions to see if he was able to provide us with the proper information needed for a recall. We then followed the batch to the distribution center, Total Seafood. There, we spoke with the manager, Marvin Quesada Martinez, about the daily processes and procedures of the distribution center. The questions used to prompt our discussion with Mr. Martinez can be seen in Appendix A_9. In this discussion, we also spoke about the process that Total Seafood uses to perform a recall. During this time, we reviewed the Receiving Record Forms and Sales Record Forms that Total Seafood received from Recibidor de Mariscos Don Chino. We also examined the additional traceability paperwork that Total Seafood uses to document fish sold to Auto Mercado. These forms are supplied by Auto Mercado and are completed by employees of Total Seafood for Auto Mercado. We also recorded field notes to document if traceability information was lacking at any point in the process. For example, when touring the center, we looked for mislabeling, cross-contamination, or improper storage practices. To supplement this, we also observed the delivery, cleaning, processing, and packaging of responsibly-caught fish during our tour.

5.4.1 Recibidor de Mariscos Don Chino

We placed a phone call to Mr. Herrera in order to confirm that he possessed the copies of the traceability documentation being used in the recall. During this phone call, we spoke to the employee responsible for maintaining the traceability documentation. He/she told us that they keep the documentation locked in a desk at the center when not in use. When we asked if they could provide us with the lot and dispatch numbers of the Receiving Record Forms and Sales Record Forms selected for the recall, they were able to locate the forms immediately. The lot numbers and dispatch numbers provided were all consistent with the copies of the documentation in our possession. During this phone call, we also spoke to Mr. Herrera about his relationship with Total Seafood. He explained to us that Total Seafood buys all of his responsibly-caught fish. For example, during the height of the season, he may receive 2,000-3,000 kilograms of responsibly-caught fish from the fishermen. Total Seafood then purchases all of Mr. Herrera's responsibly-caught fish. We learned that Recibidor de Mariscos Don Chino and Total Seafood have had a partnership for four years.

5.4.2 Total Seafood Distribution Center

When we first arrived at the Tunatun Facility of Total Seafood, we met the owner, Oscar Picante. Mr. Picante introduced us to Mr. Martinez, who gave us a tour of the facility. Prior to entering the facility, we passed by a sanitation area. This area included sinks for employees to wash their hands as well as a container of disinfecting liquid to clean their boots. Once inside, we were able to see the delivery dock (refer to #1 in Figure 20) where fresh fish are delivered to Total Seafood from receivers such as Mr. Herrera. Mr. Martinez told us that Total Seafood never receives more than two deliveries of responsibly-caught fish in a given day. After delivery, fish are transported to a room to be cleaned (refer to #2 in Figure 20). From here, the fish are moved across the hall to a refrigerated room for processing. In this room, the fish are packed in ice in two large containers marked exclusively for responsibly-caught fish (refer to #3 in Figure 20). This room also contains seven other large containers that are used to hold all other products. The responsibly-caught fish are then removed from the ice and fileted by one specific worker (refer to #4 in Figure 20). Due to the small volume of responsibly-caught fish, this employee may only spend a portion of his day fileting them, while the remainder of his day will be spent processing other fish. Other personnel work at three additional tables to filet and process all other products. During this process, the responsibly-caught fish remain separate from the rest. Mr. Martinez estimated that only approximately 40% of the weight of the fish remains after fileting. The fish are then placed into clear plastic bags and packed into crates of ice. These bags are affixed with a label that displays the company logo, type of product, date of processing, date of shipment, temperature control instructions, and weight. Each crate is labeled with the location of the Auto Mercado that the fish will be shipped to: Alajuela, Guácima, Multiplaza, or Guachipelín (refer to #5 in Figure 20). The fish are stored and shipped with an ice-to-fish ratio of two-to-one kilograms. The fish, along with their corresponding documentation, (refer to #6 in Figure 20) are then delivered to the correct Auto Mercado store in a separate truck. Overall, this entire process occurs over the course of one day. Total Seafood never s its responsibly-caught fish in order to maintain its high quality. According to Mr. Martinez, a shipment of responsibly-caught fish that arrives in the morning will be shipped out by 5:00 in the morning the following day at the latest.

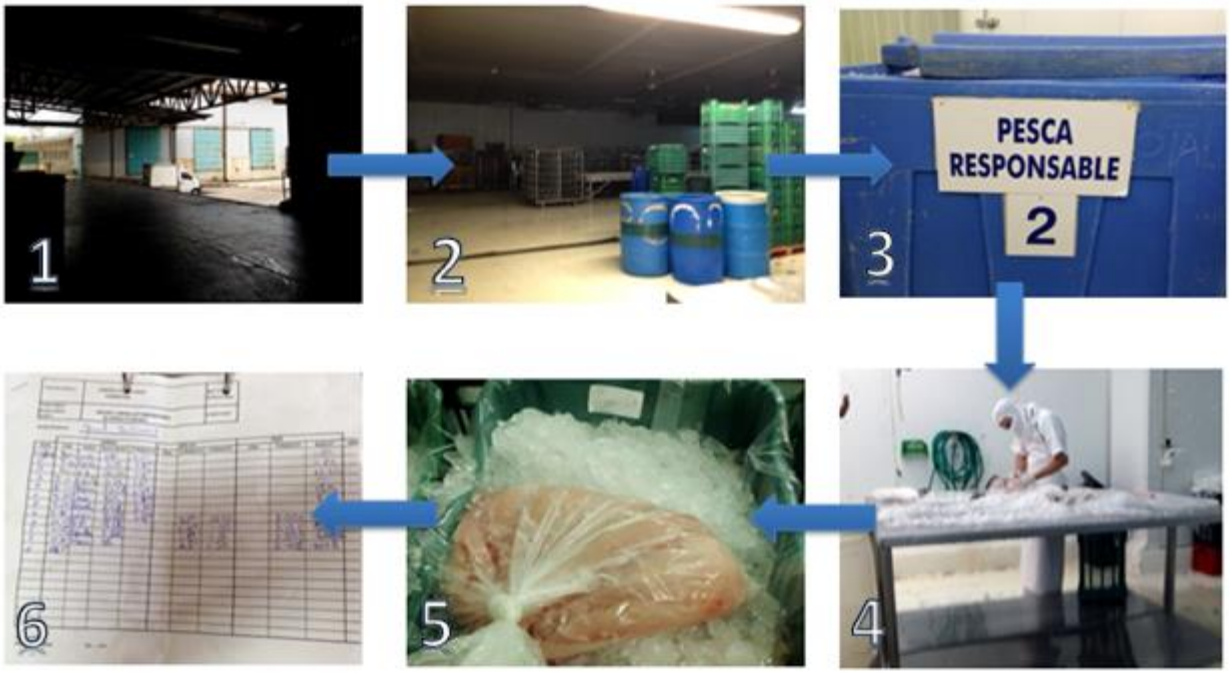

Figure 20. Steps involved in the processing of fish at Total Seafood distribution center

After touring the distribution center, we sat down with Mr. Martinez to review the traceability documents completed by employees at Total Seafood. He was able to quickly and easily produce three large binders: one containing the Receiving Record Forms and Sales Record Forms; one containing forms used to document temperatures of fish; and one containing forms given to Total Seafood by Auto Mercado. The forms distributed by Auto Mercado are completed by employees of Total Seafood and returned to the supermarket with the fish. We were able to examine these documents in detail to conduct the next step in our reverse recall. Mr. Martinez informed us that Total Seafood maintains up to one year's worth of paperwork, but they were not ordered chronologically. They were organized into packets based on lot number. The packets contained one form for each of the four supermarkets. Each packet had a form for each Auto Mercado location; if the fish corresponding to that lot number were not sold to one of the Auto Mercado locations then that form was left blank. One copy is kept for Total Seafood, and another copy is sent to Auto Mercado.

We took the seven lot numbers for the reverse recall and attempted to find the corresponding documentation in the binders. Out of the seven lot numbers on three Sales Record Fishing Forms that we used, only one lot number was able to be traced. Through our comparison of the forms from the receiving center and the forms used by Total Seafood, we noticed that many lot numbers appeared to be copied incorrectly. We also noticed that Total Seafood does not utilize the dispatch numbers contained on the Sales Record Forms from the receiving center.

We noticed that fish mass was recorded differently on the two types of documentation. On the Sales Record Forms collected from the receiving center, the mass recorded represents the mass of an entire batch of fish. On the forms completed by Total Seafood, the mass documented only indicates the final weight bought by Auto Mercado. In addition, we learned from Mr. Martinez that only approximately 40% of the original mass remains after fileting. This difference in masses recorded on the documentation makes it difficult to determine how much of the fish Auto Mercado buys from Total Seafood.

On this visit, we learned two important details about the partnership between Total Seafood and Auto Mercado. First, we learned that Auto Mercado buys fish from Total Seafood because they are of higher quality, not because they are responsibly-caught. Auto Mercado will pre-order this fish from Total Seafood because it is fresh and never frozen. Mr. Martinez told us that Auto Mercado "is a bad client" because they buy so little fish from Total Seafood. He thinks that Auto Mercado should care more about responsibly-caught fish. Second, the responsibly-caught fish that are not bought by Auto Mercado are no longer distinguished from other products and are sold to local markets. No traceability documentation is maintained for the responsibly-caught fish that are not sold to Auto Mercado. Any remaining fish are kept in a freezer used to store all products until they are sold elsewhere.

We asked Mr. Martinez about his thoughts on the traceability system. He mentioned that he would prefer a computer-based system because it would be easier to use. Additionally, he said it would increase the consistency and accuracy of the traceability records. His main recommendation for the Receiving Record Form was to replace the "Classification" column with a column for the temperature of each fish. In this way, this form could serve a dual purpose as both a traceability and quality control form. Mr. Martinez advised that recording the temperature of just one fish on the form was not enough. He also stated that he thinks the temperatures are not recorded accurately on the Receiving Record Forms from Recibidor de Mariscos Don Chino because they are too similar to each other. Mr. Martinez's emphasis on temperatures conveyed to us that Total Seafood takes quality control very seriously. Overall, Total Seafood wants recognition for their participation in this program from MarViva and consumers.

Mr. Martinez conveyed to us that Total Seafood is very proud of their program, and that it is the first of its kind in Costa Rica. In the future, they hope to work with Auto Mercado to use this program to increase profits for responsibly-caught fish. Generally, he thought that there should be more publicity and advertising for responsibly-caught fish on television and radio. In addition, he mentioned that responsible fishing will become more popular in the coming years, since net trawling licenses will be expiring soon due to the recent government ban on trawling nets.

Mr. Martinez continually asked us if everything was in order as we looked through the documentation. He appeared attentive and prepared to answer our questions. Mr. Martinez told us that MarViva is a highly respected organization. We observed this during our visit because it became clear that employees at the center seemed overly eager to impress us. He also explained to us that, in his opinion, "MarViva needs to show more muscle in the regulation of fish here". We were able to gather important information during this trip that provided valuable insight to aid us in making our recommendations to MarViva.

5.4.3 Auto Mercado

The next step in the reverse recall was to visit the four Auto Mercado locations that buy fish from Total Seafood. We coordinated visits to the locations with Hernan Fonseca Román, the head meat coordinator for Auto Mercado. The stores we visited were located in the Multiplaza Mall, Guachipelín, Guácima, and Alajuela. In order to make the best use of time, we split into two pairs. The first group visited the Auto Mercado locations in Multiplaza, Guachipelín, and Guácima, which are located close together. The second group visited the Alajuela location. The interview questions used to prompt our discussions during our meetings can be seen in Appendix_10.

At the Multiplaza location, we were greeted by the manager of the meat department. He was able to quickly locate and present the traceability forms. The forms were neatly organized in a folder; however, we were unable to locate the lot number from Total Seafood. We then conducted an interview to find out what employees of Auto Mercado do with the fish when it arrives at the supermarket. We were told that all fish are kept in a refrigerator for up to two days until they are sold. Any fish that is deemed to be of poor quality according to guidelines published by Auto Mercado is sent back to the distribution center. Responsibly-caught fish are not stored separately, nor are they identified as responsibly-caught to consumers. We were also informed that the traceability documentation received from Total Seafood is not passed along to consumers when the fish is sold. When we asked what occurred when a recall needed to be implemented, we were told that the distributor is called. This distributor is then responsible for the remainder of the recall. We then asked the manager for his thoughts on responsible fishing and the traceability program. He said that he did not think that traceability was beneficial because he does not believe that there is a market for responsibly-caught fish.

In Guachipelín we went to the meat department and spoke to the manager, who then brought us the traceability forms. We were able to locate the lot number from Total Seafood and proceeded with the interview. We found that fish are kept in boxes in a walk-in refrigerator for three to five days. Responsibly-caught fish are not separated from other products nor labeled as such when they are sold. This location had a book of guidelines on file that detailed the criteria for high quality fish. Poor quality fish, as deemed through visual inspection, are

returned to the distribution center. When we asked the manager about his thoughts on the documentation, he said that he was indifferent as they do not use the documentation for anything. He also said that he does not have control over what is purchased from the processing plant. He explained to us that in the event of a recall, the distributor is called. The distributor is then expected to carry-out the remainder of the recall.

At Guácima, we were unable to locate the manager of the meat department. We were instead directed to the general manager of the store. He informed us that traceability information is not kept on file at the store and that we would need to contact Mr. Román, the head meat coordinator of all Auto Mercado locations.

At Alajuela, we contacted the manager of the meat department. The manager brought a binder of traceability documentation to one of the workers in the department. This man approached us and introduced himself as the second-in-command of the meat department and informed us that he could answer our questions. The team then analyzed the documentation that was provided by the manager. These documents were forms received from Total Seafood. We were able to locate the lot number traced from Total Seafood. We did notice that forms were ordered by date and appeared to have all necessary information on them. Upon speaking with the butcher, we learned that all of the fish at this location were responsibly-caught and received from Total Seafood. According to the butcher, the quality of the fish is determined by observing physical characteristics such as color. Additionally, they take the temperature of the fish upon receipt and if the temperature is not between 0-5^{o} Celsius, it is not accepted. The fish that are bought are kept in a glass display case separate from all other meat and imported shellfish for a maximum of two days. He explained that if a fish needed to be traced backwards, they would handle it on a case-by-case basis. If the reason for the recall was the fault of the distributor then they are called. The distributor is then responsible for implementing the recall. If the supermarket is at fault, then they take responsibility and reimburse the consumer. The only traceability information about the fish is maintained in the paperwork from Total Seafood. A computer-based system is utilized at the supermarket, but is used solely for sales. We noted that the labels on the fish in the display contained the scientific name of the fish but had no indication that the fish was caught responsibly. When we asked the butcher if he thought it would be important to mention this on the labels, he said that he did not think it was important to the consumers. He said that customers buy the fish solely for the quality and not because it is responsibly-caught.

5.5 Database

We designed a database system for MarViva using Microsoft Excel in an effort to improve the accuracy and efficiency of the traceability program. We developed this Excel database using Visual Basic Application with help from contextures.com (Contextures Inc., 2014). We set up a

temporary form using Google Documents to begin entering the traceability data during this development process. After the Excel database was completed, we transferred all of the information compiled in the Google Document to the new database.

The design of this database includes data fields that correspond to spaces on the forms, seen in Figure 21. One feature provided in the database design was an option to filter information according to a variety of categories. These categories include the receiving center, fisherman, and type of fish. The filter option allows users to generate correlations between different sets of information collected from traceability forms. Additionally, the values highlighted in red include a drop-down menu from which a response can be selected. The boxes containing "#N/A" are automatically filled in when an option is selected from the drop-down menu corresponding to their category. This auto-fill feature allows users of the database to avoid recording certain pieces of repetitive information. For example, there is a specific INCOPESCA number assigned to each receiving center. On the documentation, this number must be written on each individual form. In the database, however, once the name of the receiving center is selected, this number is filled in automatically. This feature makes the data entry process much more efficient. It is also important to note that the Excel database only contained information from the Receiving Record Forms and was not linked to the Sales Record Forms.

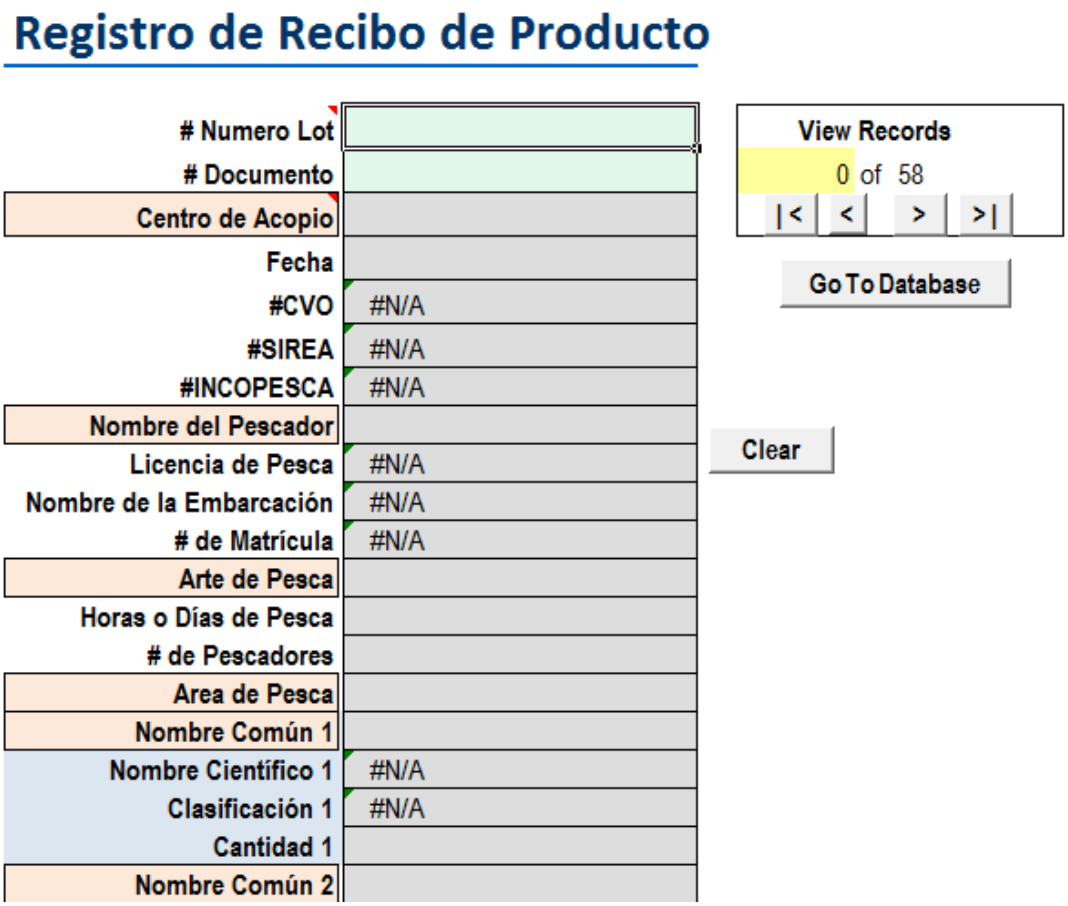

Figure 21. Traceability document created in an Excel database

While finalizing the Excel database, we continued to communicate with MarViva's information technician, Oliver Schulze. We discussed with Mr. Schulze what options we had for creating an online database and what this database would entail. He suggested developing a web based traceability application. We communicated with Mr. Schulze that we were seeking a program that could be used to input and view all information from traceability forms. This application was designed so that, in the future, it could be used directly by employees of the receiving centers to electronically input their traceability information. The data that we entered into the Excel database was transferred to this web based application that Mr. Schulze created.

The application designed by Mr. Schulze functions similarly to our Excel document. Each data field corresponds to a space on the Receiving Record Forms. The web app also includes the same auto-fill function included in the Excel database. In addition to these features, if the user types the first few letters of a previously-recorded response in the yellow boxes, they will be prompted to select it. This design also connects the Receiving Record Forms to the Sales Record Forms so that users can view and input all of this information collectively. A screenshot of the web app can be seen in Figure 22.

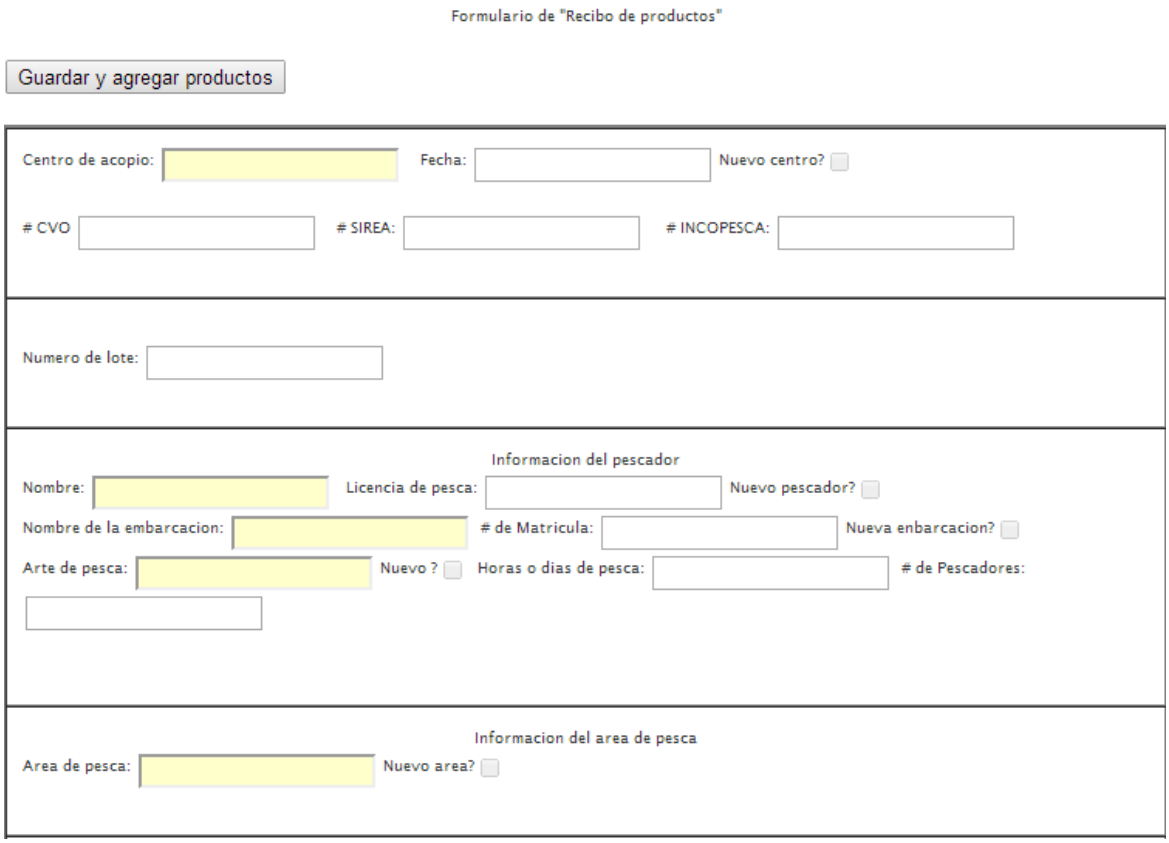

Figure 22. Web Application (Credit: Oliver Schulze)

To demonstrate how the filter option in the database can be used to analyze traceability information, we generated some example figures using the collected data from approximately 500 Receiving Record Forms. This information would be valuable to the social scientists at MarViva for their research in marine biology and fishing demographics. They can use the filter function to obtain specific data and create analyses with this information. Our first example figure shows the mass of fish processed by both receiving centers over the past seven months, as seen in Figure 23.

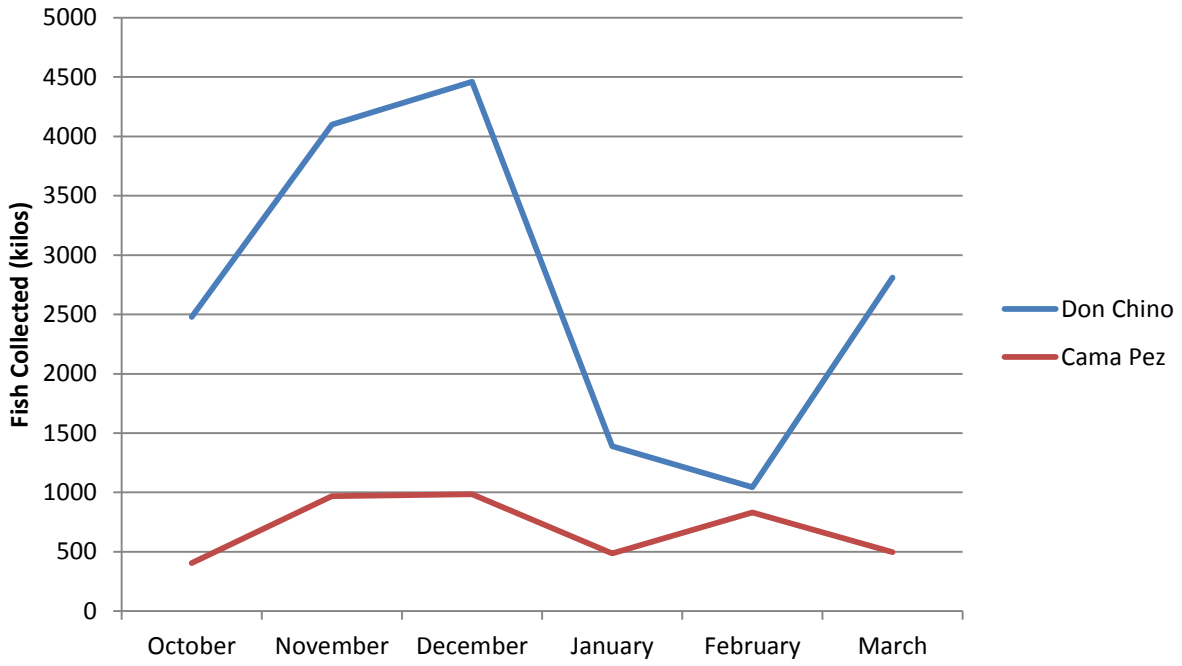

Figure 23. Comparison of fish sold to the two receiving centers in Costa de Pájaros during the October 2013 to March 2014 period.

Our next example figure shows the mass (in kilograms) of corvina (seabass) species caught in each of the individual fishing areas since the traceability program was implemented. This graph can be seen in Figure 24. The information depicted in this figure would also be helpful to social scientists at MarViva who are interested in the demographics of the fishing areas.

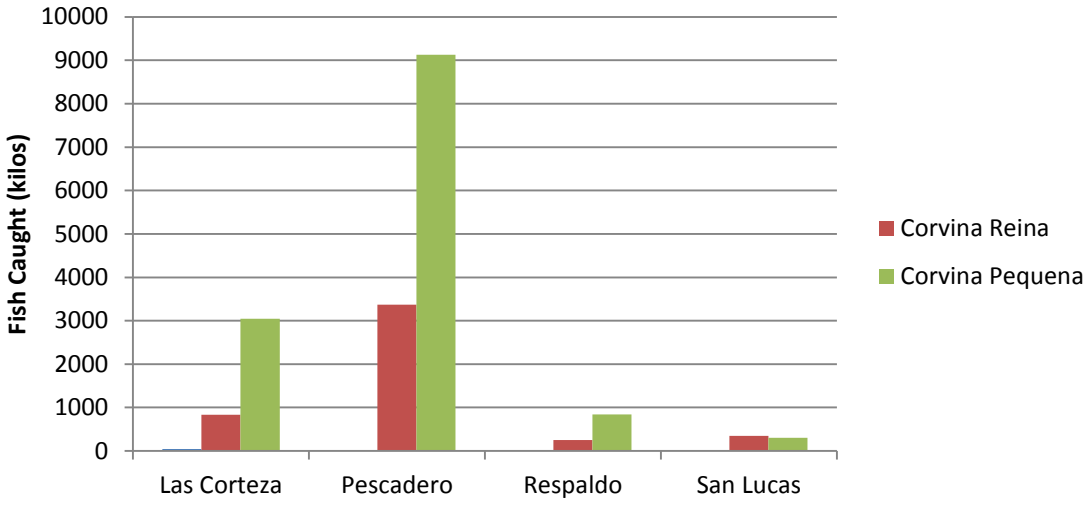

Figure 24. Comparison of amount of kilograms of Corvina (sea bass) species caught in main fishing areas during the period of October 2013 to March 2014

Chapter 6: Analysis and Recommendations

The following section contains an analysis of our research and field work findings. We begin with an examination of the interviews conducted in Palito. We then discuss our overall findings from our field work at the receiving centers in Costa de Pájaros. Lastly, we end with our recommendations for how to improve MarViva's traceability system. These recommendations include ideas for improving the existing system, suggestions to incorporate new technologies that may be beneficial to MarViva, and recommendations for future research.

6.1 Palito

6.1.1 Interviews with Fishermen

After interviewing the fishermen in Palito, it was clear that they did not have an adequate understanding of how the supply chain functions. Few fishermen that we interviewed knew about the traceability program, even those who were members of ASOPECUPACHI. In addition, those who attended MarViva's traceability presentation could not give detailed answers to our questions. Many fishermen said that they thought the program was important but could not elaborate further. The president of ASOPECUPACHI believed that every fisherman was familiar with the traceability system, which indicated a lack of communication within the organization.

From our interviews with the fishermen, we learned that many of them were invested in fishing responsibly for personal, rather than material, reasons (see Figure 16). While many mentioned that they would like to earn more money for their fish, they also said that they wished to preserve the environment for the future of their children. Additionally, none of them knew where their fish went after the receiving center; half of them assumed their catches are sold somewhere in Puntarenas (Figure 15). Due to their lack of knowledge, the fishermen have little influence in the supply chain. With more knowledge, fishermen could seek more buying options that could potentially give them a better price for their catch. They do not currently have the education or means to seek out other receiving centers. None of them, however, seemed concerned about this. Making sure that the fishermen are knowledgeable about the supply chain and how the traceability system functions within it is an important part of the educational process. When fishermen understand this, they will know how the information is being passed along. Additionally, they will be able to recognize that when the system is not functioning, it results in consumers not knowing that their fish were caught responsibly. This will show them that if the system is not working, the economic benefits of fishing responsibly will not be passed down to them. Knowing that their incomes are dependent on the system operating properly will motivate them to be more proactive and involved in ensuring its functionality.

6.1.2 Interview with Abelardo Brais

Our interview with Mr. Brais left us with strong impressions. He stressed that he wanted to bring benefits to the community of fishermen and that he thought that the traceability program was very important. Near the end of the interview, we noticed that the attitude and demeanor of Mr. Brais began to change. Instead of responding to us, he began speaking directly to our sponsor Randall Viales, who accompanied us on the interview. It appeared to us that he was originally telling us what he thought we wanted to hear and then directing his true thoughts to our sponsor.

We learned from the social scientist as well as several fishermen on the island that many fishermen are indebted to Mr. Brais. We were told that he lends equipment to the fishermen and even pays for medical and educational bills for their families (Elizondo, 2014). While at the receiving center for our interview, we noticed that there were many fishermen entering the receiving center and leaving with motors and other fishing equipment. From this observation that Mr. Brais lends fishing equipment to the fishermen, we were given the impression that they are expected to sell their catch to him.

Mr. Brais will be a challenging partner in the traceability program due to his strong viewpoints on his role in the system. While he was cooperative with us, he was combative and aggressive toward our sponsor. For this reason, he will continue to be difficult to work with. He also made it clear that he views himself an important beneficiary of the community. From our observations of the fishermen around the center, we noticed that Mr. Brais is very ingrained in the community and therefore he will be difficult to bypass in the implementation of a traceability system.

6.2 Costa de Pájaros

6.2.1 Receiving Centers

From our field work at the receiving centers of Costa de Pájaros, we concluded that, overall, the centers were in compliance with the traceability program. The workers in charge of completing the paperwork were knowledgeable about the program and had specific suggestions on what needed improvement. Through the lot number activity, we observed that both employees understood how to generate a lot number. From this observation, we concluded that many of the problems with the program lie with the program itself, and not with improper practices by the receiving centers. Although we found that the workers of the receiving centers are following the program, we did take note of some problems with their procedures. From the self-evaluation form of one of the receiving centers, we learned that the employee does not complete the forms until several days after the receipt of the fish. This calls into question the validity of some of the information on the form, specifically the temperature recordings. If the

forms are completed days later, then it would be impossible to maintain an accurate temperature record. Additionally, we noticed that the recorded temperatures on the traceability forms from that receiving center were consistently the same at time of receipt, storage of fish, and time of sale. This fact, combined with the delayed completion of the forms, indicated to us that the recorded temperatures were not accurate.

During our field work at the two receiving centers, we observed some differences in the ways that the receiving centers operate. At Recibidor de Mariscos Don Chino, there were many fishermen bringing their catches to the receiving center for processing. Comparatively, there were very few fishermen at Cama-Pez de La Costa. The Cama-Pez de La Costa receiving center is relatively small compared to Recibidor de Mariscos Don Chino's center and it has only been in operation a few years. Additionally, the traceability forms we collected show that Cama-Pez de La Costa has had a much smaller influx of fish than Recibidor de Mariscos Don Chino's. This is evidenced in Figure 23 in the Results section of this report. It can be seen that overall, Recibidor de Mariscos Don Chino processes significantly more fish than Cama-Pez de La Costa. For these reasons, it is possible that there will be more difficulties in implementing the traceability program with Recibidor de Mariscos Don Chino, as the personnel will have to change the same habits that they have been practicing for decades. Cama-Pez de La Costa, however, is still a rather new enterprise and would have less difficulty adapting. MarViva will need to be aware of these differing situations when making decisions regarding traceability at these receiving centers.

6.3 Simulated Reverse Recall

6.3.1 Recibidor de Mariscos Don Chino

As mentioned in the Results chapter, the employee at Recibidor de Mariscos Don Chino was able to produce all documentation selected for the simulated reverse recall. This documentation was a direct copy of the documentation we used for the recall so it contained all of correct information. From this, we concluded that in the event of a recall, workers at Recibidor de Mariscos Don Chino would be able to provide accurate traceability information to complete the recall.

6.3.2 Total Seafood Distribution Center

The second step in our reverse recall took us to the Total Seafood Distribution Center. Unfortunately, we were only able to locate one out of the seven lot numbers that we attempted to trace in the documentation. This showed that, despite Total Seafood's detailed records, many pieces of information were incomplete or recorded incorrectly. It is possible that errors occurred when lot numbers were copied from Sales Record Forms to Total Seafood's documentation. Mr. Martinez mentioned that paper forms make it difficult to identify the

origin of mistakes. For this reason, he recommended adopting an electronic system. Additionally, the fact that no traceability information is recorded for the fish that are sold to local markets means that the system is often not being continued after the fish leave Total Seafood. Any batches of fish that are not sent to Auto Mercado are impossible to trace. This indicated a potential reason why many of the lot numbers we attempted to trace were unable to be located in Total Seafood's documentation.

We also analyzed the information obtained at Total Seafood regarding the masses of fish that are received and sold. Through our examination of this documentation we found the mass of the whole fish is recorded when it is received, whereas only the mass of the fileted fish is recorded when sold. This makes it difficult to identify how much fish is actually sold from Total Seafood to Auto Mercado. To understand this discrepancy further, we made calculations comparing the mass of fish that Total Seafood purchased from Recibidor de Mariscos Don Chino in comparison to the mass of fish that was sold to Auto Mercado. We took into account that only approximately 40% of the fish is able to be sold after fileting. These calculations can be found in Table 1. The masses used in these calculations were taken from the records of the one lot number we were able to trace. Based on these calculations, we concluded that the mass of fish was reasonable for Corvina pequena (small seabass) but not for Corvina reina (large seabass). Due to this analysis, we determined that the mass of fish may have been copied or interpreted incorrectly.

Table 1. Comparison of approximated masses of batches of fish before and after fileting

Receiving Form Information Lot Number: 01-06414-05-01			
Species	**Mass before Filet (kg)**	**Mass After Filet (kg)**	**Mass Sold to Auto Mercado (kg)**
Corvina Reina	33	13.2	12.4
Corvina Pequena	12.4	4.96	20.3

Throughout our visit, we gained the overall impression that the employees were anxious and eager to confirm with us that everything was in order. Mr. Martinez emphasized to us that MarViva has a very good reputation in the eyes of the workers. Given his perspective, it is likely that Total Seafood will be very willing to continue to collaborate with MarViva on the improvement of the traceability system.

We further concluded that a partnership with Total Seafood would be beneficial due to the approaching expansion of the responsibly-caught fish market. Mr. Martinez informed us that licenses for trawling nets will begin to expire soon. For this reason, the fishing industry will be forced to switch to responsible methods in the future to avoid breaking the law. He said that if Total Seafood desires to capitalize on the increasing market for responsibly-caught fish, the company will need to do so in the near future. He mentioned many times during our conversation that he wants Total Seafood to be the first in this market.

Despite the initiative of those at Total Seafood, there is a central issue of a lack of cooperation from the administration of Auto Mercado. We learned that Auto Mercado currently does not buy the fish because they are responsibly-caught, but rather because they are of higher quality. While Auto Mercado has a recordkeeping system in place, they do not use this system to prove that fish were caught responsibly. Mr. Martinez expressed his dissatisfaction that Auto Mercado is not marketing responsibly-caught fish to the upscale consumer market. If Auto Mercado were able to recognize this opportunity, Total Seafood would be more enthusiastic to work with them.

In addition to the information discovered about the partnership between Total Seafood and Auto Mercado, we encountered inconsistences in the system used by Total Seafood. These errors included mistakes in mass records as well as others created through the use of handwritten forms. We concluded that these errors make it difficult to fully analyze how much fish Auto Mercado buys from Total Seafood. This issue would need to be further examined in the future.

6.3.3 Auto Mercado

From our visits to the Auto Mercado supermarkets, we determined that product quality was the highest priority for this company. The responsibly-caught fish are only purchased for their quality and not how they are caught. Department managers expressed to us that they do not believe there is a market for responsibly-caught fish; they do not think that consumers care about it. We discovered in a discussion with our sponsor, Mrs. Morales, that the upper management at Auto Mercado has yet to capitalize on the responsibly-caught fish market. This could imply that the lower management, such as the employees we spoke to during our interviews, was unaware of this opportunity. Due to this, we believe that there will be a need for increased communication between personnel of Auto Mercado to realize that there is a consumer demand for responsibly-caught fish. It will have to be proven that responsibly-caught fish can be marketed in a way that will engage consumers and be beneficial to Auto Mercado. We also believe increased education for the upscale consumer is needed so that they understand the importance of responsibly-caught fish in comparison to other products.

Educating the personnel will help in marketing the responsibly-caught fish to consumers as well as develop a greater demand for the product.

While three of the four Auto Mercado locations we visited had traceability information on file, it was not being utilized. From this fact we determined that the flow of information in the supply chain is not followed through to the consumers.

6.4 Recommendations

6.4.1 Increased Education

Through our field work we found flaws throughout the system due to a lack of education amongst all supply chain constituents. We observed that some participants of our study appeared uninformed of the overall concept of traceability and how the supply chain functions, while others did not know how to properly use it.

The issue needs to be addressed that most fishermen do not know about the concept of traceability, specifically the purpose or benefits of the program. We believe the most effective method of educating the fishermen about traceability and its potential benefits for the community would be through more information sessions. We noted during our interviews that the fishermen care very much about preserving their island, increasing the quality of life for their families, and receiving recognition for their efforts. We also noticed that fishermen seemed excited about learning about the system. We observed on our first trip that during the presentation many were actively interested and engaged. We believe that MarViva can capitalize on this enthusiasm in the community. Additionally, showing the fishermen how traceability can help preserve their fishing areas for the future would be a strong motivator for them. If MarViva connects the traceability program to the fishermen on a personal level, it is likely that fishermen will feel more dedicated to the program. With this in mind, we recommend further information sessions for the fishermen and other members of the community that focus on what the traceability system is, whom it benefits, what benefits it has, and why their participation matters. This way the fishermen can become more comfortable with and involved in the program.

In our conversations with the fishermen of Palito, we also observed that many of them were unable to provide details about their role in the supply chain. Most fishermen knew that their fish were sold after they delivered them to the receiving center, but few knew where. From this, we concluded that the fishermen were unaware about how the supply chain operates. The fishermen did not seem concerned by their lack of information, but instead seemed comfortable with their answers. For this reason, we encourage increased education about the supply chain for the fishermen to allow them to become knowledgeable of their options. If they become better informed about the how the supply chain functions, they might be willing to

take the initiative to seek alternative options to sell their fish. The completion of the receiving center that is currently under development would help establish a more competitive market for fish in Palito by giving the fishermen another selling option. Different buyers may be able to offer the fishermen better prices for their fish, resulting in more sustainable and prosperous livelihoods for them.

Beyond the fishermen, we also recommend increased education for the workers at the receiving centers. For instance, in the documentation at one receiving center, we found that the temperature is always recorded at the same value. When we asked Mr. Martinez for his opinion about this, he responded that he agreed with our suspicions that this information was falsely reported. In our meeting with the employee responsible for the traceability documentation at this center, however, the participant was very open about the process used to complete paperwork there and did not appear to be hiding any incorrect practices. Due to this openness, we noted that the problem does not have to do with careless work, but rather a lack of knowledge of how to properly record temperatures. We further observed other mistakes on the documentation, such as having the same person completing and verifying forms as well as incorrectly deriving lot numbers. All of these issues can be remedied with increased education on how to properly use the traceability system.

Lastly, we recommend increased education for the workers of Total Seafood regarding how to use the traceability system. While reviewing the documentation, we noticed that many lot numbers were transcribed incorrectly. For this reason, only one of the seven lot numbers used in our recall could be traced. Education for the workers that complete the traceability documentation may help to identify why so many systemic mistakes are made.

6.4.2 Changes to the Current Documentation System

Changes to Traceability Forms

During our visit to Costa de Pájaros, we received feedback from the employees of the receiving centers responsible for completing the traceability documentation. From this feedback, in addition to feedback from Mr. Martinez at Total Seafood, we were able to formulate recommendations that would generate a more efficient, intuitive, and user-friendly version of the Receiving Record Form and the Sales Record Form. Specifically, we recommend to:

1. Switch from the Julian calendar to a standard calendar format
2. Eliminate repetitive information about receiving center and fisherman from the forms
3. Adjust the amount of space dedicated to “Captured/Delivered Product”
4. Replace the “Classification/Size” and “Scientific Name” columns with a “Temperature” column
5. Eliminate the dispatch number from Sales Record Forms

Using the feedback obtained, we drafted a new version of the Receiving Record Form that takes these suggestions into account. Additionally, we drafted a new version of the Sales Record Form. These forms are available in Appendix_11 with an explanation of the changes made in accordance with these recommendations. Also included in Appendix_11 are copies of Reference Charts that we created that compile all repetitive information that was removed from the traceability forms. This would allow for receivers and distributors to have this data easily accessible without repeating it on every traceability form. An explanation of these changes can be found in Appendix_12.

We recommend that MarViva consider the potential use of these new forms as a means of simplifying the traceability system. We believe that the time and effort saved by using these new forms would result in more thorough and accurate archival. We also believe that taking into consideration the suggestions of those who fill out the forms will incentivize them to increase their efforts to complete documentation more accurately. From the conversations we had at the receiving centers, we were able to see that traceability is a priority but can be neglected due to the inefficiency of the process. It is necessary to eliminate carelessness and optimize the process as much as possible.

Clarification of Procedure Documents

During our revision of the procedure documents distributed by MarViva, we noted elements that could be improved to make the documents easier to read and interpret. First, we noted and corrected minor spelling and grammatical issues. We then examined the content of the document, searching for sections that appeared convoluted, and attempted to simplify the wording. Additionally, the procedure documents were modified to correspond to the new traceability forms that we had created.

These documents play an important role in understanding the technical aspects of the traceability system. They enable constituents of the supply chain to have a reliable reference for how to use the traceability system. If these documents are unclear or difficult to understand, they might be neglected, misinterpreted, or ignored by constituents. If the documents are not used, participants may miss important details of traceability processes which could lead to inaccurate documentation. To avoid these possible issues, we modified the documents in two significant ways: (a) we simplified the content and shortened the length of the writing, and (b) we reformatted the documents and added additional visual aids. We believe that these changes will make supply chain constituents more willing to use the documents in an effort to ensure they follow the traceability protocol. The final versions of the four procedure documents are listed in Appendix_13.

6.4.3 Implementation of an Electronic Database

Currently, the traceability program is still being piloted. In this program, the only method for recording traceability information is the use of paper forms. During our field work, we asked supply chain constituents for their opinions about converting to an electronic database to document traceability information. Members of the receiving centers all advised that an electronic system would make completing documentation simpler and more efficient. Mr. Martinez from Total Seafood explained to us that an electronic system would be most beneficial not because it is faster, but because it reduces the room for human error. We firmly believe that converting to an electronic system will help lower or even eliminate mistakes that occur during the record keeping process. Overall, everyone that we interviewed had the desire to switch to an electronic system. They also said that they had the computer access to do so. With the knowledge that all participants have access to the technology needed to implement an electronic system, we can say that cost of additional materials would not be an issue. Additionally, the format of the online system is similar to the format of the paper traceability forms so personnel would not need extensive training to convert to this system. We strongly encourage MarViva to pursue this option, because an online database would make the information more accessible. More importantly, the electronic system would also allow for employees of MarViva to analyze the collected data for their own research.

6.4.4 Incorporation of New Technologies

Since we found that all of the constituents had a clear desire to convert to an electronic system, we investigated additional alternatives beyond the electronic database explained above. Implementation of the following technologies would remedy the same problem of human error that is also removed through the use of an electronic database. These technologies would provide additional marketing and communication benefits. This is achieved by informing consumers of where their fish came from as well as increasing information exchange amongst supply chain constituents.

The Use of Two-Dimensional QR Codes

QR codes are a widely used tool that could be applied to the supply chains observed in our research. These can be used to document both traceability and quality control information for supply chain constituents as well as consumers.

Information from a Receiving Record Form from Cama-Pez de La Costa was input into a QR code generating website (www.qrstuff.com) to demonstrate how QR codes are used. The explanation of this process is included in Appendix_14.

The largest issue with the use of QR codes, however, is likely to be internet access. We were unable to confirm whether or not fishermen on Chira Island and in Costa de Pájaros have access

to the internet, computers or printers. In this case, generating QR codes would be the responsibility of the receiving center. This would be an easy transition because the receiving centers are currently responsible for all of the paper traceability documentation.

We understand that the complete replacement of the paper forms and conversion to a QR Code system may not be immediately feasible. If not as an entirely new system, the use of QR codes could be useful in documenting times, dates, temperatures, sales, and other time-sensitive information for a fish. For example, some receiving centers do not immediately fill out their documentation when a fish is received. They may not complete this documentation until days later, which means that some of the information will be lost or improperly recorded. A QR code could be generated quickly and easily to record the temperature, date, and sale price of the fish. This code could then be read later during completion of traceability forms.

Our recommendation to MarViva would be to explore the use of QR codes as a way to simplify the traceability system. We believe that switching to a QR code system would reduce human error and increase efficiency. Additionally, information about each individual fish would be more accessible to the consumer. This system would allow for information to travel more easily with each fish, further incentivizing distribution centers and retailers to utilize the system. QR codes could function as an easier and more efficient alternative to paper documentation.

ThisFish

MarViva is the first organization in Costa Rica to contact *ThisFish* to learn more about their traceability system. We contacted Eric Tamm, the director of Marketing and Communications of *ThisFish*, to learn more about the organization's traceability system. The system works to implement various traceability technologies to fulfill the needs of different supply chains. For example, with fisheries that desire to have a unique identification for a batch of fish, *ThisFish* can provide the technology to issue a QR code. Moreover, *ThisFish* can provide unique tags with identification codes for individual fish. The technology provided by *ThisFish* requires a fee. This fee, however, is negotiable and the company informed us that there are grants that can help supplement the cost of the program. At the time of the completion of this report, *ThisFish* is in the process of translating the program into Spanish.

We found that the technologies for *ThisFish*'s traceability program can easily be applied to the artisanal fisheries that MarViva works with. The unique technology provided by *ThisFish* enables consumers to learn more about the product by directly contacting the workers who handled their fish. This advancement in traceability provides the added benefit of marketing the origin of products to environmentally conscious consumers. We suggest that MarViva further communicate with *ThisFish* to not only learn more about this particular traceability program, but also to potentially partner with them in the future.

6.4.5 Future Research

In addition to the four recommendations explained above, we also recommend that MarViva continue research into topics we did not have time to explore. Specifically, we encourage MarViva to study a so-called co-operative (co-op), which is currently under development in Palito. We believe that if the fishermen of Palito work together with the help of MarViva, they could form a co-op system for their own economic benefit. Currently, there is a receiving center partially built and attached to the ASOPECUPACHI headquarters. This facility, however, is still under development. The completion of this receiving center would provide a new opportunity for the fishermen to increase the number of potential buyers of their fish. At present, they have no other option but to sell their fish to Mr. Brais. This lack of competition in the market leaves Mr. Brais in total control over the prices fishermen receive for their catch. Different buyers may be able to offer fishermen better prices, allowing them to make a more substantial income. As a result, a new receiving center would help to create a competitive market so that fishermen would have more control over their incomes.

In addition to the idea of a co-op we recommend further research into the motives of the fishermen in Costa de Pájaros. Unlike Palito, fishermen in this area have the choice to sell to different receiving centers. It should prove useful to speak with responsible fishermen there and ask why they choose to sell to a specific receiving center. Analysis of how this competition among receiving centers has impacted the choices of responsible fishermen could be beneficial in the planning of future receiving centers.

Chapter 7: Conclusion

We determined through our field work that the new traceability program designed by MarViva is not functioning to its full potential. In Palito, increased education is recommended for the fishermen who were unfamiliar with the program and did not know how the supply chain operates. Furthermore, we concluded that increased education for constituents involved in the documentation process would address the frequent human error seen throughout the program.

Our analysis showed that a transition from a paper-based system to an online record keeping database would allow information to be easily stored at each step in the process and quickly accessed if needed. We developed a database in Excel to facilitate this. The information that we entered into the Excel database was transferred to a web application database designed by MarViva's information technician, Mr. Schulze. In the future, the supply chain constituents can use this web application to directly input traceability information. Until such a system can be implemented, however, the redesigned traceability forms will improve efficiency and accuracy.

Our research into new technologies determined that QR codes offer significant opportunities to enhance traceability. Furthermore, the web-based program developed by *ThisFish* could be used by itself or in conjunction with QR codes to greatly improve all aspects of fish traceability. Collaboration between *ThisFish* and MarViva is highly recommended.

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Appendix_1: Receiving Record Form Currently in Use

MARVIVA

Receiving Record N° 00001

Traceability Program for Responsible Fishing

Receiving Center_____ Date _____

CVO _____ # SIREA _____ # INCOPESCA _____

Lot Number _____

Fisherman's Identification

Name: _____ Fisherman License:_____

Name of the boat: _____ Boat License# _____

Fishing Gear: _____ Fishing Hours or days: _____ # Fishermans: _____

Fishing Area Information

Fishing area_____

FAO Fishing Zone _____ 77 _____ Authorities: ____INCOPESCA / SENASA_____

Product Description

	Common Name	Scientific Name	Classification	Quantity	
1					kg.
2					kg.
3					kg.
4					kg.
5					kg.
6					kg.
7					kg.
8					kg.
9					kg.
10					kg.
11					kg.
12					kg.
13					kg.
14					kg.
15					kg.

Product Temperature

Receiving:_____°C Storage _____°C Dispatch_____°C

Receiving:_____°C Storage _____°C Dispatch _____°C

Responsible Name_____ Signature _____ Date _____

Verifier Name_____ Signature_____ Date_____

D-02-CR-F-01 Ver 1 (Jun 2013)

Appendix_2: Community Fishing Monitoring Form Currently in Use

MARVIVA

Community Fishing Monitoring N° 00001

Traceability Program for Responsible Fishing

Receiving Center: _____ Date: _____

Lot Number: _____

Fish Size information

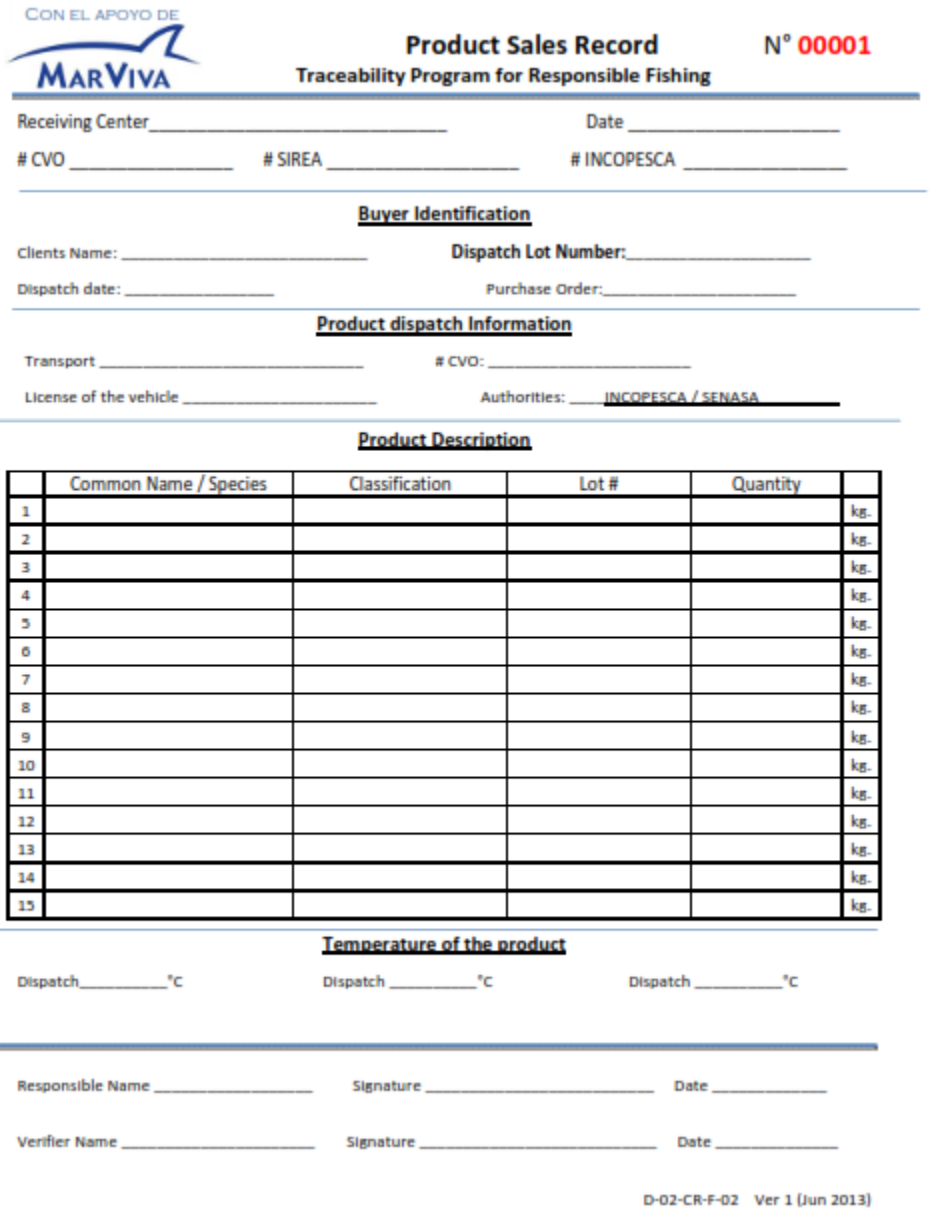
	Common Name	Size (mm.)		Common Name	Size (mm.)
1			31		
2			32		
3			33		
4			34		
5			35		
6			36		
7			37		
8			38		
9			39		
10			40		
11			41		
12			42		
13			43		
14			44		
15			45		
16			46		
17			47		
18			48		
19			49		
20			50		
21			51		
22			52		
23			53		
24			54		
25			55		
26			56		
27			57		
28			58		
29			59		
30			60		

Responsible Name _____ Signature _____ Date _____

Verifier Name _____ Signature _____ Date _____

D-02-CR-F-03 Ver 1 (Jun 2013)

Appendix_3: Product Sales Record Form Currently in Use



CON EL APOYO DE

MARVIVA

Product Sales Record N° 00001

Traceability Program for Responsible Fishing

Receiving Center_____ Date _____

CVO _____ # SIREA _____ # INCOPESCA _____

Buyer Identification

Clients Name: _____ **Dispatch Lot Number:**_____

Dispatch date: _____ Purchase Order:_____

Product dispatch Information

Transport _____ # CVO: _____

License of the vehicle _____ Authorities: ____INCOPESCA / SENASA_____

Product Description

	Common Name / Species	Classification	Lot #	Quantity	
1					kg.
2					kg.
3					kg.
4					kg.
5					kg.
6					kg.
7					kg.
8					kg.
9					kg.
10					kg.
11					kg.
12					kg.
13					kg.
14					kg.
15					kg.

Temperature of the product

Dispatch_____°C Dispatch _____°C Dispatch _____°C

Responsible Name _____ Signature _____ Date _____

Verifier Name _____ Signature _____ Date _____

D-02-CR-F-02 Ver 1 (Jun 2013)

Appendix_4: Interview Questions for the Fishermen of Palito

Interview Questions for Fishermen in Palito

We are students from Worcester Polytechnic Institute in the United States. We are working with The MarViva Foundation to learn more about the distribution of responsibly-caught fish in Palito. Our objective it to assure that the proposed traceability system is easy and useful. We invite you to participate in our study. This study is voluntary. Your responses will remain anonymous, but the results of this study could be published by MarViva or in a report for the university.

1. For how long have you been fishing?

   _____

2. How often do you fish?

   _____

3. What types of fish do you catch?

   _____

4. How much fish do you catch during a normal week?

   _____

5. What do you do with the fish you catch?

   _____

6. Who do you sell your fish to?

   _____

7. How often do you sell to this person?

   _____

8. What do you think this person does with the fish?

   _____

9. Do you wish there were more people you could sell to?

   _____

Thank you. Now we have some more questions. Please don't worry if you can't answer any of the following questions.

10. Are you part of a fishing association in the area?

    - ☐ Yes
    - ☐ No

    If so, which one?

    - ☐ ASOPECUPACHI (Association of Fishermen in Palito)
    - ☐ ASOMM (Association of Fishermen in Montero)
    - ☐ None
    - ☐ Other: _____

11. Have you attended any information sessions about fishing practices (from MarViva or other organizations)?
    - ☐ Yes
    - ☐ No
12. Do you know about the traceability program that has been proposed by MarViva?
    - ☐ Yes
    - ☐ No
13. How did you learn about the traceability system?
    - ☐ MarViva
    - ☐ ASOPECUPACHI / ASOMM
    - ☐ Your family or other fishermen
    - ☐ Other Organization: _____
14. ¿Do you think the traceability system is important to your community and can improve your livelihood??
    - ☐ Yes
    - ☐ No
    - ☐ Somewhat
15. What was your impression of the traceability system after the presentation?

    _____
    _____
    _____
    _____

16. Do you see any advantages or disadvantages to the traceability system?

    _____
    _____
    _____
    _____

17. After seeing the presentation about traceability, do you think that the traceability system will be able to show that your fish are caught responsibly?

    _____
    _____
    _____

18. How could the traceability system help you?

    _____
    _____
    _____
    _____

19. Do you think there is a benefit (for you specifically) by participating in the traceability system?

_____
_____
_____
_____

20. Why do you want to participate in the traceability system?

_____
_____
_____
_____

Appendix_5: Graphical Representation of Results from Interviews with Fishermen

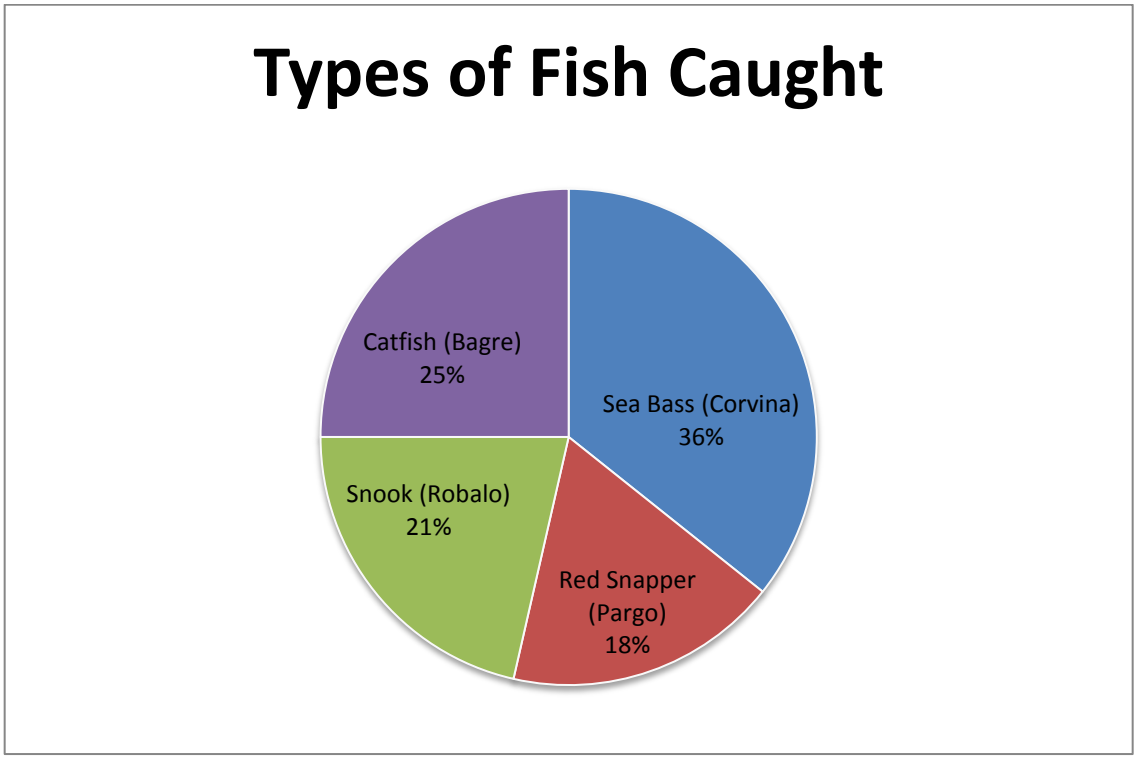


Figure 25. Fish species that the fishermen of Palito catch

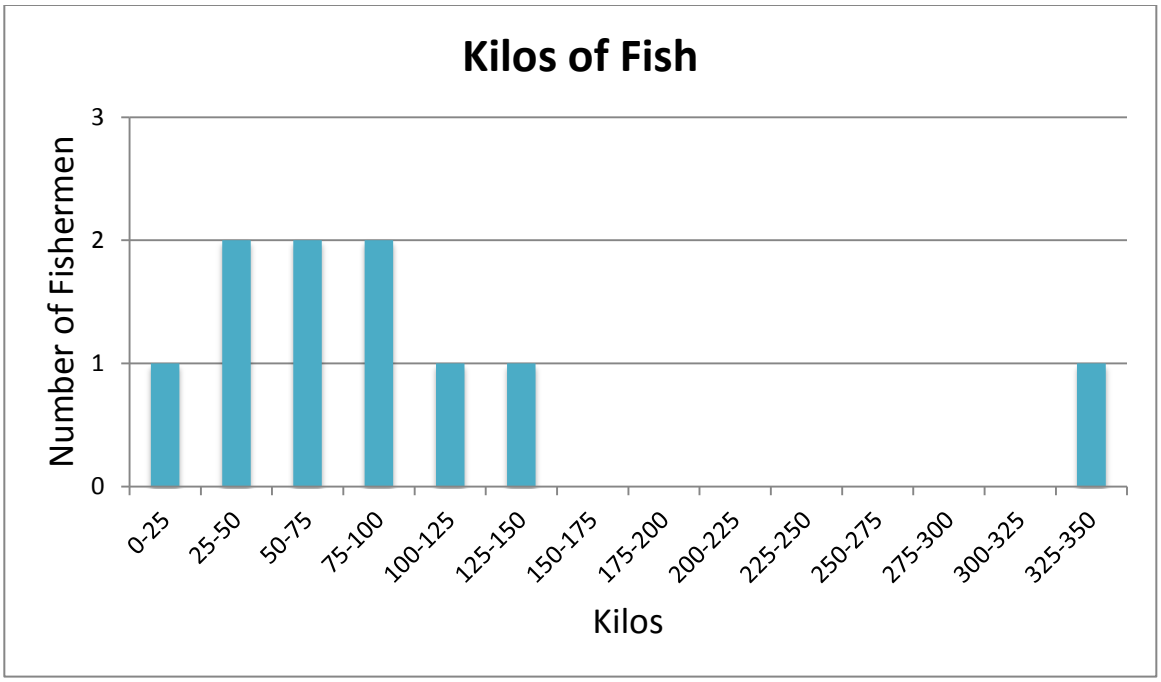


Figure 26. Approximate mass of fish caught by fishermen in a week

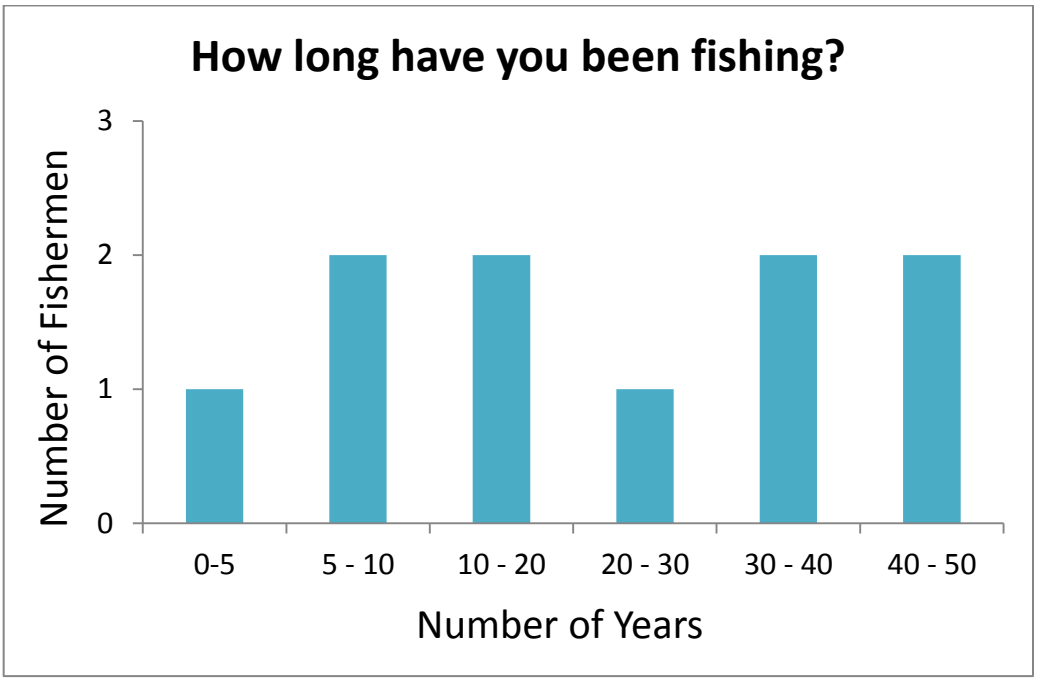


Figure 27. Number of years the fishermen have been fishing in Palito

Appendix_6: Interview Questions for Abelardo Brais

Interview Questions for Abelardo Brais

We are students from Worcester Polytechnic Institute in the United States. We are working with The MarViva Foundation to learn more about the distribution of responsibly-caught fish in Palito. Our objective it to assure that the proposed traceability system is easy and useful. We invite you to participate in our study. This study is voluntary. Your responses will remain anonymous, but the results of this study could be published by MarViva or in a report for the university.

21. For how long have you been receiving fish?

    _____

22. How often do you receive fish from fishermen?

    _____

23. From how many fishermen do you receive fish?

    _____

24. How much fish do you receive on an average day?

    _____

25. What do you do with the fish you receive?

    _____

26. Who do you sell your fish to?

    _____

27. How often do you sell to this person/business?

    _____

28. What do you think this person/business does with the fish?

    _____

29. Do you wish there were more people/businesses you could sell to?

    _____

30. Do you sell responsibly-caught fish as well as fish that was not caught responsibly?

    _____

31. Where do you store the fish? Are they kept separated?

    _____

Thank you. Now we have some more questions. Please don't worry if you can't answer any of the following questions.

32. Are you part of a fishing association in the area?

    - ☐ Yes
    - ☐ No

If so, which one?

- ☐ ASOPECUPACHI (Association of Fishermen in Palito)
- ☐ ASOMM (Association of Fishermen in Montero)
- ☐ None
- ☐ Other: _____

33. Have you attended any information sessions about fishing practices (from MarViva or other organizations)?
    - ☐ Yes
    - ☐ No
34. Do you know about the traceability program that has been proposed by MarViva?
    - ☐ Yes
    - ☐ No
35. How did you learn about the traceability system?
    - ☐ MarViva
    - ☐ ASOPECUPACHI / ASOMM
    - ☐ Your family or other fishermen
    - ☐ Other Organization: _____
36. ¿Do you think the traceability system is important to your community and can improve your livelihood??
    - ☐ Yes
    - ☐ No
    - ☐ Somewhat
37. What was your impression of the traceability system after the presentation?

    _____
    _____
    _____
    _____

38. Do you see any advantages or disadvantages to the traceability system?

    _____
    _____
    _____
    _____

39. After seeing the presentation about traceability, do you think that the traceability system will be able to show that your fish are caught responsibly?

    _____
    _____
    _____

40. How could the traceability system help you?

_____
_____
_____
_____

41. Do you think there is a benefit (for you specifically) by participating in the traceability system?

_____
_____
_____
_____

42. Why do you want to participate in the traceability system?

_____
_____
_____
_____

Appendix_7: Alternative Traceability Forms

TF1:

Product Registration Receipt

Traceability Program for Responsible Fisheries

Receiving Center: _____ Date: ___ ___ /__ ___ /__ ___
(mm / dd / aa)

Lot Number: ___ ___ - ___ ___ ___ ___ ___ - ___ ___ - ___ ___

Fishermen Information

Name: _____ Hours Fished: _____ # of Fishermen: _____

Fishing Area Information

Fishing Area: _____

Product Captured

	Common Name	Scientific Name	Classification	Number(kilos)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Product Temperature

Receiving: _____ °C Storage: _____ °C Dispatch: _____ °C

Receiving: _____ °C Storage: _____ °C Dispatch: _____ °C

Documenter: _____ Signature: _____ Date: ___ / ____ / ___

Verifier: _____ Signature: _____ Date: ___ / ____ / ___

TF2:

Con el apoyo de:
MarViva

Product Registration Receipt

Traceability Program for Responsible Fisheries

Receiving Center: _____ # _____

Name of Fishermen: _____ # _____

Date (Today): ____ ____ /____ ____ /____ ____

Number of Delivery: #_____

Fishing Date

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

January	February	March	April	May	June
July	August	September	October	November	December

Fishing Gear: Line / Rope

Hours Fished: ____ H

# of Fishermen: _____

Fishing Area:

	Common Name	Scientific Name	Classification	Number (kilos)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Receiving Temperature:	Storage Temperature:	Dispatch Number:
_____ °C	_____ °C	_____ °C
_____ °C	_____ °C	_____ °C

Documenter: _____ Signature: _____ Date: ___ / ____ / ___

Verifier: _____ Signature: _____ Date: ___ / ____ / ___

LOT NUMBER: ___ ___ – ___ ___ ___ ___ ___ ___ – ___ ___ – ___ ___

(# of the Receiving Center) (d d m m a a) (# of the Fishermen) (Catch #)

Self-Evaluation Form for Receiving Centers

Anna Civitarese
Lina Tran
Tessa Hulburt
Cy Ketchum

Self-Evaluation Form for Receiving Centers

We are students from Worcester Polytechnic Institute in the United States. We are working with The MarViva Foundation to learn more about the distribution of responsibly-caught fish in Palito. Our objective it to assure that the proposed traceability system is easy and useful. We invite you to participate in our study. This study is voluntary. Your responses will remain anonymous, but the results of this study could be published by MarViva or in a report for the university.

Traceability Program

Do you think the traceability program is important to your community?

☐ Yes ☐ No ☐ I am indifferent ☐ I don't know anything about this program

Please explain: _____

_____

_____

Do you think the forms are too difficult to complete?

☐ Yes – they require too much time to fill out
☐ Yes – they are too difficult to read
☐ Yes – they are too difficult to keep track of
☐ No – I don't think they are difficult
☐ I don't fill out traceability forms
☐ Other: _____

Do you always have time to completely fill out your forms?

☐ Always ☐ Sometimes ☐ Rarely

How much time does it take to fill out each form?

_____ minutes

After you receive the fish, how soon do you fill out the form for it?

_____ (immeditately? # of hours? # of days?)

If you don't complete the forms immediately, what system/information do you use to fill out the forms at a later date?

*Please explain:*_____

How much time would you be willing to spend filling out a form?

☐ 0-5 minutes ☐ 6-10 minutes ☐ 11-15 minutes
☐ Greater than 16 minutes

In your opinion, is it important to have standardized forms?

☐ Yes ☐ No ☐ I am indifferent ☐ I don't understand this question

Please explain:

_____

_____

_____

Documentation

Do you document the number of each type of fish you buy/sell every day?

☐ Always ☐ Sometimes ☐ Rarely

Do you document the number of kilos of fish you buy/sell every day?

☐ Always ☐ Sometimes ☐ Rarely

Do you document the temperature that you store the fish at?

☐ Always ☐ Sometimes ☐ Rarely

Do you continue documentation of the fish while it is in your possession?

☐ Always ☐ Sometimes ☐ Rarely

Do you document the price at which you buy/sell fish?

☐ Always ☐ Sometimes ☐ Rarely

Logistics

Do you know what happens to the fish after it leaves your possession?

☐ Yes ☐ No

Please explain your answer: _____

_____

Your Process

Where do you store the responsibly-caught fish?

_____

On average, how long is the responsibly-caught fish stored before it is sold?

☐ Less than 1 day ☐ 1 day ☐ 2 days ☐ More than 3 days

From who do you buy your fish? Please provide their name and their role (ex: fishermen, receiver, etc.).

Please explain:

Who do you sell your fish to? Please provide their name and role (ex: receiver, business, distributor, etc.)

Please explain:

Additional Feedback

Please describe any additional ideas or recommendations that you have.

Appendix_9: Interview Questions for Total Seafood

Thank you for meeting with us. We are students working with MarViva and we are working on a project with our school to improve the traceability system here. We are here to learn more about how to keep records of fish to help us understand how the traceability system can be improved. We want to make the system as simple and effective for you as possible so we need your help to learn as much about the current process as possible before we can do this.

1. Where do you keep your responsibly-caught fish?

2. How do you keep your fish?

3. What's the maximum time that your fish stay here before selling it?

4. Do you keep your responsibly-caught fish separate from your non-responsibly-caught fish?

5. How do you process and package your responsibly-caught fish?

6. Do you package the responsibly-caught fish with some way to identify that they are responsibly-caught?

7. Where or to whom do you sell your responsibly-caught fish?

8. Do you think a traceability system offers advantages and disadvantages to your business?

9. Do you trust that other constituents of the supply chain use a traceability system properly?

10. Do you receive MarViva's traceability documentation from Don Luis? If yes, proceed to question 11. If no, proceed to question 12.

11. What do you think of MarViva's documentation? Do you like it or dislike it? Why?

12. What do you do with this documentation when you receive it? If they use MarViva's traceability documentation for their process, see table 1. If no, proceed to question 13.

13. Do you use your own traceability system?
    If yes, see table 2. If no, proceed to question 14.

14. If you do not use a traceability system, do you use another system to keep record of your fish?
    If yes, see table 3. If no system at all, see table 4.

Table 1. Follow up Questions if they Use MarViva's Traceability System		
Questions for DWT	**Notes for Us**	**Answers**
Do you have record of _____ lot number?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	Do they know how to look for this information?	
	Do they know what to tell us? Do they know what information is important when performing a recall	
	Notes about filing system	
Can you tell us where you sold	ANSWER	

this batch to?	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Can you tell us from where this batch came from?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do you know the name of the fisherman that caught this batch?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do you know where this fisherman caught this batch?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Can you tell us when you sold this batch?	ANSWER	
	How long does it take to retrieve this information	

	How complete is the information	
	How specific is the information	
Can you tell us to whom you sold this batch to?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Can you tell us the dispatch lot number with this lot number in it?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Can you tell us the truck license number that transported this batch here?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do you pass this information onto Auto Mercado?	ANSWER	
	How complete is the information	
	How specific is the information	
If so, how and in what form?	ANSWER	

	How complete is the information	
	How specific is the information	
Do you think MarViva's traceability is transparent?	ANSWER	
Would you prefer an electronic system to trace fish?	ANSWER	
If so, do you have access to a computer or other technology?	ANSWER	
Do you think MarViva's traceability system is organized well?	ANSWER	
Do you have any suggestions for us on how to improve this traceability system?	ANSWER	
Do you use another system besides the traceability system to keep records of your fish?	ANSWER	
If yes, can we see it?	Notes about record system	
	Is it neat?	
	Organized by date?	
	Take a picture of the document	

Table 2. Follow up Questions if they Use a Different Traceability System		
Questions for DWT	**Notes for Us**	**Answers**
Can you explain to us the traceability system you use?	ANSWER	
Where do you keep your records?	ANSWER	
Can we see them?	Notes about record system	
	Is it neat?	
	Organized by date?	
	Take a picture of the document	
How long to they keep records for?	ANSWER	
In the event that fish needed to be recalled, could you supply information about where your fish came from?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
We have traceability documentation from Don Luis. Can you provide us with your documentation that corresponds to these documents? If no, Continue to ①below. If yes, skip to ②.		
① Do you keep track of the name of the fisherman that catches each batch?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the	

	information	
	How specific is the information	
Do you keep track of where the fisherman catch their fish?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do you keep track of when you sell each batch?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do keep track of who you sell each batch to?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do you use a lot number or disbatch number to keep track of batches received and sold?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	

Do you keep track of the truck license number of the truck that transports each batch here?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do you pass this information onto Auto Mercado?	ANSWER	
	How complete is the information	
	How specific is the information	
If so, how and in what form?	ANSWER	
	How complete is the information	
	How specific is the information	
② Do you have record of _____ lot number?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	Do they know how to look for this information?	
	Do they know what to tell us? Do they know what information is important when performing a recall	
Can you tell us	ANSWER	

where you sold this batch to?		
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
	Notes about filing system	
Can you tell us from where this batch came from?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do you know the name of the fisherman that caught this batch?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do you know where this fisherman caught this batch?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Can you tell us when you sold this batch?	ANSWER	
	How long does it take	

	to retrieve this information	
	How complete is the information	
	How specific is the information	
Can you tell us to whom you sold this batch to?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Can you tell us the dispatch lot number with this lot number in it?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Can you tell us the truck license number that transported this batch here?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do you pass this information onto Auto Mercado?	ANSWER	
	How complete is the information	
	How specific is the information	
If so, how?	ANSWER	

	How complete is the information	
	How specific is the information	

Table 3. Follow up Questions if they Use a Different System to Keep Record of Fish		
Questions for DWT	**Notes for Us**	**Answers**
Can you explain to us how this system works?	ANSWER	
What information do you record with your system?	ANSWER	
Can we see what your records look like?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
	Notes about filing system (take a picture)	
Do you record where the batch comes from and who it is sold to?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
	Notes about filing system	

Do you record the name of the fisherman that catch the fish?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do use a lot number or some other identification system to identify your fish?	ANSWER	
	How long does it take to retrieve this information	
	How complete is the information	
	How specific is the information	
Do you pass information about the fish on to Auto Mercado?	ANSWER	
	How complete is the information	
	How specific is the information	
If so, how and in what form?	ANSWER	
	How complete is the information	
	How specific is the information	

Table 4. If There is No System	
Questions for DWT	**Answers**
Are you interested in using a traceability system?	

If so, why?	
How do you see a traceability system fitting into your company?	

Appendix_10: Interview Questions for Auto Mercado

Thank you for meeting with us. We are students working with MarViva and we are working on a project with our school to improve the traceability system here. We are here to learn more about how to keep records of fish to help us understand how the traceability system can be improved. We want to make the system as simple and effective for you as possible so we need your help to learn as much about the current process as possible before we can do this.

1. Where do you keep your responsibly-caught fish? (¿Dónde y cómo almacenan la pesca responsable?)

2. How do you keep your fish? (Como mantiene su pescado?)

3. What's the maximum time that your fish stay here before selling it? (¿Cuál es el máximo tiempo que guarda el pescado antes de venderlo?)

4. Do you keep your responsibly-caught fish separate from your non-responsibly-caught fish? (¿Como separar la pesca responsable separada del resto la pesca que no es responsable?)

5. How do you process and package your responsibly-caught fish? (¿Cómo procesan y empaquetan la pesca responsable?)

6. Do you package the responsibly-caught fish with some way to identify that they are responsibly-caught? (¿Empaquetan la pesca responsable con una manera diferente para identificarla el estado responsable del pescado?)

7. Where or to whom do you sell your responsibly-caught fish? (¿Adónde o a quien venden la pesca responsible?)

8. Do you think a traceability system offers advantages and disadvantages to your business? (¿Cree que el uso de un sistema de trazabilidad tiene ventajas y desventajas para su empresa?)

9. Do you trust that other constituents of the supply chain use a traceability system properly? (¿Confía en que las otras personas en la cadena de suministro utilizan un sistema de trazabilidad y utilizan correctamente?)

10. Do you receive documentation from Total Seafood? (¿Reciben documentación del pescado de Total Seafood?)

If yes, proceed to question 12. If no, proceed to question 13.

11. What do you think of this documentation? Do you like it or dislike it? Why? (¿Que cree sobre los formularios?)

12. What do you do with this documentation when you receive it? (¿Que hace con esta documentación cuando la recibe?)

13. Do you know about the documentation steps from the time the fish is caught until it arrives to Auto Mercado?

14. How do you determine the quality of the fish?

15. What do you do with the fish if it is not good quality?

Table 1. Trace the Lot Number 01-06414-05-01			
Questions for Auto Mercado	**Spanish Translation**	**Notes for Us**	**Answers**
Do you have record of _____ lot	(Tiene este numero de lot?)	ANSWER	

number? 01-06414-05-01		How long does it take to retrieve this information	
		How complete is the information	
		Do they know how to look for this information?	
		Do they know what to tell us? Do they know what information is important when performing a recall	
		Notes about filing system	
Can you tell us where you sold this batch to?	**(**¿Adónde lo vendió este lote?)	ANSWER	
		How long does it take to retrieve this information	
		How complete is the information	
		How specific is the information	
Can you tell us from where this batch came from?	¿De dónde viene este lote?	ANSWER	
		How long does it take to retrieve this information	
		How complete is the information	
		How specific is the information	
Do you know the name of the fisherman that caught this batch?	¿Tiene la información sobre el pescador y la área de pesca para este lote?)	ANSWER	
		How long does it take to retrieve this information	

		How complete is the information	
		How specific is the information	
Do you know where this fisherman caught this batch?		ANSWER	
		How long does it take to retrieve this information	
		How complete is the information	
		How specific is the information	
Can you tell us when you sold this batch?	¿Cuándo se vendió este lote?	ANSWER	
		How long does it take to retrieve this information	
		How complete is the information	
		How specific is the information	
Can you tell us to whom you sold this batch to?	¿A quién le vendió este lote?	ANSWER	
		How long does it take to retrieve this information	
		How complete is the information	
		How specific is the information	
Would you prefer an electronic system to trace fish?	¿Prefiere un sistema electrónico en el computador en el futuro?	ANSWER	
If so, do you have access to a	¿Tiene acceso a una	ANSWER	

computer or other technology?	computadora u otra tecnología?		

Table 2. Follow up Questions if they Use a Different Traceability System			
Questions for Auto Mercado		**Notes for Us**	**Answers**
Can you explain to us the traceability system you use?	¿Puede explicar el sistema usa?	ANSWER	
Where do you keep your records?	¿Dónde almacenan los registros para la pesca responsable?	ANSWER	
Can we see them?	¿Podemos verlos? ¿Podemos tomar una foto?	Notes about record system	
		Is it neat?	
		Organized by date?	
		Take a picture of the document	
How long do you keep your records for?	¿Por cuánto tiempo guarda los documentos?	ANSWER	
In the event that fish needed to be recalled, could you supply information about where your fish came from?	Si hubiera un problema con el pescado, ¿tienen la documentación e información suficiente para hacer una devolución? (Información sobre la origen del	ANSWER	
		How long does it take to retrieve this information	
		How complete is the information	
		How specific is the information	

	pescado, como el pescador o la área de pesca)		
What information do you record with your system?	¿Qué información registra con este sistema?	ANSWER	
Can we see what your records look like?	¿Podemos ver sus registros y otros documentos?	ANSWER	
		How long does it take to retrieve this information	
		How complete is the information	
		How specific is the information	
		Notes about filing system (take a picture)	
Do you record where the batch comes from and who it is sold to?	¿Registra de donde recibe el lote y a donde vende el lote?	ANSWER	
		How long does it take to retrieve this information	
		How complete is the information	
		How specific is the information	
		Notes about filing system	
Do you record the name of the fisherman that catch the fish?	¿Registra el nombre del pescador que pesca cada lote?	ANSWER	
		How long does it take to retrieve this information	
		How complete is	

		the information	
		How specific is the information	
Do use a lot number or some other identification system to identify your fish?	¿Usa un número de lote u otro tipo de identificación para identificar este pescado?	ANSWER	
		How long does it take to retrieve this information	
		How complete is the information	
		How specific is the information	

Table 4. If There is No System		
Questions for Auto Mercado	**Spanish Translation**	**Answers**
Are you interested in using a traceability system?	¿Está interesado en la idea de un sistema de trazabilidad?	
If so, why?	Si, si Por que?	
How do you see a traceability system fitting into your company?	¿Como se imagina que un system de trazibilidad se convierta en parte de su empresa?	

Appendix_11: Simplified Traceability Forms and Reference Charts

Con el apoyo MarViva

Registro de Recibo de Producto
Programa de Trazabilidad para la Pesca Responsable

Centro de Acopio: _____ # _____
Fecha: ____ ____/____ ____/____ ____
Número de Entrega: #_____

Información del Pescador

Nombre de Pescador: _____ # _____
Arte de Pesca: Línea / Cuerda Horas de Pesca: ___ H # de Pescadores: _____
Área de Pesca: _____

Número de Lote: ___ ___ - ___ ___ ___ ___ ___ ___ - ___ ___ - ___ ___
(# de Centro de Acopio) (dd mm aa) (# de Pescador) (# de Entrega)

Producto Capturado

	Nombre Común	Temperatura	Clasificación	Cantidad (kilos)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Nombre de Llenador: _____
Firma: _____ Fecha: ____/____/____
Nombre de Verificador: _____
Firma: _____ Fecha: ____/____/____

Con el apoyo de:
MarViva

Registro de Venta de Producto Programa de Trazabilidad para la Pesca Responsable

Información General

Centro de Acopio: _____ # _____ Fecha: ___ ___ /___ ___ /___ ___

Nombre de Cliente: _____ # Orden de Compra: _____

Fecha de Despacho: ___ ___ /___ ___ /___ ___ Licencia de Vehículo: _____

Producto Capturado

	Nombre Común	Temperatura (°C)	Número De Lote	Cantidad (Kilos)
1			___ ___-___ _____-____-___ ___	
2			___ ___-___ _____-____-___ ___	
3			___ ___-___ _____-____-___ ___	
4			___ ___-___ _____-____-___ ___	
5			___ ___-___ _____-____-___ ___	
6			___ ___-___ _____-____-___ ___	
7			___ ___-___ _____-____-___ ___	
8			___ ___-___ _____-____-___ ___	
9			___ ___-___ _____-____-___ ___	
10			___ ___-___ _____-____-___ ___	
11			___ ___-___ _____-____-___ ___	
12			___ ___-___ _____-____-___ ___	
13			___ ___-___ _____-____-___ ___	
14			___ ___-___ _____-____-___ ___	
15			___ ___-___ _____-____-___ ___	
16			___ ___-___ _____-____-___ ___	
17			___ ___-___ _____-____-___ ___	
18			___ ___-___ _____-____-___ ___	
19			___ ___-___ _____-____-___ ___	
20			___ ___-___ _____-____-___ ___	

Nombre de Llenador: _____

Firma: _____ **Fecha:** _____/_____/_____

Nombre de Verificador: _____

Firma: _____ **Fecha:** _____/_____/_____

Hoja de Referencia para Recibidor de Mariscos Don Chino

Información del Centro de Acopio

Centro de Acopio	#CVO	#SIREA	#INCOPESCA
Recibidor de Mariscos Don Chino	082027-01		PC-012-01

Información del Pescador

Nombre de Pescador	Licencia de Pesca	Nombre de la Embarcacion	# de Matrícula
Alexandre Chavarra	H-0809-12-PTS	Rosaly	11120 PP
Alexis Perez Fonesca	H-0042-97-10PTS-2169-12	Atayuvi	10393PP
Ana C. Villareal Brenes	H-0515-08PTS-227-12	Olamar Yes	P012137
Barrantes Perez Wilfreth	P-0397-10-PTS	Dancing Waves	11793
Baudilio Barrantes Jiminez	H-0028-94PTS-2048-12	Talolinga	6554 PP
Coto		Patricia	
Denis Sanchez Peña	P-0412-10-PTS	Dany S.	10975 PP
Deyler Garcia Guevara	H-0802-12-PTS	Yuma D.	P-012106
Diego Hererra Ramirez	H-001403PTS-1997-12	Don Chino	11107 PP
Emilia Rojas Mendoza	P-0347-10PTS	Fernando	11742 PP
Francisco Jiron Arias	H-0088-98PTS-2064-12	La Nira III	11309 PP
Gerardo Peña	H-0089-93-PTS-2118-12	Jose Miguel	9410 PP
Ivan Barahona	P-0412-10-Pts	Lucero	
Jose Emilio Herrera Rojas	P-0718-11-PTS	Navil H.R.	11772 PP
Jose Jiron Arias	P-0347-10-PTS	Fernando	11742 PP
Juan Jose Perez	H-0039-97PTS-1325-11	Katy IV	10018 PP
Luis D. Herrera	H-0014-03-PTS-1997-12	Don Chino	11107 PP
Mabiel Herrera Ramirez	H-004-09PTS-1241-10	Saharin III	11911 PP
Marcos Guevara	—	Esteben	—
Mario Pena		La Pulpa	
Marlyn Campos	—	Cristina	—
Ulfreth Barrantes		Dancing Waves	

Hoja de Referencia para Cama-Pez de la Costa

Información del Centro de Acopio

Centro de Acopio	#CVO	#SIREA	#INCOPESCA
Cama-Pez de la Costa	060878-01		SC-PC-024-13

Información del Pescador

Nombre de Pescador	Licencia de Pesca	Nombre de la Embarcacion	# de Matrícula
Jose Emilio Herrera Rojas	P-0718-11-PTS	Navil H.R.	11772 PP
Manrique A. Alvarez Medrano	H-0048-97-PTS-2449-12	CHATO M	P 012141
Maximilliano Peña	H-0079-79PTS-2061-12	La Pulga P.	9706 PP
Monica Villalobos	H-0049-03-PTS-2450-12	Alonso M.	P-012093
Rodolfo Martin Ulloa	H-0135-93-PTS-2127-12	San Jose V	10750 PP
Timoteo Alvarez Rojas	H-0040-97-PTS-2442-12	Berrea P	P 012097

Appendix_12: Explanation of Changes Made to Traceability Forms

To begin, we changed the calendar system to be in the conventional format, as opposed to the Julian calendar. This means that the lot number was changed from having a 5-digit date slot to a 6-digit date slot to follow the standard Costa Rican date notation of day/month/year. Second, we eliminated the details of the receiving center as well as of the fisherman. This information would no longer be required on each form, but instead would be available for reference on a supplementary sheet, as seen in Appendix_11. Third, we decreased the number of spaces for the "Captured Product" from fifteen to ten, as we received feedback that having fifteen spaces was excessive. We used the extra space this created to enhance other parts of the form; for example, to provide an explanation of each part of the lot number or to allow for more important parts of the form to be printed larger. Fourth, we replaced the "Scientific Name" column with a "Temperature" column to provide space for the temperature of each fish to be recorded. We decided this would be beneficial after speaking with Mr. Martinez at Total Seafood. He told us that he thought that more space on the forms should be allocated to temperature, as it is an extremely important part of the quality control and traceability process. We believe that with this change, the document can serve as not only a traceability form but also a quality control form. We also noticed that none of the forms that we collected from the receiving centers had the "Scientific Name" column completed. We believed that this information was unnecessary and that the space was not being utilized to its full potential, so this change would increase the usability of the form.

We also drafted a new version of the Sales Record Form. This form included the same changes as the Receiving Record Form, except that we increased the number of "Delivered Product" spaces from fifteen to twenty. We did this in response to the feedback from the employees at the receiving centers. They explained to us that they frequently ran out of space on the Sales Record Forms. We were able to include these additional spaces because we eliminated the repetitive information about the fisherman from the earlier portion of the form. Additionally, we changed the "Classification/Size" column on this form to a "Temperature" column for the same reasons that led us to change the "Scientific Name" column on the Receiving Record Form. Finally, we eliminated the dispatch number from the Sales Record Form. We made this change because we observed that this number is not being used at Total Seafood and is not passed along to Auto Mercado. We believed that the process would become more efficient if this number was eliminated.

Lastly, on both forms, more space was provided for the names of the employees who complete and verify the form. Providing more space for the name and signature will increase the readability of this information.

Appendix_13: Revised Procedure Documents

13.1: “Programa de Trazabilidad y Procedimiento de Recobro para la pesca responsable

Programa de Trazabilidad y Procedimiento de Recobro para la pesca responsable

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Trazabilidad: El presente documento establece las pautas y criterios a tomar para la identificación de los productos pesqueros proveniente de la pesca responsable que se almacena y distribuyen por parte del recibidor de mariscos don chino. Cumpliendo el decreto legislativo no 8495, ley general del servicio nacional de salud animal en su capítulo vi (seguridad y trazabilidad/rastreabilidad).

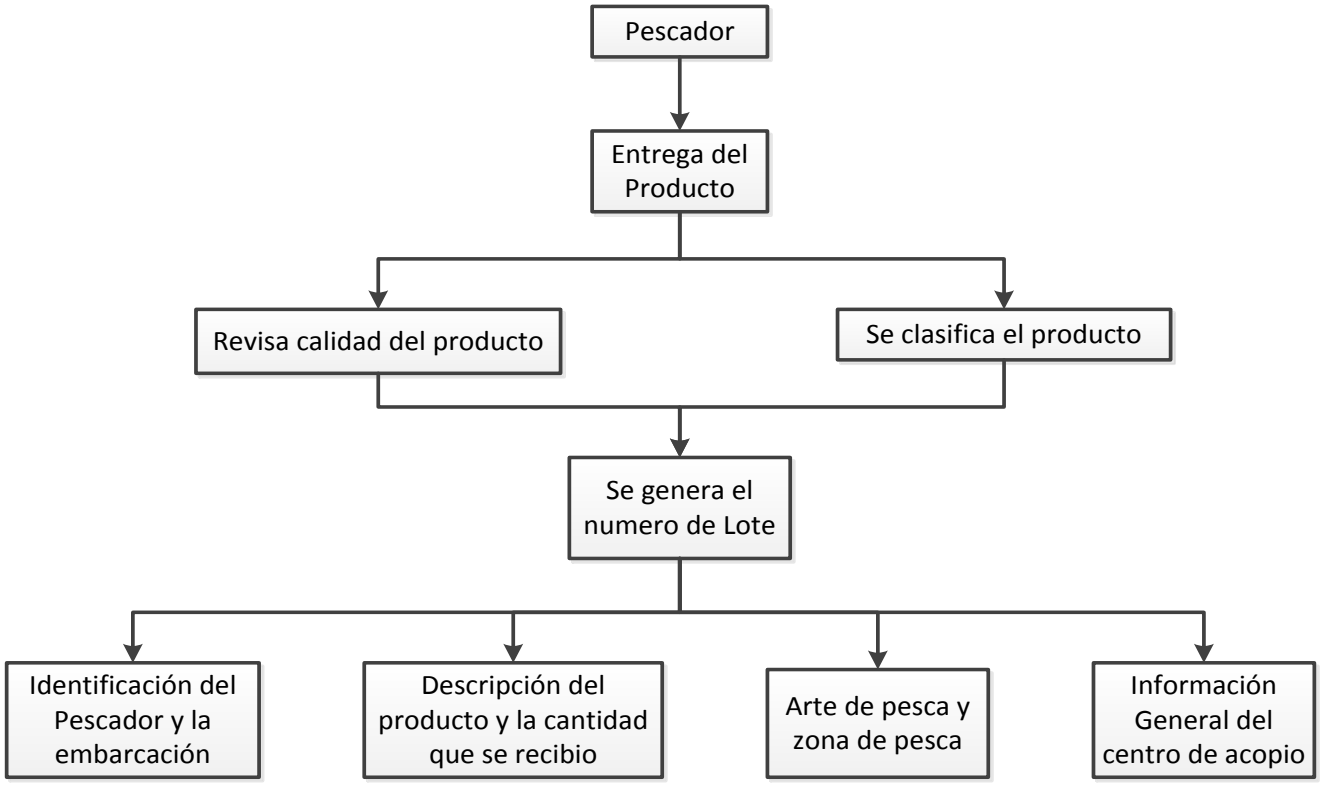
Trazabilidad de Pescado Fresco:

Para lograr la trazabilidad del pescado fresco proveniente de la pesca responsable se prepara este documento que describe el programa de trazabilidad del Recibidor de Mariscos Don Chino.

El proceso conlleva la recolección de información que es anotado en el documento “Registro de Recibo de Producto” en donde se captura la siguiente información:

- Información general del centro del recibidor
- Se genera el número de lote.
- Se anota toda la información de la embarcación y pescador además del arte de pesque que utilizo durante la faena.
- Se anota también la zona donde realizo la pesca.
- Se anota todo el producto capturado identificando y la cantidad que trajo de cada uno.
- Se anota las temperaturas del producto
- Al final de completar el documento se firma el documento.

El siguiente es el flujo del proceso, donde se muestra donde se obtiene la información para el proceso de trazabilidad para el pescado fresco.



Recibo de Producto

Generación del Número de Lote

El número de lote de esta compuesto de catorce (14) caracteres, compuesto de doce números y tres guiones, siendo la función de los guiones como un separador de información.

Los parámetros para la asignación del número de lote son los siguientes:

Ejemplo de número de lote 01-160314-09-02

Para describir la composición del número de lote es el siguiente:

1. Los primeros dos dígitos "01" significa el número de identificación del centro de acopio (este número fue generado por la fundación MarViva y ningún otro centro de Recibo tiene el mismo número).
2. El "–" es un guion separador de información.
3. Del tercero (3ro) digito al octavo (8vo) digito que corresponden al "160314" en el número de lote significa la fecha en la forma de día/mes/año.
    a. Los dígitos tres y cuatro "16" significan el día. En este ejemplo, corresponde al 16 de mes.

   b. Los dígitos cinco y seis “03” significan el mes. En este ejemplo, corresponde a marzo.
   c. Los dígitos siete y octavo “14” significan los últimos dos dígitos del año. En este ejemplo, corresponde al año 2014.
4. El “–” es un guion separador de información.
5. Los dígitos número nueve (9) y diez (10) “09” significa el número de identificación del pescador, esta lista está en el documento *Lista de Pescadores del Programa de Pesca Responsable*.
6. El “–” es un guion separador de información.
7. Los dígitos número once (11) y doce (12) “02” significa el número de entrega que realizo el este especifico pescador. En este ejemplo, es la segunda entrega del día.

Al final el número de lote 01-29413-01-02

Se interpreta de la siguiente forma:

Del Recibidor de Mariscos Don Chino, con Fecha del 3 de marzo del 2014, del pescador # 9, el producto registrado fue de su segundo entrega durante este día.

Almacenamiento:

Materia Prima

El producto proveniente de la pesca responsable será almacenado identificado para esto y no será mezclado con producto proveniente de otras artes de pesca que no sea la cuerda y anzuelo o la línea.

El contenedor tendrá un rotulo de “PESCA RESPONSABLE”.

El producto seria consolidado en estos contenedores por lo que en este paso se pierde la trazabilidad individual de cada pescador individual pero no del producto proveniente de la pesca responsable.

Procedimiento de recolecta:

Todo producto comercializado a la planta de proceso contiene un número de Lote de Despacho que es único. Estos lotes identifican el producto, cliente, fecha y están ligados a los números de lote de recibo de cada pescador con relación a la fecha de despacho.
La información referente a todo este producto se tiene copia de todos los registros realizados con la respectiva información de los diferentes pescados.

Todo procedimiento de recolecta se iniciará con la recepción de la notificación o de la llamada del comprador. El dueño del centro del centro de acopio recibirá la notificación y de inmediato informará al resto de sus compañeros responsables del centro de acopio y entre ellos analizarán la situación hasta determinar si la queja sobre el producto es responsabilidad del recibidor de mariscos don Chino.
Si se tratara de una situación menos seria por problemas de calidad en el producto, la denuncia será aceptada para análisis únicamente si se realiza dentro de las veinticuatro horas siguientes al recibo del producto. Si se determina que el centro de acopio es la responsable en cualquiera de las situaciones anteriores, se inicia inmediatamente el procedimiento de recobro.

Si un producto tiene que ser recobrado, una vez determinado que podría perjudicar la seguridad y salubridad de alguna persona, el dueño del recibidor de Mariscos Don Chino y conjuntamente con la planta de proceso que compro el producto seguirán el procedimiento que a continuación se detalla:

Identificación:

- Se identificarán de inmediato el número de lote de despacho que podrían contener el producto violatorio y que han sido despachadas
- A qué clientes fue enviado este producto.
- La cantidad de ese mismo producto que está en el inventario de la planta de proceso.

Comunicación:

- Se comunicará de inmediato vía telefónica a los clientes para que no utilicen el producto y lo retengan

Acciones a tomar:

- Se retiene el producto existente en la planta de proceso y se identifica este producto adulterado.
- Una vez que se tenga identificado el producto y su retención, se toma la decisión de qué hacer con dicho producto.
- Si el producto ha sido despachado se programa la recolecta del producto a los diferentes puntos de venta a los que fueron enviados.
- Todo comunicado de recobro que deba enviarse a los socios comerciales y para las autoridades sanitarias contemplará la siguiente información básica:
    - Razón del retiro
    - Cantidad de producto retirado
    - Numero respectivo número de lotes.
    - Áreas de distribución del producto
    - Persona contacto dentro de la compañía

Como parte de las actividades de control y comprobación del funcionamiento del Programa de Trazabilidad y Recobro del Recibidor de Mariscos Don Chino, se realizará por lo menos una vez

al año un simulacro de recuperación de producto que será coordinado entre el dueño del centro de acopio o a la persona que designe y la planta procesadora que compra el producto de la pesca responsable.

Lista de personal que forma parte de los retiros de producto:

Participante	Teléfono
Recibidor de Mariscos Don Chino	(506) 2678-8213
Planta de Proceso	(506) 2438-3958

13.2 “Instructivo para el llenado del registro de Recibo del Programa de Trazabilidad”

Instructivo para el llenado del registro de Recibo del Programa de Trazabilidad

Proposito: Garantizar el correcto llenado del Registro de Recibo de Recibo de Producto del programa de trazabilidad para la pesca responsable

Documentos necesarios: Formulario Registro de Recibo de Producto

Instrucciones de trabajo:

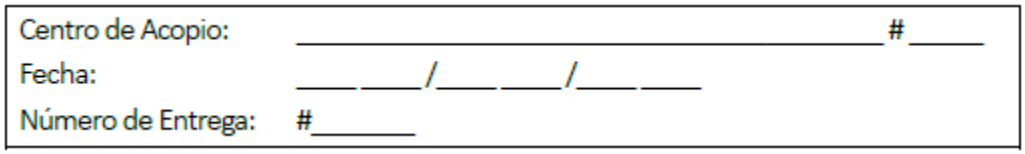
El encargado del centro de acopio es el responsable de garantizar la correcta puesta en práctica del presente instructivo. El llenado del *Registro de Recibo de Producto* debe de realizarse cada vez que una embarcación (con pesca responsable) llega al centro de acopio para entregar su producto.

Registro de Recibo de Producto:

El documento tiene seis (6) secciones, cada de estas deberá ser llenada con la información que corresponda.

1. Primera sección: Información Inicial

   Esta sección corresponde a la información inicial del producto que se recibe, incluyendo del nombre de centro de acopio, la fecha del recibo, y el número de entrega del día.



- **Centro de Acopio**: En este espacio, se tiene que colocar el nombre del centro de acopio.
- **Fecha**: En este espacio, se coloca la fecha en el que se recibe el producto en el centro de acopio.
- **Numero de Entrega**: En este espacio, se coloca el número de la entrega para este día. (Por ejemplo, si es la segunda entrega del día, se coloca el número dos.)

2. Segunda sección: Información del Pescador

Información del Pescador

Nombre de Pescador: _____ # _____

Arte de Pesca: Línea / Cuerda Horas de Pesca: _____ H # de Pescadores: _____

Área de Pesca: _____

Esta sección corresponde a la identificación del pescador que ingresa producto al centro de acopio de la pesca responsable.

- **Nombre de Pescador**: En esta sección se coloca el nombre del pescador dueño de la embarcación que tiene la licencia de pesca.
- **Arte de Pesca**: En este espacio se coloca el arte de pesca utilizada por la embarcación (ya sea cuerda o línea)
- **Horas / Días de pesca**: En este espacio se coloca el tiempo que duro la embarcación pescando en horas o días (en el caso que la embarcación realiza una pesca de horas se coloca entonces las horas que duró la faena y se coloca después del número "hr".)
- **# Pescadores**: En este espacio se coloca la cantidad de pescadores que realizaron la faena de pesca.
- **Area de Pesca**: En este espacio, se coloca el nombre del área en que el pescado fue capturado. Usa el nombre del golfo o de la comunidad.

3. Tercera sección: Número de Lote

Esta sección corresponde al número de lote y explica como se establece el número de lote.

Número de Lote: ___ ___ - ___ ___ ___ ___ ___ ___ - ___ ___ - ___ ___

(# de Centro de Acopio) (dd mm aa) (# de Pescador) (# de Entrega)

- **Número de Lote**: En este espacio, se coloca el número de lote que se establecerá de acuerdo al procedimiento interno de cada centro de acopio. Hay un número específico de espacios para cada parte del número de lote. Usa la información en los paréntesis para ayudarle en llenar los números. También, usa los números que usted ya establecen en sección número uno para llenar este número de lote (número de centro de acopio, la fecha, y número de entrega de la sección uno, y el número de pescador de la sección dos.

4. Cuarta Sección: Producto Capturado

Esta sección corresponde a cada producto específicamente. Aquí se coloca la información incluyendo el nombre común, temperatura al tiempo de recibo, clasificación, y la cantidad del pescado en kilos.

Producto Capturado

	Nombre Común	Temperatura	Clasificación	Cantidad (kilos)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Esta parte consiste de una tabla con diez (10) espacios para colocar esta información:

- **Nombre Común**: Es este espacio, se coloca el nombre común de la especie capturada (ejemplos: Corvina reina, Cola de Bagre, Pargo Seda, Robalo etc.)
- **Temperatura**: En este espacio, se coloca la temperatura en grados al tiempo *del recibo* del pescado.
- **Clasificación**: En este espacio, se le coloca la clasificación que le tiene al producto de acuerdo con las especificaciones del comprador. Este espacio no necesariamente tiene que ser llenado si no existe una clarificación establecida.
- **Cantidad**: En este espacio, se coloca el número de kilos para cada especie descrita en la tabla. (Por ejemplo, ponga la cantidad de *toda* la corvina reina de un pescador en una línea.)

5. Quinta Sección: Verificación

Esta sección corresponde a la identificación de los funcionarios del centro de acopio que llenaron el formulario.

Nombre de Llenador: _____

Firma: _____ Fecha: _____/_____/_____

Nombre de Verificador: _____

Firma: _____ Fecha: _____/_____/_____

- **Nombre del Llenador**: En este espacio, se coloca el nombre de la persona que ya llenó el formulario.
- **Firma**: En este espacio, se coloca la firma del responsable.

- **Fecha**: En este espacio, se coloca la fecha del llenado del documento.
- **Nombre de Verificador**: En este espacio, se coloca el nombre de la persona que verificó que el documento fue llenado correctamente y tiene toda la información - por ejemplo, la persona que estaba como responsable del centro de acopio y recibió el producto del pescador. Esta persona no puede ser la misma persona de la "llenador".
- **Firma**: En este espacio, se coloca la firma del verificador.
- **Fecha**: En este espacio, se coloca la fecha que el verificador verificó el documento.

Información General

- Cada registro tiene un numero consecutivo en la esquina derecha (ejemplo: 00001, 00002, 00003, etc.)
- Necesita llevar el registro al centro de acopio (para que no puedan intercambiarse la documentación entre los centros de acopio).
- Cada formulario tiene un original y dos copias:
    - Original (blanco) deberá ser entregado cuando se venda el producto para que el comprador tenga la información completa de trazabilidad del lote o lotes que está comprando.
    - Primera copia (rosada) será para la Fundación MarViva para dar seguimiento al proceso de trazabilidad
    - Segunda copia (amarillo) queda para los registros del centro de acopio, para ser presentado a las autoridades competentes a la hora de las inspecciones y como un registro de trazabilidad del producto recibido.
- Cada centro de acopio necesita almacenar los registros de trazabilidad por lo menos por tres años de acuerdo a lo establecido por el SENASA.

13.3 “Instructivo para el llenado del registro del Control Participativo del Programa de Trazabilidad”

Instructivo para el llenado del registro del Control Participativo del Programa de Trazabilidad

Proposito: Garantizar el llenado correcto del *Registro del Control Participativo* del programa de trazabilidad para la pesca responsable.

Documento de Referencia: Registro de Control Participativo

Instrucciones de Trabajo

El encargado del centro de acopio tiene responsabilidad de garantizar la puesta correcta en práctica de estas instrucciones. El llenado del *Registro de Control Participativo* del programa de trazabilidad debe ser realizarse por lo menos al 30% del producto capturado dentro del programa de la pesca responsable.

El en *Registro de Control Participativo*, lo que se hace es una medición de todos los pescados de una pesca o faena establecida. La medición es desde la boca del pescado hasta la aleta caudal conocido (como la longitud total del pescado). Se muestra como el siguiente ejemplo:

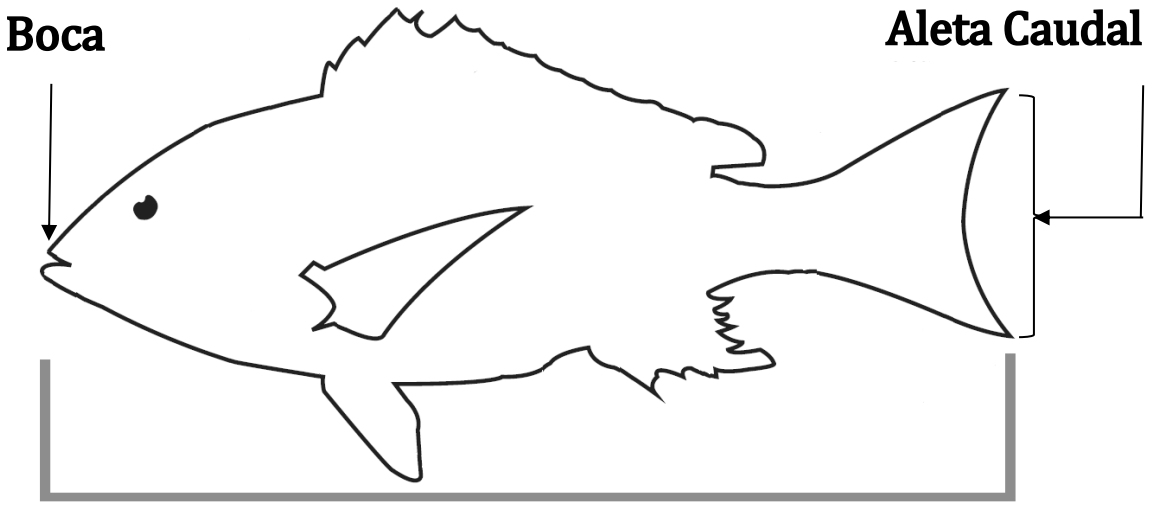


Figura 1: La manera para medir la longitud total del pescado

Aquí esta una foto del instrumento para realizar esta medición. Es un ictiómetro. Se coloca la boca del pescado en la parte inicial y se deje descansar el resto a través de la regla que está en la tabla. Estos instrumentos pueden ser de madera o plástico. El plástico más higiénico y fácil de limpiar.

Figura 3: Aquí es un ejemplo de la forma del pescado que debe usar con el ictiometro.

Llenado del Registro del Control Participativo

El documento tiene tres (3) secciones. Cada de estas secciones deberá ser llenada con la información que corresponda.

1. Primera sección: Información Inicial de Producto

Esta sección corresponde a la información inicial del producto que se recibe y donde se establece el número de lote.

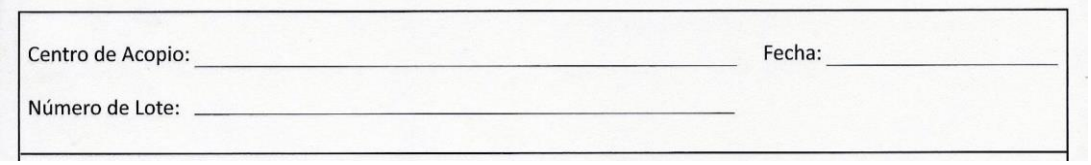


Figura 4: Foto del parte del formulario de Registro Control Participativo

- **Centro de acopio**: En este espacio, se tiene que colocar el nombre con el que se registró con el CVO (Certificado Veterinario de Operación)
- **Fecha**: En este espacio, se coloca la fecha en el que se realiza la medición de los pescados.
- **Número de Lote**: En este espacio se coloca el número del lote del producto que se está midiendo.

2. Segunda sección: Información de Talla

Esta sección corresponde a la información que se colocara de las diferentes mediciones que se les realizan a los pescados.

Información de las Tallas de Pesca

	Nombre Común	Talla (mm.)		Nombre Común	Talla (mm.)
1			31		
2			32		
3			33		
4			34		
5			35		
6			36		
7			37		
8			38		
9			39		

Figura 5: Foto de parte del formulario Registro Control Participativo

- **Nombre Común**: En este espacio, se coloca el nombre común de la especie que se está midiendo (ejemplos: Corvina reina, Cola de Bagre, Pargo Seda, Robalo etc.).
- **Talla (mm)**: En este espacio se coloca la medida del pescado en unidades de milímetros.

OJO: Es importante considerar a la hora de llenar el documento:

- Cada hoja tiene espacio para una cantidad de 60 pescados.
- Si un número de lote tiene más de 60 pescados (o una panga trajo más de 60 pescados) se utiliza una segunda hoja y se almacenan juntas.
- Si un número de lote tiene menos de 60 pescados de deja ahí no se coloca medidas de otro lote en la misma hoja.

3. Tercera Sección: Información de Identificación

Esta sección corresponde a la identificación de los funcionarios del centro de acopio que realizaron el trabajo.

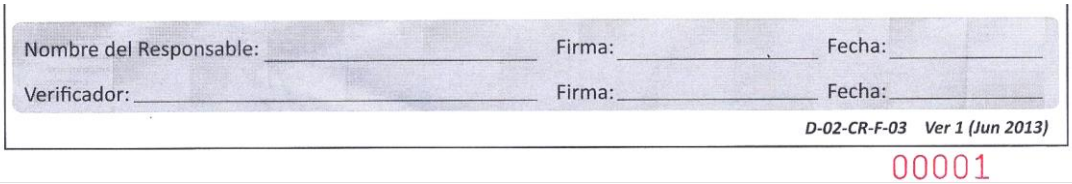


Figura 6: Foto del parte del formulario Registro Control Participativo

- **Nombre del Responsable**: en este espacio se coloca el nombre de la persona que esta como responsable de realizar las medidas de los pescados.
- **Firma**: En este espacio el responsable medir los pescados coloca su firma.
- **Fecha**: en este espacio el responsable de medir los pescados coloca la fecha del llenado del documento.
- **Verificador**: en este espacio se coloca el nombre de la persona que verificara que el documento fue llenado correctamente y tiene toda la información.
- **Firma**: En este espacio el verificador coloca su firma.
- **Fecha**: en este espacio el verificador coloca la fecha del día que verifico el documento.

Información General

- Cada registro tiene un número consecutivo. (ej: 00001, 00002, 00003, etc)
- Se llevara el registro de entrega de documentos **por** centro de acopio (para que no puedan intercambiarse la documentación entre los centros de acopio).
- Cada formulario tiene un original y una copia:
    - La original será para la Fundación MarViva para dar seguimiento al proceso de trazabilidad.
    - La primera copia queda para los registros del centro de acopio. Debe ser presentado a las autoridades competentes a la hora de las inspecciones y como registro de trazabilidad del producto recibido.
- Cada centro de acopio deberá almacenar los registros de trazabilidad por lo menos por **tres años** de acuerdo a lo establecido por el SENASA. [3]

13.4 “Instructivo para el llenado del registro de Venta del Programa de Trazabilidad”

Instructivo para el llenado del registro de Venta del Programa de Trazabilidad

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Proposito: Garantizar el correcto llenado del *Registro de Venta de Producto* del programa de trazabilidad para la pesca responsable

Documentos de referencia: Registro Venta de Producto

Instrucciones de trabajo:

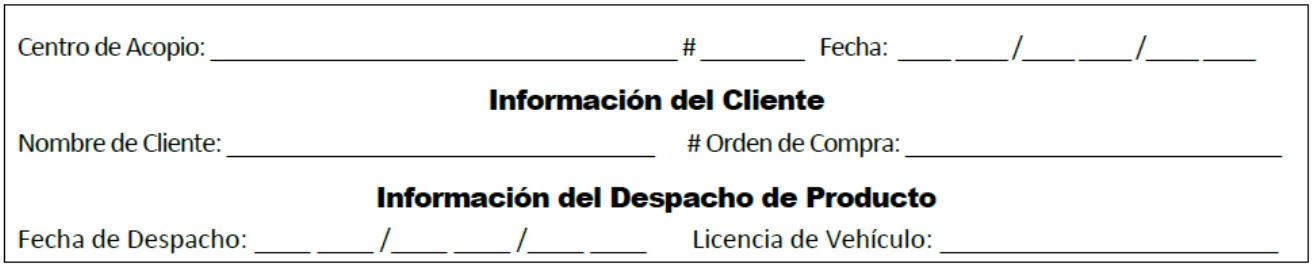
El encargado del centro de acopio es el responsable de garantizar la correcta puesta en práctica del presente instructivo. El llenado del *Registro de Venta de Producto* debe de realizarse cada vez que se realice una venta del producto a un cliente.

Registro de Venta de Producto:

El documento tiene seis (6) secciones, cada una de estas deberá ser llenada con la información que corresponda.

1. Primera sección: Información General

   Esta sección corresponde a la información inicial del centro de acopio y la fecha, información sobre el cliente, e información del despacho de producto.


Centro de Acopio: _____ # _____ Fecha: ____ ____/____ ____/____ ____

Información del Cliente

Nombre de Cliente: _____ # Orden de Compra: _____

Información del Despacho de Producto

Fecha de Despacho: ____ ____/____ ____/____ ____ Licencia de Vehículo: _____

- **Centro de acopio:** En este espacio se tiene que colocar el nombre con el que se registró con el CVO (Certificado Veterinario de Operación) y el número del centro.
- **Fecha:** En este espacio, se coloca la fecha en el que se realiza la venta del producto desde el centro de acopio.

- **Nombre del Cliente:** En este espacio, se coloca el nombre del cliente que esta realizando la compra del producto.
- **Fecha de Despacho:** En este espacio, se coloca la fecha que el producto sale del centro de acopio.
- **Orden de Compra:** En este espacio, se coloca el número de la orden de compra que entrega el cliente. (Existen casos que los clientes no utilizan órdenes de compra por lo que puede que este espacio se puede o no llenar, es opcional.)
- **Licencia del vehículo:** En este espacio, se coloca la placa del vehículo que transportara el producto o la licencia de la panga.

2. Segunda Sección: Producto Capturado

Esta sección corresponde a la descripción del producto que se entrega en el proceso de la venta al cliente.

Producto Capturado

	Nombre Común	Temperatura (°C)	Número De Lote	Cantidad (Kilos)
1			__ __-__ __ __ __ __ __-__ __ - __ __	
2			__ __-__ __ __ __ __ __-__ __ - __ __	
3			__ __-__ __ __ __ __ __-__ __ - __ __	
4			__ __-__ __ __ __ __ __-__ __ - __ __	
5			__ __-__ __ __ __ __ __-__ __ - __ __	
6			__ __-__ __ __ __ __ __-__ __ - __ __	
7			__ __-__ __ __ __ __ __-__ __ - __ __	
8			__ __-__ __ __ __ __ __-__ __ - __ __	
9			__ __-__ __ __ __ __ __-__ __ - __ __	
10			__ __-__ __ __ __ __ __-__ __ - __ __	
11			__ __-__ __ __ __ __ __-__ __ - __ __	
12			__ __-__ __ __ __ __ __-__ __ - __ __	
13			__ __-__ __ __ __ __ __-__ __ - __ __	
14			__ __-__ __ __ __ __ __-__ __ - __ __	
15			__ __-__ __ __ __ __ __-__ __ - __ __	
16			__ __-__ __ __ __ __ __-__ __ - __ __	
17			__ __-__ __ __ __ __ __-__ __ - __ __	
18			__ __-__ __ __ __ __ __-__ __ - __ __	
19			__ __-__ __ __ __ __ __-__ __ - __ __	
20			__ __-__ __ __ __ __ __-__ __ - __ __	

- Esta parte consiste de una tabla con veinte (20) espacios para colocar información.
    - **Nombre Común:** Es este espacio, se coloca el nombre común de la especie que es vendida al cliente (ejemplos: Corvina reina, Cola de Bagre, Pargo Seda, Robalo etc.)

- **Temperatura:** En este espacio, se coloca la temperatura en grados al tiempo *de la venta* del pescado.
- **# Lote:** En este espacio se coloca el número de lote específico para este producto, al ser consolidado te toma los datos de los registros de recibo de producto.
- **Cantidad:** En este espacio se coloca el número de kilos que se le entrega al cliente.

Nota: *Debe existir una línea para cada producto con un lote específico*.

3. Tercera Sección: Verificación

Esta sección corresponde a la identificación de los funcionarios del centro de acopio que llenaron el formulario.

Nombre de Llenador: _____

Firma: _____ Fecha: _____/_____/_____

Nombre de Verificador: _____

Firma: _____ Fecha: _____/_____/_____

- **Nombre del Llenador:** En este espacio, se coloca el nombre de la persona que ya llenó el formulario.
- **Firma:** En este espacio, se coloca la firma del responsable.
- **Fecha:** En este espacio, se coloca la fecha que el llenador llenó el documento.
- **Nombre de Verificador:** En este espacio, se coloca el nombre de la persona que verificó que el documento fue llenado correctamente y tiene toda la información - por ejemplo, la persona que estaba como responsable del centro de acopio y recibió el producto del pescador. Esta persona no puede ser la misma persona de la "llenador".
- **Firma:** En este espacio, se coloca la firma del verificador.
- **Fecha:** En este espacio, se coloca la fecha que el verificador verificó el documento.

Información General

- Cada registro tiene un numero consecutivo en la esquina derecha (ejemplo: 00001, 00002, 00003, etc.)
- Necesita llevar el registro al centro de acopio (para que no puedan intercambiarse la documentación entre los centros de acopio).
- Cada formulario tiene un original y dos copias:
  - Original (blanco) deberá ser entregado cuando se venda el producto para que el comprador tenga la información completa de trazabilidad del lote o lotes que está comprando.
  - Primera copia (rosada) será para la Fundación MarViva para dar seguimiento al proceso de trazabilidad

    - Segunda copia (amarillo) queda para los registros del centro de acopio, para ser presentado a las autoridades competentes a la hora de las inspecciones y como un registro de trazabilidad del producto recibido.
- Cada centro de acopio necesita almacenar los registros de trazabilidad por lo menos por tres años de acuerdo a lo establecido por el SENASA.

Este documento fue elaborado con el apoyo técnico de la Fundación MarViva.

Appendix_14: Use of QR Codes

To demonstrate how QR codes can be used, the information from a Receiving Record Form from Cama-Pez de la Costa was inputted into a QR code generating website. This code included information on the receiving center, lot number, fisherman, area and method of fishing, product type weight, etc. – all the information from the Receiving Record Form. After inputting this information, a QR code was generated through the website, and the option of downloading, printing, and emailing were presented. The QR code was downloaded and saved to a laptop. This exact QR code can be seen in Figure 28.

Figure 28. QR code generated from receiving form information

On an iPod Touch, we downloaded the top-rated application for QR Codes, titled “Scan – QR Code and Barcode Scanner” from QR Code City, and used this to scan the QR code seen above. The app quickly displayed the following information linked to the code, seen in Figure 29.

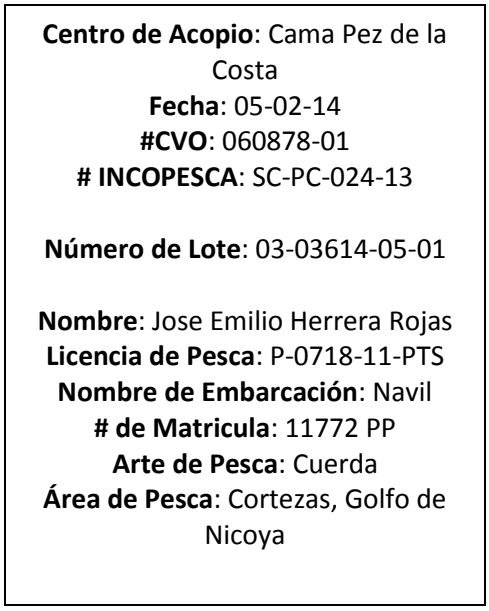


Figure 29. Information produced from scanned QR Code using Scan app on iPod

The process of typing in the information and generating the QR code took less than a minute and a half – a significant decrease from the time it takes to write the information on a form according those at the receiving center. The website is simple and easily accessible, and could allow for the creation of multiple QR codes quickly, as they can be downloaded, printed, and saved instantaneously.