Shrimp Aquaculture and Aguadulce: A Broken Partnership.

Sylvia M. Bolanos
University of Miami, smbolanos@hotmail.com

Follow this and additional works at: https://scholarlyrepository.miami.edu/oa_dissertations

Recommended Citation
https://scholarlyrepository.miami.edu/oa_dissertations/892

This Open access is brought to you for free and open access by the Electronic Theses and Dissertations at Scholarly Repository. It has been accepted for inclusion in Open Access Dissertations by an authorized administrator of Scholarly Repository. For more information, please contact repository.library@miami.edu.
UNIVERSITY OF MIAMI

SHRIMP AQUACULTURE AND AGUADULCE: A BROKEN PARTNERSHIP

By

Sylvia M. Bolanos

A DISSERTATION

Submitted to the Faculty
of the University of Miami
in partial fulfillment of the requirements for
the degree of Doctor of Philosophy

Coral Gables, Florida

December 2012
UNIVERSITY OF MIAMI

A dissertation submitted in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy

SHRIMP AQUACULTURE AND AGUADULCE: A BROKEN PARTNERSHIP

Sylvia M. Bolanos

Approved:

________________                    _________________
Richard Weisskoff, Ph.D.             M. Brian Blake, Ph.D.
Professor of International Studies   Dean of the Graduate School

________________                    _________________
Bruce M. Bagley, Ph.D.                Ambler H. Moss, J.D.
Professor of International Studies             Professor of International Studies

________________
Daniel O. Suman, Ph.D.
Professor of Marine Affairs and Policy
A socio-economic impact study was conducted in Aguadulce, Panama to analyze the viability of the shrimp aquaculture industry. Two visits in 2004 and 2010 document the changes the industry underwent through the use of a survey and interviews of knowledgeable informants. Interviews were conducted among field and processing plant employees, managers and owners, government officials, and local artisanal fishermen. It was of relevance to understand the viability of this industry at both the town and country level.

Changes are evident when comparing the data. The industry has undergone drastic changes resulting from the spread of White Spot Syndrome Virus (WSSV) and the reduced price paid for shrimp in the international market. Job generation will never reach the levels anticipated in the 1980s and 1990s. The industry is no longer viable for small subsistence shrimp farms in Aguadulce and Panama. The survival of this industry for Panama is based on the production of shrimp for a small niche market that desires an organically raised and environmentally sustainable shrimp which consumers are willing to pay a higher price. The survival of this industry will be based on the price consumers are willing to pay for a better product with stringent certification guidelines in comparison to those from Asia.
Acknowledgements

My deepest appreciation are for Mr. Ricardo de La Espriella and his wife, Mrs. Mercedes de la Espriella, former President and First Lady of Panama who facilitated all my meetings and interviews with government officials, business leaders, political representatives, and members of the community, regardless of their political affiliation. Mr. Luis Dutari, my host in the city of Aguadulce, a very distinguished businessman and member of the community, who personally introduced, advised, and assisted me in gathering all the information and helped me schedule all the interviews conducted in the city of Aguadulce. Miguel de Leon, Head-Biologist of the Ing. Enrique Enseñat Experimental Brackish Water Station in Agudulce, for all his time and assistance in providing all the government data available and introducing me to all the shrimp farm owners in the area that were open for operation. And lastly to my father, Jorge L. Bolanos, for all his support throughout my academic endeavors; including enduring the role of personnel assistant in my travel to Panama.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Historical Development</td>
<td>1</td>
</tr>
<tr>
<td>Production Methods</td>
<td>4</td>
</tr>
<tr>
<td>Current State of Aquaculture and Global Fisheries</td>
<td>7</td>
</tr>
<tr>
<td>Benefits of Aquaculture</td>
<td>11</td>
</tr>
<tr>
<td>2 Globalization and Shrimp Aquaculture</td>
<td>17</td>
</tr>
<tr>
<td>Effects of Globalization on the International Shrimp Aquaculture Industry</td>
<td>24</td>
</tr>
<tr>
<td>3 The Development of the Panamanian Shrimp Aquaculture Industry</td>
<td>31</td>
</tr>
<tr>
<td>Policies and Laws Relevant to the Aquaculture Industry</td>
<td>36</td>
</tr>
<tr>
<td>Trade: Shrimp Importation to the United States</td>
<td>39</td>
</tr>
<tr>
<td>Future of Shrimp Aquaculture Industry</td>
<td>44</td>
</tr>
<tr>
<td>4 Aguadulce Field Visit 2004</td>
<td>46</td>
</tr>
<tr>
<td>Field Visit Interviews and Finding for 2004</td>
<td>61</td>
</tr>
<tr>
<td>Panama Pacific Farms Inc</td>
<td>62</td>
</tr>
<tr>
<td>Survey Conducted at Panama Pacific Farms Inc</td>
<td>65</td>
</tr>
<tr>
<td>Small Aquaculture Farm Owner</td>
<td>66</td>
</tr>
<tr>
<td>Local Fishermen</td>
<td>67</td>
</tr>
<tr>
<td>Altrix Processing Plant Employees</td>
<td>70</td>
</tr>
<tr>
<td>Mayor of Aguadulce</td>
<td>73</td>
</tr>
<tr>
<td>Local Entrepreneur</td>
<td>75</td>
</tr>
<tr>
<td>5 Aguadulce in 2010</td>
<td>79</td>
</tr>
<tr>
<td>Field Visit 2010</td>
<td>84</td>
</tr>
<tr>
<td>Ex-President Richardo De La Espriella</td>
<td>88</td>
</tr>
<tr>
<td>Interview Ministro de Desarrollo (MIDA) Victor M. Perez</td>
<td>90</td>
</tr>
<tr>
<td>Dr. Ricardo Pretto Malca</td>
<td>91</td>
</tr>
<tr>
<td>Alfonso Nieto (Ex-Mayor of Aguadulce)</td>
<td>94</td>
</tr>
<tr>
<td>Luis Carlos Ramos (Treasure of Aguadulce)</td>
<td>96</td>
</tr>
<tr>
<td>Miguel De Leon (Head-Biologist of ARAP Field Station in Aguadulce)</td>
<td>98</td>
</tr>
<tr>
<td>Roberto Chamorro (CEO-CAMACO)</td>
<td>101</td>
</tr>
<tr>
<td>Faustin Cabadas (Shrimp Farm and Processing Plant Owner)</td>
<td>103</td>
</tr>
<tr>
<td>Jaime Diez (Regional Director of ARAP-Fishing Section)</td>
<td>106</td>
</tr>
<tr>
<td>Interviews at Puerto de Vacamonte, Estacion de Maricultura del Pacifico</td>
<td>109</td>
</tr>
<tr>
<td>6 Comparison of Findings</td>
<td>120</td>
</tr>
<tr>
<td>Conclusion</td>
<td>137</td>
</tr>
</tbody>
</table>

**BIBLIOGRAPHY** | 144

iv
Chapter One:

Historical Development:

The science of raising aquatic plants or animals in a controlled environment is called aquaculture. Aqua is a Latin word meaning water and culture means to cultivate. The true beginning of aquaculture is difficult to identify. Historical evidence suggests that agriculture developed before aquaculture. Agriculture began around 10,000 years ago in the Middle East, when the human population changed from hunting and gathering to cultivating wheat and barley.\(^1\) The cultivation of aquatic organisms has been practiced since ancient times with no true written records of its time of origin, but can be traced to water-oriented civilizations of the east, where fish served as a main part of the human diet. It is believed that some form of aquaculture began around 2000-1000 B.C. with the raising of carp in China.

The first written document was by Fan Lai (also spelled Li or Lee by some authors) who wrote *The Classic of Fish Culture*. This book was the first to record and describe the structure of ponds, the method of propagation of the common carp, and the growth of fry. The book was written around 500 B.C. and was influential in the promotion of aquaculture. Between 500 B.C. and 500 A.D. historians consider it the “Golden Age” of carp culture which continued to develop in China and neighboring countries where the Chinese people migrated including Taiwan, Thailand, Malaysia, Indonesia, and elsewhere in the Indo-Pacific region. Common carp (*Cyprinus carpio*), milkfish (*Chanos chanos*), catfish (*Pangasius sp.*), and marine shrimp (*Penaeus spp.*)

were among the first fish and crustacean cultured in the region.\(^2\) During this same period (321-300 B.C.), records of the use of ponds to hold fish in the Indian sub-continent were also documented.\(^3\)

The next developmental stage of aquaculture was during the Tang Dynasty in China (618-906 B.C.). The emperor of the Tang Dynasty had the family name of Li, which also was the common name of the cultivated common carp in China. An imperial decree was issued prohibiting the culture of this fish since it was considered sacred. This decree turned to be a blessing in disguise for other species of fish used for culture such as silver carp, big-head carp, grass carp, and mud carp. It was discovered that when raised in polyculture in the same pond, these species complemented each other by eating different types of food and staying in different environmental strata within the pond. The new polyculture methods revolutionized the productivity of freshwater pond culture. The Tang Dynasty period, was also an influential initiative for fish growers to collect different fry since the imperial decree banned the common carp. Fry collection and dispersal was carried out in natural waters and was further developed under the Sung Dynasty (906-1120 B.C.). In 1243, Chow Mit published the Kwei Sin Chak Shik that described fry transportation in bamboo baskets.\(^4\) In India during this period, a manuscript was written by Namasollasa discussing the fattening of fish in reservoirs.\(^5\)

The next influential phase was during the Ming Dynasty (1368-1644 B.C.) in which the complete aquaculture process was documented in detail. Methods for

---


cultivating fry to adult, the structure of ponds, stocking density, polyculture, feed, the use of fertilizers, and even disease prevention were discussed at great lengths. At around the year 1500, brackish water aquaculture was started in Southeast Asia, on the island of Java. Records in the penal laws indicated that for any individual, stealing fish from ponds was prohibited. Aquaculture is believed to have started with the production of milkfish (Chanos chanos). In 1639, the Complete Book of Agriculture by Heu, which included fish culture, was released in China. The Ching Dynasty (1644-1911) continued the development of aquaculture with detailed descriptions of fish culture methods.

Aquaculture continues to be an important industry in China, especially in the production of shrimp.

Aquaculture was also developing in other parts of the world as well. The oldest form of coastal aquaculture known is oyster farming which was first used by the Romans, Greeks, and Japanese. Ancient records as early as 2000 B.C. document the Japanese cultivation of oysters. Egyptian hieroglyphics indicate that Egyptians of the Middle Kingdom (2052-1786 B.C.) attempted fish culture. Tomb paintings show fish, probably tilapia, held in man-made ponds. Following in the footsteps of the Egyptians, the Romans also developed aquaculture practices and became known for developing the cultivation of oysters that still continues in its original form today. In Europe, aquaculture developed during the Middle Ages with the introduction of the common carp in monastic ponds and in castle moats. Fish was eaten during special occasions. Carp flourished in most of

---

Eastern Europe and from there was introduced to Israel.\textsuperscript{9} Trout was also cultured in Europe; the first record was in France by a monk, Don Pinchot, who lived in the 14\textsuperscript{th} century and was accredited with the discovery of the artificial impregnation of trout eggs.\textsuperscript{10} Large scale cultivation of trout was later introduced in Denmark, Japan, Italy, and Norway. The British also introduced trout cultivation to their colonies in Asia and Africa. In the 18\textsuperscript{th} century trout was cultivated in North America for release into open waters along with salmon.

Modern shrimp farming production is attributed to Motosaku Fujinaga, a graduate of Tokyo University, who in the 1930s successfully spawned the kuruma shrimp \textit{(Penaeus japonicus)}. He cultivated larvae in the laboratory and later succeeded in mass-producing them on a commercial scale. Through his research and findings published in 1935, 1941, 1942, and 1967, he assisted fishermen and hatcherymen to begin supplying large quantities of juvenile shrimp to farmers, thus increasing farm-raised shrimp production.\textsuperscript{11} He is considered the father of modern shrimp aquaculture.

**Production Methods:**

There are three methods of cultivation currently being used: extensive, semi-intensive, and intensive. These three methods can be carried out in fresh, salt, and brackish waters in ponds, nets, cages, or raceways. The extensive aquaculture that was

---

\textsuperscript{11} Treece, Gravil. 1996. "Introduction to the Shrimp Farming Industry." For the 1996 Texas Shrimp Farming Short Course.
first developed in Asia used the mangrove forests for aquatic animal containment, storage, and growth, especially during stormy months when fishing at sea was difficult. For these reasons, some mangrove areas were modified into large trapping ponds for small fish and crustaceans. Extensive culture ponds for poly-culture of fish and shrimp evolved, consequently becoming an integrated part of subsistence for coastal communities. These practices still persist today and account for a substantial quantity of all world shrimp farm production.  

Extensive primitive ponds exceeded 100 hectares, with modern varieties having greater management control, typically ranging in size from 5 to 20 hectares per pond. Water exchange occurs with the natural tidal cycle allowing for shrimp seeds enter the pond naturally. Stocking density is about 8,000 post larvae per acre. In this system there is no use of mechanical pumping devices. Little or no food is required to feed the shrimp since the food supply comes from the natural productivity of the pond. Cost of inputs and labor are low with minimal capital investment, which is generally the lowest in the aquaculture industry. Usually these farms are owned and operated by a small family without the need to employ outside labor.  

Shrimp production by the extensive method is rather low; however it is the most environmentally sustainable farming practice of the three categories.

When consumer demands increased and higher price levels consequently followed, semi-intensive cultured systems evolved and became the method of choice for most farms in the Western Hemisphere. Higher shrimp prices justified the greater cost of

---

inputs to intensify production. These ponds are usually smaller, ranging in size between 100-500 hectares. One species is stocked with greater control over stocking density (8,000 to 40,000 post larvae per acre). While in extensive shrimp culture systems the shrimp feed on the organisms that grow naturally in the pond, semi-intensive culture differs in that the farmer must add supplemental feeds due to higher standing stock of shrimp exceeding the natural carrying capacity of the pond. The total grow-out time ranges between 90-120 days with farms in tropical climates typically having 2-2.5 crops per year. Shrimp farmers need pumps, aeration, and control gates to increase water exchange and exclude predators.\textsuperscript{14} Shrimp production increases up to 10 fold or more per unit of land area. Today, semi-intensive shrimp culture accounts for 42 percent of all world shrimp farm production.\textsuperscript{15} Semi-intensive systems are more labor intensive, and also have more serious environmental consequences. This was the predominant culture practice prior to the spread of the White Spot Syndrome Virus.

The intensive systems are the most technologically advanced culture systems. These systems were developed in Japan, Taiwan, and the United States, where wild post larvae are not readily available and where land and labor are expensive. This production method accounts for approximately 10 percent of the total world shrimp farming. Shrimp is stocked at very high densities (40,000-2,000,000 post larvae per acre) requiring greater amount of feed than the semi-intensive. With higher feeding rates, the farmer must also apply greater management efforts to maintain the water quality. Input costs are very high for this type of culture system, requiring greater production yields. Daily water

\textsuperscript{14} Treece, Granvil. 1996. "Introduction to the Shrimp Farming Industry." For the 1996 Texas Shrimp Farming Short Course.

\textsuperscript{15} Treece, Granvil. 1996. "Introduction to the Shrimp Farming Industry." For the 1996 Texas Shrimp Farming Short Course.
exchange is essential. Due to the higher feeding rates, this method produces pollution of surface and underground water unless wastewater is treated. Raceways are predominately used along with cages in the open ocean.

The cost of production generally rises with increased culture intensity, due to higher stocking densities, feeding rates, and water quality management efforts. The most cost-effective production strategy for any particular farmer depends on the size of the initial capital investment, the cost of available inputs, (fry, feed, labor, fuel, and power, etc.), and potential cost savings realized from economics of scale related to the total area under culture.\textsuperscript{16} The intensive system is technology dependent and thus capital intensive.

**Current State of Aquaculture and Global Fisheries:**

Why Aquaculture? It is well documented that the current global population will increase 1.14 percent annually with a doubling time of 61 years and will outpace the viable production of fish supply. As world captured marine fisheries continue to decrease and world population continues to increase, other alternatives are necessary to feed the human population. In 1997, the United Nations Food and Agriculture Organization (FAO) reported that over 70 percent of the world’s commercially imported marine fish stocks are “over-exploited, fully exploited, depleted, or recovering from over-exploitation.” Global capture production in 2006 was at around 81.9 million tons, which according to

FAO was considered the third lowest amount since 1994. In 2009, fish demand exceeded open sea catches proving that aquaculture was the only realistic alternative available to continue supplying the world with seafood. As it is one of the fastest growing food-production sectors, aquaculture is perceived as having the greatest potential to meet the growing demands for aquatic food and is a reliable supply source of protein. The aquaculture industry has experienced tremendous growth in the last 60 years with an annual growth rate of 8.8 percent from 1950 to 2004. World aquaculture production attained an all-time high in 2010, at 60 million tons (excluding aquatic plants and non-food products), with an estimated total value of US$119 billion. The highest average annual growth rates for aquaculture production are in Latin America and the Caribbean at 21.3 percent, followed by Near East, North Africa and sub-Saharan Africa. Aquaculture is the only alternative for seafood to supply an increasing demand of natural foods low in fat and a source of protein.

Most importantly, seafood is an excellent food choice according to nutritionists. It is one of the most balanced and healthiest foods available. The protein derived from seafood is highly digestible, easily absorbed, very low in fat, and contains all nine essential amino acids. It provides vitamins A and D, phosphorus, iron, calcium, magnesium, selenium, and iodine. A diet including 2-3 portions of fish per week reduces coronary heart disease (CHD). Fish, on average, has the potential of providing 20-30 kilocalories per person per day. Fishing and aquaculture produced approximately 16.7 kilograms per capita supply and 110 million tons of food fish in 2006. Aquaculture

accounted for 47 percent of these figures according to FAO statistics. They calculated that overall, fish provided at least 15 percent of the average per capita animal protein for more than 2.9 billion individuals. \(^\text{22}\) This percentage is much higher for small island developing countries, as well as in Bangladesh, Cambodia, Equatorial Guinea, French Guiana, Gambia, Ghana, Indonesia, and Sierra Leone where fish contributes to at least 50 percent of the total animal protein intake.\(^\text{23}\)

As the dependency on fish products continues, other alternatives are needed to compensate for the reduced fishing catches. Aquaculture is the best alternative and it is playing an increasing role in satisfying the needs of human consumption. There is significant potential for continued expansion and growth of aquaculture especially in alleviating poverty, improving rural livelihoods, and contributing to food security in developing nations throughout the world. Aquaculture continues to be the fastest growing animal food-producing sector when compared to poultry and cattle. In 1970, aquaculture produced only 0.7 kilograms of protein, and that figure rose to 7.8 kilograms in 2006, with an annual average growth rate of 6.9 percent. In 2006, aquaculture produced 51.7 million tons with a value of US$78.8 billion. In 2011, aquaculture production had steadily increased to 63.6 million tons and provided 18.8 kilograms per capita food fish supply with an estimated total value of US$119 billion.\(^\text{24}\)

Food protein generation is not the sole benefit from aquaculture, employment and revenue generation is also of relevance. In 2006, the estimated number of fish farmers

was close to 9 million\textsuperscript{25} and by 2010 it increased to about 16.6 million.\textsuperscript{26} FAO estimates that for every primary job produced, 4 additional jobs are created in the secondary sector (fish processing, marketing, and service industries) by aquaculture. They estimate that 170 million people are being employed as a result of aquaculture.\textsuperscript{27} Employment in the fisheries and aquaculture primary sector continues to grow faster than employment in agriculture; by 2010 it represented 4.2 percent of the 1.3 billion people economically active in the agriculture sector worldwide compared to 2.7 percent in 1990.\textsuperscript{28} Employment and revenue generation are of most significance in developing nations with fish being a highly traded commodity as more than 37 percent of total production entering international markets.

In 2006, world exportation of fish was calculated at having a value of US$85.9 billion.\textsuperscript{29} FAO estimated that 194 countries reported exports of fish and fishery products with more than 37 percent (live weight equivalent) of total production entered international markets. In 2006, export value expanded at an average annual rate of 5 percent for the period 1996-2006.\textsuperscript{30} The United States (US) market, in 2007, consumed 16.3 pounds of seafood per person, importing over 80 percent.\textsuperscript{31} Shrimp was the top imported seafood product in 2007 for the US, at a volume of 1.2 billion pounds and a value of $3.9 billion.\textsuperscript{32} This growth in demand for all fishing products is not only being seen in US markets but also in the European Union (EU) and Asia. The top exporter

\begin{thebibliography}{99}
\bibitem{25} FAO. 2008. \textit{The State of World Fisheries and Aquaculture 2008} p 61
\bibitem{26} FAO. 2012. \textit{The State of World Fisheries and Aquaculture}, p 28.
\bibitem{28} FAO. 2012. \textit{The State of World Fisheries and Aquaculture}, p 28.
\bibitem{29} FAO. 2008. \textit{The State of World Fisheries and Aquaculture 2008} p 8
\end{thebibliography}
countries in 1996 were Thailand, Norway, and the US. For that same year the top importers were Japan, the US, and Italy. Ten years later, in 2006, it changed with China being the top exporter, followed by Norway, and Thailand. The top importers were Japan, the US, and Spain. Progress in processing, packaging, handling, and transportation has enabled more rapid and efficient trade throughout the world, furthering global demand and economic significance of the fisheries industry.

Benefits of Aquaculture:

There are numerous benefits associated with aquaculture including the supplementation of natural stocks, generation of jobs, income, food supply, and creation of foreign exchange. The objectives of rural development must incorporate environmentally sustainable practices that do not hinder the needs of future generations. Aquaculture can facilitate the stocking or replacing of natural populations which are over-harvested. Stock enhancement is practiced in numerous countries throughout the world in Taiwan, Canada, France, Norway, the United Kingdom, and the United States.33 This program can augment sport-fishing stocks and replace populations depleted through industrial development and over-fishing.

An effective stock enhancement program was developed in Alaska (US) in response to record low wild-stock runs in the 1960s and 1970s. Initially, the hatcheries were funded by a state-run system. Currently they are run by private sector corporations, or regional aquaculture associations comprised of fishermen and other stockholders.

Alaska now has 33 hatcheries and each hatchery can release over 100 million juvenile salmon annually. The program’s success is attributed to Alaska’s strong directed laws and policies which preserve wild salmon stock and habitat.\textsuperscript{34}

Japanese flounder has the longest history of sea ranching, another method of stock enhancement. More than 2.9 billion animals were released into Japanese water in 1995.\textsuperscript{35} The United States had a similar ranching program for red drum and Bangladesh releases fry fishes into the flood plains in the rainy season. All three programs are successful, and have financial support from government authorities. These programs have numerous limitations: the target species must be well studied to understand its natural growth cycles, it must be endemic to the area of release to avoid genetic alterations, and landings are not guaranteed to increase in the area of release.

Aquaculture provides livelihood options for developing nations, specifically in rural communities throughout the world. Generation of income and jobs is a necessity for developing nations, where most of the population growth is centered. Three quarters of aquaculture production comes from low-income countries, the key region being Asia with Chinese production predominating.\textsuperscript{36} The number of people who derive their livelihood from fishing or aquaculture has nearly doubled since 1970. Aquaculture has the potential of providing additional income along with improving food security.

\textsuperscript{36} Haylor, Graham and Simon Bland. 2001. “Integrating Aquaculture into Rural Development in Coastal and Inland Areas.” Aquaculture in the Third Millennium, FAO. p. 73.
Increasing employment opportunities and income generation within rural communities is attainable. FAO has been monitoring a commune, Thuy Hai, since 1996 which has incorporated rural development and coastal aquaculture. This commune is located in the Thai Binh Province on the Red River Delta in northern Vietnam. Thuy Hai has no agricultural land and is dependent on fishing and salt production for its local economy. These activities support 51 percent and 36 percent, respectively, of households. About 10 percent of the 1,173 inhabitants are below the poverty line, while only 5 percent are relatively wealthy. Aquaculture has contributed to the overall wealth of the commune according to FAO.

Hand collection of mud crab seeds is a popular activity for the local people in Thuy Hai. They sell the seeds to local aquaculture facilities in the area. They earn about US$2.20 per trip. Collectors are, predominately, women and children earning additional income for their household. Crab seeds have increased up to ten times the amount caught in 1996 according to locals. This increase is a result of mangrove plantations initiated by various nongovernmental organizations (NGOs) to create buffer zones in front of the existing sea-dyke system. Once mature, the mangrove community not only increases the life-span of the dyke to about 50 years but enhances nursery areas for crabs, shrimp, and other local fish populations.37

To improve food availability in rural communities through aquaculture, educational programs need to be set in place. These programs would teach small farmers how to grow fish or shrimp at feasible levels in accordance to pond sizes and

environmental parameters of the area, thus minimizing environmental impact. Asian countries have increased fish food supply in rural communities through the use of aquaculture. Polyculture practices are common alongside people’s homes in many communities throughout Asia. These practices have proven proficient for hundreds if not thousands of years, with limited educational programs. However, with the assistance of educational programs, in the areas of disease prevention, nutrient cycles, and other technological advancements from the commercial sector, higher levels of production are feasible. Furthermore, increasing the dissemination of knowledge to a wider audience can also contribute to increasing production levels.38

Government support is essential to developing aquaculture in rural communities. Since 1975 the government of Fiji through its Ministry of Agriculture, Fisheries and Forestry (Development Plan 7, 1975–1980), stressed the importance of developing rural fish farming for both subsistence and commercial purposes. In the beginning years, progress was slow, but the basis for rural farming development was established. The government understood the importance of finding a means of feeding rural communities. At first, Tilapia (*Oreochromis niloticus*) was not well received as a nutritional supplement, since the fish was predominately used to feed pigs. With time the fish gained acceptance due to being an easy species to culture and has proven to be a good source of animal protein. Since 1983, fish ponds were constructed in the interior areas of Viti Levu and Vanua Levu for the purpose of providing supplemental animal protein to the protein-

---

deficient inland rural communities in Fiji. Unfortunately, with the government not having a monitoring program set in place, uncontrolled introduction accidental or intentional release, of cultured species in rivers and streams has led to genetic contamination of the wild species. Programs that encourage rural development must take into consideration future environmental constrains to minimize possible damages, when possible.

Another country supporting the growth and promotion of the aquaculture industry is South Africa. It is so committed, that it has developed an aquaculture park to expedite investment by foreign investors. South Africa’s main aquaculture species (by value) is abalone, which is exported to Asia for US$35 per kg. The first commercial harvest only began in 1998, but by 2003, output was 500 tons. Other countries in the region are realizing the potentials of aquaculture. In Zimbabwe, for example, one farm exports tilapia fillets to Europe, generating approximately US$5 million a year. It not only generates foreign exchange, but employs more than 350 people.40

Effective rural development programs must be implemented. These programs result from sound governance and policy coherence along with participation from all levels of society. The policies must have a multi-sectoral agenda that encourages the development of the aquaculture sector while monitoring environmental impacts. The programs must also address the needs of the rural coastal communities who need access to coastal resources for artisanal fishing or other traditional activities. The aquaculture

---


development plan must have benefits for the most possible people involved.

Governmental laws and policies must define salary, health benefits, and any other procedures that protect the employees. Aquaculture development must be responsible for both the society and environment.

The largest constraint to rural aquaculture development is the lack of funds available to implement educational programs along with monitoring environmental hazards. The general question raised is whether or not shrimp aquaculture generated new or expanded employment opportunities in coastal communities around the globe. Specifically, the research undertaken in this project seeks to address the question of whether or not shrimp aquaculture has truly made a difference for individuals in Aguadulce, Panama since its origin in the 1970.
Chapter Two:

Globalization and Shrimp Aquaculture:

This section will define globalization, give a general overview of the positive and negative contributions, and discuss how it affects the shrimp aquaculture industry. The major buyers of shrimp will also be identified in relation to the globalized economy and their current demand. Globalization is defined as a multidimensional concept, entailing economic, financial, technological, social, and political processes which continuously transform the global economy, society, and politics. It is considered a dynamic process of liberalization, openness, and international integration across a wide range of markets, from labor to goods and from services to capital and technology transfers.41

Economic growth can either be positively or negatively dependent upon the macro and micro economic policies of a particular country. Countries following globalization principles encourage deregulation, Social Darwinism, opening markets to international competition, and reducing tariff rates. Globalization is a means of opening markets to international trade and capitalizing on each country’s competitive advantage. The elements involved in globalization are on unequal footing. Industrial-country governments, together with transnational corporations, exert the strongest influence. Numerous authors have discussed both the positive and negative results of globalization in Latin America during the last thirty years.

Borraz and Lopez-Cordova discuss the relevance of globalization to Mexico in relation to the signing of North America Free Trade Agreement (NAFTA) in 1994 as a

positive movement towards reducing inequality. The authors indicated that both trade and investment flows increased substantially throughout the 1990s, which facilitated an increase in employment. They concluded that states which were more closely linked to the world economy had a lower rate of income inequality. They also perceived it to encourage economic growth of the country. The authors found that globalization was most beneficial to the unskilled women with an education level of one to six years. The women are mostly hired by export-assembly factories in cities closer to the United States border that are foreign owned.42

In his book, *Winners and Losers in Globalization*, Guillermo de la Dehesa takes a middle of the road approach to understanding the success of globalization. He feels that this process has “a long way to go.”43 In the book, he discusses both the positive and negative issues of relevance to globalization and the different economic indicators available for its evaluation. Technological progress is one of the many indicators perceived as a positive tool for globalization.44

Dehesa views technology as an important component enhancing development and welfare of the population. He emphasizes this point the best in his second book, *What do We Know About Globalization?* In his view, “it significantly increases productivity by saving time and cost associated with production, distribution, transportation, and

---

commercialization." New technologies allow the working population and their families to earn higher salaries and income. It also allows people to live longer and have better lives by reducing diseases, malnourishment, and significantly enhancing healthcare along with reducing inequality. Both Dehesa, Borraz, and Lopez-Cordova view lowering inequality as an important indicator of the success of globalization.

Nobuaki Hamaguchi in his article addresses the need for implementing a different monetary policy in Latin America. The International Monetary Fund (IMF) and the Washington Consensus were unable, in his opinion, to stimulate the economy of this region. The two organizations encouraged privatization policies which did not facilitate economic growth and stabilization. These countries encountered high levels of inflation and unemployment along with increasing inequality. The author examines the benefits of globalization that encouraging economic growth. He states that countries should independently decide the speed and scope of policy reforms which encourage globalization along with maximizing benefits and minimizing associated cost. Economic and monetary policies should be developed based on the independent needs of a country in relation to globalization. Governments or institutions should encourage market incentives as long as “the institutional framework guarantees a consistency of social cost and benefits, a stable macro-financial environment, and established property rights.”

The government should play an active role in keeping a strict control on the economic policies that will encourage globalization, while protecting the domestic industries. An equitable balance must be reached between both environments.

---

Omar Sanchez more clearly restates and defines the domestic components necessary for globalization to be effective in his article. He defines six domestic policies, (1) increasing domestic savings, (2) implementing countercyclical fiscal policies, (3) mobilizing public resources, (4) investing in education, (5) promoting employment, and (6) reducing income inequality, which must be addressed before Latin American can truly benefit from international markets. Globalization cannot be viewed as a reliable substitution for a domestic development strategy.

The author begins the analysis by stating that globalization does increase economic growth and that no country in the last half-century has achieved growth in a closed economic model. He believes the trade model is being oversold by international development communities such as the World Bank and International Monetary Fund (IMF) as a “panacea.” Latin America is not at the same level of economic growth as other countries involved in the international market and these six domestic policies must be achieved for the success of globalization in this region.

Historically, Latin America has a low rate of domestic savings and this directly affects economic growth. According to Sanchez, savings can be enhanced through frugal consumption habits, efficient financial intermediaries, positive real interest rates, and providing attractive domestic investment options. The governments’ goal should be to generate budget surpluses over the long run along with creating a stable macroeconomic environment. Secondly, the government needs to implement policies which attract savings from a broad base of the population and foster private sector investment. This can

---

be accomplished through export promotion, technology development, and sponsoring assistance programs to small and medium size businesses.

The second pillar for economic growth to occur is reducing volatility through the implementations of countercyclical fiscal policies. In Latin America the fiscal and monetary policies change very drastically and over a very short period of time. These policies magnify the effects of recessions with increasing taxes and reduce spending. Once the cycle changes to a boom, policies allow for larger-than-normal spending and lower tax levels. Fiscal responsibility must be established with a constant level of taxation and government spending independent of economic cycles.

Thirdly, fostering an adequate taxation system mobilizes public resources. The IMF, World Bank, and the Inter-American Development Bank, according to the author, urge countries to simplify tax norms, reduce marginal tax rates, expand the tax base, and rely more on the Value Added Tax (VAT). The true problem is that countries do not have the manpower for collection and enforcement. Mexico is a prime example, used by Sanchez, “in a country of 100 million inhabitants, and a workforce of 40 million, only 10 million regularly pay taxes.” Expanding the tax base and increasing government revenue is a long term challenge for countries in Latin America.

The fourth pillar necessary for economic growth is education because it increases the accumulation of human capital and productivity rate. Sanchez and numerous authors (Ocampo, Martin, De la Dehesa, Reimers) discuss the relevance of education to the advancement of a country. According to world schooling patterns, the average education

---

level of the work force in Latin America is 5.3 years. For its level of development, two additional years need to be added. The Inter-American Development Bank (IDB) calculated that for each additional year of schooling the workforce has, one percentage point growth rate could be attained. This is not an easy task resulting from inefficiencies in the education system. Expenditure on education stands at 3.7 percent of GDP with similar rates among other developing nations but a large disparity exists.

Education needs to be a priority for development. Schools in Latin America still marginalize the children of indigenous groups, rural population, and the poor. Government policies need to encourage or even enforce the length of time children remain in school. A primary education is just not enough for competition in international markets. Education cannot be left to market forces alone, since the benefits would only reach very few. Education enables countries to contribute to and benefit from the global economy: “It reduces inequality both within and between countries; it widens the pool of available skills and innovative capacity; it broadens the opportunity for employment; creates free and open societies; and is a wise investment for global peace and stability” according to Ruth Kagia.50

The fifth pillar for economic growth to successfully occur which is very closely tied with education is promoting employment. The workers must be prepared to adapt to different working environments with numerous tasks. This can be accomplished through employment promotion by co-operative interests and the assistance of government incentives. The government must take an active role to enhance the labor market.

---

Employment is beneficial for household saving, increased spending, and allowing the individuals to have a better life, therefore facilitating a better income distribution.

Decreasing economic inequality is the final pillar necessary for economic growth. As the disparity rises between the rich and poor, further strains on the economy of a country result. Inequality also places strains in the local communities by promoting social instability and poor governance. Numerous authors discuss these two issues extensively and all agree it discourages foreign investment. The debate continues as to whether inequality is reduced with globalization. Some believe that by encouraging trade productivity in the long term, there will be a decrease in inequality among the poor by providing more jobs. Others state the opposite; they feel that labor mobility is only available to a limited few.

Latin American along with other developing nations encounters numerous problems with globalization. Firstly, volatility of the financial markets in relation to Latin American have to function within the uncertainties generated by the macroeconomic policies of industrial countries. This phenomenon is related to the markets inability to distinguish properly between different groups of borrowers and the behavior of the financial markets during boom and bust cycles. This instability additionally strains the economic growth and social equity. Secondly, asymmetry between the power of the market and the lack of adequate governance places further strains on development and globalization. Thirdly, technological advances along with educational level differences place further restraint on Latin American moving closer to the international markets. The developed nations tend to marginalize those countries which cannot provide the advance
products resulting from the general population not having the adequate schooling necessary for manufacturing them.\textsuperscript{51}

These authors discuss globalization in the context of recommended government policies for economic growth to occur but do not examine specific industries which can be developed or expanded as a result. Globalization and its effects on aquaculture is a relatively new topic area. The discussion of globalization in the context of aquaculture is of relevance since farmed shrimp is a commodity that is traded internationally providing foreign income, employment opportunities, and poverty alleviation to many developing nations throughout the world including Mexico, Ecuador, and Panama.

**Effects of Globalization on the International Shrimp Aquaculture Industry:**

FAO held a conference in Bangkok in 2000, “Aquaculture in the Third Millennium”, discussing the developments within the aquaculture industry and recommendations for its further development. Ulf Wijkstrom, one of the speakers at the conference, discussed the importance of globalization providing an “open market economy” enhancing trade and foreign capital. Recommendations were given on how countries can facilitate the globalization process for the aquaculture industry to develop or expand by establishing: (1) a basic legal framework, (2) an accessible permitting process, (3) designating zoning areas for aquaculture, (4) government allowing technology transfer from foreign entrepreneurs, and (5) government support at a

minimum basic level. The speaker stated the importance of the government having an active role in diminishing the negative effects of this industry on the environment and coastal communities, since this industry will continue to grow and producers will always try to improve their returns.52

Conflict between protecting the environment, decreasing inequality of coastal communities involved in aquaculture, and increasing return will continue to be a problem with respect to the shrimp aquaculture industry. In 2009 an article was written by Marta Rivera-Ferre specifically discussing the case of shrimp aquaculture in relation to export-orientation and its effects on developing countries. These countries are predominant producers of agriculture, livestock, and/or fishery products and rely heavily on these products as their main export commodities for foreign exchange earnings. River-Ferre states that the main problem with these commodities is that countries become monoculture with very few species being culture dependent on market prices. This makes farmers more vulnerable to price fluctuations in the world market. The drive has not been for polycultures of both shrimp and agriculture operations working in conjunction. Profit continues to be the motivation factor not sustainability. This could be a result of International Development Institutions (IDIs), such as the Food Agriculture Organization of the United Nations (FAO) along with International Financial Institutions (IFI’s), which focused on promoting international trade and economic growth. All these entities promoted the development of the aquaculture industry to improve food security, and provide an alternative source of economic and social well-being since shrimp aquaculture fit well within the parameters of a commodity that could be traded in a globalized

economy. Unfortunately, these organizations did not take into account the complexities involved in massive amounts of feed, fertilizer, chemicals, and infrastructure that the shrimp aquaculture requires for its production. Only industrialized intensive or semi-intensive farms which are vertically integrated can compete. Although most of the shrimp farms are located in developing nations, these farms are financed by external capital and with governments supporting the installation of large corporations.53

It is estimated that only 15 countries in the world produce over 15,000 tons of cultured shrimp per year with nine in Asia and six in Latin America which include Mexico and Ecuador. The shrimp farms in Latin America are owned by large corporations with very few being owned by subsistence farmers. The industry is very competitive with a very high cost of operation. This puts great strain on the small farmers that have to compete with the transnational corporations (TNC), such as Mitsubishi, British Petroleum-Aquastar, Charoen Pokphand, and Ralston Purina which have control over all phases of the international shrimp commodity chain.54

Globalization is facilitating trade but at the expense to society and the environment. Developing nations see the shrimp aquaculture industry as an alternative for providing social benefits of employment creation in coastal communities and foreign exchange earnings, but do not truly take into account the long term effects associated with this industry. Boom and bust cycles continue to hinder the industry as a result of disease and viral outbreaks. Environmental protection of coastal areas is extremely difficult since governments lack funding for enforcement. This is an industry which has

---

developed from subsistence to commercialization fairly quickly, in 1982 shrimp aquaculture accounted for only 5 percent of the world shrimp supply and today it accounts for 50 percent. This exponential growth has allowed little time for policy development.

Thailand is an example of the short boom bust cycle associated with the shrimp aquaculture industry and is one of the leading producers. FAO in 2002 stated that Thailand was considered one of the world’s largest exporters of farmed shrimp. The industry generated approximately $2 billion Balboa in export earnings in 2000 but this figure does not take into account how the industry migrates from one area to another with extensive areas of abandoned shrimp farms that are in coastal areas.55 The farms have a life-span of about 5 to 10 years dependent on the level of intensification and carrying capacity of the area. Shrimp farms are built on salt flats and coastal margins, often on the shores of estuaries lined or formerly lined with mangrove forests which have access to a constant water influx. The problem develops when too many farms are built in the same area and surpass the carrying capacity, resulting in water pollution, salt intrusion, nitrification, and outbreaks of disease. These issues are not new to the industry and extensive articles have been written on the environmental impact of the industry by Boyd, Primavera, FAO, and the World Development Bank.

The shrimp industry does provide jobs to local communities, generate income, provide a product that the developed nations purchase but at a cost to small coastal communities. David Barnhizer of Mangrove Action Project summarizes this cost by

saying, “Shrimp aquaculture offers a paradigm case of the inherent conflict between the process of a globalized economy and the rights and interests of the local people.”\textsuperscript{56} The main problems arise from domestic and foreign investors who have few or no ties to local communities and over-exploit the natural resource base. They look for quick profits and do not take into account the long-term potential of this industry to the local communities. Once this farms and processing plant depart the area, the community is left with no employment opportunities and a depleted environment. The original fishing stocks are further depleted since the mangroves and coastal vegetation has been modified by the farms. Proper laws, policies, and regulations need to be established and then enforced which protect the environment and the local community while still facilitating shrimp aquaculture development with an emphasis on long-term productivity.

Shrimp aquaculture will continue to develop in the current globalized economy which has facilitated rapid expansion of seafood trade, technology transfer between developed and developing nations, and shifted labor-intensive processing to developing nations which provide new employment opportunities. For shrimp producers, this economy is bringing more opportunities in more markets around the world with more demand from consumers. Shrimp is the largest single commodity in value terms, accounting for 17 percent of the total value of internationally traded fishery product in 2006 according to FAO statistics.

Shrimp is predominately purchased in the US, Europe, and Japan with prices and margins under pressure. This has been a direct result of over-production from Asia and

the current state of the global economy. In 2009 US shrimp imports remained almost unchanged in terms of volume, totaling 236,076 tons and, in terms of value, imports fell 2.5 percent to US$ 1,600 million. Thailand remained the top supplier of shrimp to the US market, with 73,367 tons or 31 percent of total import volumes. The second main supplier is Indonesia followed by Ecuador. Sales from Mexico increased by 59 percent during this same period. Headless shell-on frozen shrimp remains the main imported product with 92,741 tons with Ecuador being the main supplier.57

The Spanish market is the strongest importer of shrimp for the EU. They imported 160,000 tons in 2009 with Argentina being the largest exporter. Argentina sold 36,000 tons or almost one quarter of the supply in 2009. The United Kingdom (UK) was the second largest importer for the region with cooked and peeled shrimp being the most desired. The other European markets reported stable imports with Germany showing the biggest import increase at 17 percent according to FAO Globefish. Japan had the least amount of change in shrimp import for 2009 from their largest producers, Indonesia and Vietnam. Indonesia and Vietnam continue to prefer black tiger shrimp to farmed vannamei which is also preferred in the US and Europe. The Japanese and European markets also prefer head-on shrimp. The US, Japan, and EU continue to be the largest consumers of shrimp with a continued increase in demand. Foreseeable changes are predicted of consumers desiring an environmentally sustainable product.

The beginning of the twentieth century marked the transition to a globalized economy. Following World War II, there was a desire for multilateralism in trade among nations. This period marketed the highest development of international institutional -

frameworks that included the founding of the United Nations, the IMF, International Trade Organization, and International Bank for Reconstruction and Development (World Bank). These organizations were founded on the premise of establishing international order, financial stability during times of crisis, a multilateral framework for developing trade, and facilitating the reconstruction of a country devastated by war. The priority at this time was for financial development and trade among all nations. All countries were perceived to be on the same playing field and globalization was fostering economic growth at record levels.

This is completely different today as there are large disparities between the developed and developing nations. Trade is perceived completely on the basis of comparative advantage with no social consciousness among the developed nations. Some would agree that this perception is the correct pattern and open-markets will reach equilibrium—but at what cost to society? New industries like aquaculture can fill the gap for developing nations as a means of providing jobs for individuals who have already worked in the agriculture industry. Globalization is a friend to aquaculture as a means of providing an international market with easy access to a wide verity of consumers. Shrimp aquaculture has the potential to provide another means of employment for the rural communities with governmental monitoring. A balance must be reached between protecting the local environment and facilitating proper business management.
Chapter Three:

The Development of the Panamanian Shrimp Aquaculture Industry:

Panama began the development of aquaculture in 1972 through the support of the national government and President Omar Torrijos. It was one of the first countries in Latin America to establish a commercial shrimp farming industry. President Torrijos famously commented he would “not rest until there is a fish pond in every village.”\(^{58}\) The program was designed to improve the Panamanian populations’ diet, specifically the rural communities. It was named the Fish Farming Project and headed by the Ministry of Agriculture and Livestock (MAG), which today is the Ministry of Agriculture and Husbandry Development (MIDA). The government built the Divisa Freshwater Culture Experimental Station in 1972 at Santa Maria, Herrera Province, 213 km away from Panama City. This was the first nationally funded aquaculture center established for the advancement of rural fish culture in Panama. In 1976, the National Aquaculture Directorate (Direccion Nacional de Acuicultura-DINAAC) was established as a governmental entity that promoted and facilitated the development of aquaculture. The National Aquaculture Directorate (Direccion Nacional de Acuicultura-DINACC) was officially conferred by the Executive Decree No. 16 on May 11, 1979.\(^{59}\) These two activities furthered the development of the aquaculture industry in Panama and encouraged funding from United States Agency for International Development (USAID) and the Inter-American Development Bank (IDB). This promoted research, technical


assistance, and incentives. Two distinct paths were followed in the developmental phase of growth for the industry.

The government fostered two paths: commercial and subsistence. The commercial phase or private sector emphasized shrimp cultivation of *P. vannamei* and *P. Stylirostris*. While the subsistence or semi-commercial, targeted fish culture of trout, carp, and tilapia. The first successful commercial shrimp farm, Agromarina de Panama, began operations in 1974. They opened a hatchery in Veracruz and a grow-out facility in Aguadulce on the Pacific coast. Ralston Purina, a US company, funded these facilities and applied shrimp farming technologies developed in Texas and Florida by US scientist. Agromarina became the first commercial larval production facility in the Americas.  They began their operations with 34 hectares in Aguadulce. This grow-out facility later grew to be one of the largest shrimp farms in Panama with 4,670 continuous acres (1,890 hectares). A second commercial operation was lead by Camarpan with a laboratory in Panama City and ponds in Bique, Panama. They specialized in breeding and culturing river pawn (*Macrobrachium rosenbergii*).

Furthering the subsistence path, the government and international agencies funded an educational component. In 1981, twenty students graduated as Aquaculture Technicians from the Regional University Center of Veraguas with the majority working in ARAP. This program emphasized agro-aquiculture which integrated aquaculture, farming, and forestry. The program lasted 3 years and terminated when the group graduated. About 10 years later, in the 1990s, a bachelors degree in aquaculture was

---

formally established at the University of Panama with 24 students graduating. In 2001, the Professional Technical Institute (Instituto Profesional Tecnico) in Aguadulce, started offering a Technical Aquaculture Degree with 38 graduates as of 2010.

A total of five Aquatic Experimental Stations were established, including the Divisa Freshwater Aquaculture Station in Veraguas, Ing. Enrique Enseñat Experimental Brackish Water Station in Aguadulce, Pacific Mariculture Station in Vacamonte, the Freshwater Aquaculture Station in Chirique, and the Laboratory of Achotines in Los Santos. Each were established for research and development for both shrimp and fish culture. All these stations have received outside funding from the US, Sweden, Canada, Japan, China and Taiwan. These stations are all used for training and advancement of the aquaculture industry in Panama. The two largest stations are the ones located in Aguadulce and Vacamonte. In 2009-2010, the Vacamonte station was working on Tilapia, Robalo, and Sea Cucumber domestication projects while the Aquadulce station continued with shrimp cultivation and some tilapia work. The private and government sector continue to see a potential in aquaculture but are not certain of the direction which is best for Panama.

Since the outbreak of White Spot Syndrome Virus in 1998, the industry has been forced to modify its production levels from semi-intensive to extensive levels with harvesting cycles extending up to 160 days. Panama only contributed 10 percent of Latin American shrimp production while Honduras contributed 44 percent for the 2000-2007 period according to Organización del Sector de la Pesca y Acuicultura del Istmo Centroamericano (OSPECA) The Panamanian government, in the last ten years, has not provided any loan programs or subsidies to the shrimp farm owners. Their consensus is in
lack of support from the central government and has been detrimental to the industry.

Prior to the outbreak of White Spot Syndrome Virus banks were all giving loans and the industry was expanding. The Asociacion Panamena de Acuicultores (ASPAC) estimated that Panama lost approximately $100 million Balboas in frozen shrimp exportations and $20 million Balboas in post-larvae and nauplii after the outbreak, along with 5,000 direct jobs. The impact was devastating to Aguadulce and the rest of the shrimp aquaculture industry in Panama. The industry reduced its employment by 60 percent after the outbreak with Aguadulce being the worst hit followed by Anton, Penome, Punta Chame, Chitre, and Parita. In 1998 there were 40 shrimp farms in operation in Aguadulce and by 2010 there are only 34.

The Panamanian farms have never truly recuperated from the outbreak of White Spot. In 2004, the general consensus was optimistic but that has all changed in 2010. Production has not returned to semi-intensive levels. The industry is also being hit by diminishing international prices (See Figure 3.1) and greater competition from Asia, who produce shrimp at a much lower price. Asia produces a product with lower operation cost since most of their farms are subsistence or cooperatives that are subsidized by the central government. The future for shrimp production in Panama and Aguadulce is not optimistic. The general opinion from many of the owners is of vertical integration. The small subsistence farmers will eventually disappear and only 4 or 5 companies will remain in Aguadulce that are completely vertically integrated with their own feed mills, processing plants, hatcheries, and grow-out facilities. Employment will still be generated but not at the level that was predicted in the early 1990s prior to the outbreak of White Spot.
The Panamanian government is looking at other alternatives for aquaculture. They understand the long term importance of the aquaculture industry especially for employment and income generation. One thing Panama has recently done is becoming a member of a regional producer group (OSPECA). The group includes Honduras, Costa Rica, Belize, El Salvador, Guatemala, and Nicaragua. The group facilitates trade of aquaculture products throughout the region, transfer of technology, and advice on regional regulations to protect the environment. They encourage aquaculture advancement throughout Central America. The Panamanian government is also funding research for Tilapia, Sea Bass, Oysters, and Sea Cucumber. The government is trying to find alternatives for shrimp aquaculture and for farmers to diversify. One option is to poly-culture shrimp and Tilapia. Panama is not turning its back to shrimp aquaculture but understands the limitations of the current global market and the competitive disadvantage it is facing.

**Figure 3.1**

*Average Price Paid for Shrimp 1996-2009*

*Source:* ARAP and Asociacion de Productores de Camaron
Policies and Laws Relevant to the Aquaculture Industry:

As stated previously, the aquaculture industry began in 1972 with the assistance and perseverance of President Omar Torrijos. The first aquaculture development project was headed by the Ministry of Agriculture and Livestock (MAG) which today is the Ministry of Agriculture and Husbandry Development (MIDA). The government built the Divisa Freshwater Culture Experimental Station in Santa Maria, Herrera Providence. This was the first nationally funded aquaculture center established for the advancement of rural fish culture in Panama. In 1976, the National Aquaculture Directorate (Direccion Nacional de Acuicultura-DINAAC) was established as a governmental entity which promoted and facilitated the development of aquaculture. The National Aquaculture Directorate (Direccion Nacional de Acuicultura-DINACC) was officially conferred by the Executive Decree No. 16 on May 11, 1979. The decree facilitated the development of the aquaculture industry through the promotion of research, technical assistance, and incentives. In 1995, Law 58 was passed by the Legislative Assembly reinstating DINAAC authority over the planning, permitting, and enforcement of all aquaculture activities. The law also defined aquaculture as an “agriculture activity”, granting it financial incentives for environmentally sustainable practices. Law 58 was specifically designed to streamline (“Ventanilla Unica”) the permitting process with only one application being required for submission to DINAAC. The law also required that an Environmental Impact Assessment (EIA) be performed for all new aquaculture projects.

In the 1990s-2000s, several laws and resolutions were passed to protect private businesses involved in aquaculture. On December 16, 1999, Article 11 of Law 58 of December 28, 1995 was amended by “Resuelto ALP-091-ADM-99.63 This amendment was enacted to protect private investment in aquaculture during the outbreak of White Spot. It protected leased land from reverting to the state when farmers were unable to make further developments or enhancements to the concession area as stated in Article 11 of Law 58. The government allowed a three year grace period for farm owners to not be concerned with a decrease in productivity resulting from the White Spot Syndrome Virus. According to the National Directorate of Aquiculture in 1998, this virus reduced productivity in Panama by almost 80 percent. In the year 2000, Law 40 was passed amending Article 18 of Law 58. It granted extensions of payment for land leases issued by the state to individuals from 5 to 10 years, as long as they complied with the guidelines for proper aquaculture development. Owners of farms had an extension of payment, as long as they were doing improvements to the infrastructure of the facility or any other advancement, which allow for higher production rates per hectares.64 On January 21, 2004, Law 9 was passed amending, again, Law 58 Article 18, granting 10 year payment concessions for water rights according to Law 40 Article 1 of September 27, 2000. These laws and articles were intended to protect and entice further investments of the aquaculture industry in Panama. Unfortunately, these laws and resolutions did not stimulate further advancement in the industry, especially with the continuing challenges of White Spot, decreasing prices paid for shrimp in the global market and increasing operating cost.

The Panamanian government continues to support the shrimp aquaculture industry with Law 44 which created the Authority of Aquatic Resources of Panama (Autoridad de los Recursos Acuaticos de Panama-ARAP) on November 23, 2006.\(^{65}\) This law unified all entities related to coastal resource management including aquaculture and fishing as a means of facilitating the transfer of research information, funding, and monitoring. It removes aquaculture from a purely agriculture practice to one that involves coastal resources and its effects on the environment. Preceding the organization of ARAP, the legislation re-defined the payment scale for water concessions and the price paid for the illegal removal of mangroves with Resolution (Resolucion) J.D. No. 1 of February 26, 2008.\(^{66}\) They defined the cost for water concessions at $3 Balboas per hectare a year under production, and established and cut a fine of up to $300,000 Balboas per hectare of mangroves. The second component is Law 80 of December 31, 2009 which defined the cost of land title depended on the location and optimum land use.\(^{67}\) This law also defined and delineated the coastal areas. This resolution and law was designed for protecting coastal resources although enforcement is almost impossible due to limited staff to monitor the areas.

Another important policy was the signing of the Executive Decree (Decreto Ejecutivo No. 97-A) on November 16, 2009. It officially joined Panama to the Organization of the Fishing and Aquaculture Sector of the Isthmus of Central America (Organizacion del Sector de la Pesca y Acuicultura del Istmo Centroamericano-OSPECA). This organization, OSPECA, was officially created on July 1, 2005 and the

\(^{65}\) Asamblea Legislativa de la Republica de Panama. 2006. *Gaceta Oficial*, No. 25680. p 36.


Executive Decree joined Panama with Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Dominican Republic to further advance the shrimp aquaculture industry throughout the region. OSPECA is designed to facilitate the decimation of technical information, enhancement of trade in the region and globally, along with development of environmentally sustainable practices. This organization is designed to improve the marketability of shrimp aquaculture for the region. Shrimp continues to be one of the leading commodities exported to the United States and Europe.

**Trade: Shrimp Importation to the United States**

Shrimp is the number one seafood product imported into the United States followed by salmon, crab, tuna-fillets, American lobster, tuna-canned, ground fish, and crabmeat. In 2007, the US imported by volume 1.2 billion pounds, at a value of $3.9 billion.\(^{68}\) The US consumes about 3 pounds of shrimp per person. Panama, due to its proximity to the US, has great potential for expanding its shrimp production. In 2008, Panama exported to the US 8 million pounds of shrimp at a value of $30,836,063 (See Figure 3.2 and 3.3).

---

\(^{68}\) National Marine Fisheries Service. [www.nmfs.noaa.gov](http://www.nmfs.noaa.gov)
Figure 3.2

Top Places the U.S. Imports Shrimp From, 2007, by Volume

Source: National Marine Fisheries Service

Figure 3.3

US Shrimp Imports from Panama
Source: National Marine Fisheries Service
Economically, the shrimp aquaculture industry has great potential for Panama and its relations with the US. The US is one of the top consumers of this product, along with Europe and Japan. Logistically, with the Canal, a waterway that links the Atlantic Ocean to the Caribbean Sea and the Pacific Ocean, offers another incentive for increasing shrimp production resulting from the accessibility of these markets. Currently, the Canal is undergoing a reconstruction project that would double the canal’s capacity, at a cost of $5.3 billion dollars with a completion date of 2014. Panama exported $9.7 million dollars worth of commodities to the world in 2007.\textsuperscript{69} The top exporting products are bananas, clothing, coffee, shrimp, and sugar. In 2006, the US was their top importer of products at 39.8 percent of total exports.\textsuperscript{70} Panama exported $378.2 million worth of products to the US in 2006 and imported $2.7 billion of merchandise from the US.\textsuperscript{71} These two countries share mutual interest in trade which can lead to lasting partnerships.

The United States and Panama signed a Trade Promotion Agreement or a Free Trade Agreement (FTA) on June 28, 2007. Panama approved the Trade Promotion Agreement on July 11, 2007 and it was signed into law by the US on October 21, 2011. This Agreement redefined the “preferred trading partner” statues between the US and Panama and guarantees Panamanian goods enter the US “duty-free”, creating new export opportunities. Prior to this agreement, 96 percent of Panama’s goods exported to the US entered “duty-free.” The FTA is designed to reduce tariffs between both nations. It was estimated that two-thirds of the 14,000 annual transits are bounded to/from US ports.

This agreement eliminated tariffs to 88 percent of US exports of consumer and individual goods to Panama immediately, with remaining tariffs being phased out over a 15 year period. It is based on a “zero-for-zero” immediate duty-free access to all goods that are imported and exported between both countries. It also established increased transparency for the promotion of businesses in Panama.

This agreement has the potential of increasing new business development. The agreement establishes a stable legal framework for US investors operating in Panama. All forms of investment are protected under the agreement. US investors will have the right to establish, acquire, and operate investments in Panama at an equal level with local investors. This agreement guarantees a fair and transparent process to sell goods and services to a wide range of Panamanian government entities. The agreement allows for more money to come into Panama that indirectly could facilitate the aquaculture industry with infrastructure and logistical improvements. These improvements could reduce transportation costs to the shrimp farmers and allow for a lower priced product. For example, during the week ending on March 6, 2009, farmed Panamanian shrimp was priced in the New York market for size 16/20 at $5.70 compared to $5.40 from Thailand and $4.90 from China. Ecuador was also selling white shrimp farmed of the same size for $4.90.\textsuperscript{72} A small reduction in price with enhanced infrastructure improvements that reduce transportation cost could make a substantial difference to shrimp farmers in Panama by making their product more competitively priced for US buyers. For example, the port near Aguadulce could be used to ship shrimp, sugar, or other agriculture products strait to US instead of having to send them from Aguadulce to Panama City.

\textsuperscript{72} 2009. www.shrimpnews.com
Transportation cost could be reduced for both the aquaculture and agriculture industries in the Province of Coclé, if efficiently maintained and managed since the port is easily accessible. The second advantage to using the port is that more trucks would be registered in Aguadulce for transporting products and would pay registration fees based on tonnage capacity of the trucks. These fees are paid to the town of Aguadulce. The fees could be used indirectly to repair town roads that are not covered by the central government. The estimated cost to rehabilitate the port is $14.7 million dollars.

Any trade agreement between Panama and other countries including the US are beneficial to all industries including shrimp aquaculture. This industry has grown since the 1970s when it was encouraged by President Omar Torrijos. The US market has great potential for Panama as the US imports approximately $11 billion in seafood products annually and its number one product is shrimp. In 2011, US imported 405.6 tons of shrimp with the highest amount of 130.4 tons coming from Thailand according to GlobeFish. China, which is the largest producer of farmed shrimp, raised attention in the press for producing a product that contains harmful residues. In 2007, the US Food and Drug Administration (FDA) detained shrimp products because the suppliers were unable to produce adequate health certificates. This is definitely a potential niche for Panama as it produces a product that is better. Most farms in Panama already are EU certified and their standards for health control are much more stringent than the US.

Panama as a result of its close and continuous ties with the US has great potential for the advancement of the shrimp aquaculture industry. The market is easily accessible and is in great demand. The US market will continue to desire shrimp but the price must be competitive. Trade liberalization can enhance the industry, if the price is right and the
resources to bring this product to the market are cost affective. The proximity of Panama to the US greatly facilitates the trade of shrimp. The framework is all in place for the shrimp aquaculture industry to increase imports to US because of its government support, possible infrastructure, banking institutions providing financial assistance, and an easily accessible market to sell their product. The main problem encountered by Panama’s shrimp farmers is how to reduce their operating cost and make their product competitively priced.

Future of Shrimp Aquaculture Industry:

The question remains to be whether or not shrimp aquaculture can be long term partner for Aguadulce and Panama. The answer is possibly answered through: (1) government support, (2) infrastructure, (3) proximity to a large market and Free Trade Agreements, for example US, and (4) globalization. Since the 1970s, the industry has grown in Panama with support from the government and international organizations. Laws and policies have been passed to facilitate and protect the industry from its origin. Free Trade Agreements could increase transparency of laws that encourage foreign investment and ownership of new businesses by non-nationals. We are witnessing the progression of the normal business cycle when few individuals enter the market and make a large profit with high risks involved, then saturation of the market with many individuals entering the markets and making very little profit, and finally equilibrium. The shrimp aquaculture industry in Aguadulce is starting to find the equilibrium point. Employment options will be limited but will remain a large employer for the area. This
shift in the demand curve is necessary. The shrimp farms which continue production will be highly specialized and completely vertically integrated.

The smaller family-run farms will need to grow another crop along with shrimp in order to be profitable or produce a smaller quantity that can be sold to the local markets. These smaller shrimp farms can also be a secondary business for the family along with fishing, construction, or other trade. Shrimp continues to be a commodity that is highly desirable by many, with the oceans not being able to keep up with the current demands. Shrimp continues being a luxury item that is highly desirable for the United States, Europe, and Japan. Shrimp is a product that is purchased by many, but further specialization of the production process is necessary to reduce fixed operating cost. Small family or subsistence farms cannot compete in this current global market with higher operating cost resulting from higher fuel costs or feed. Finding specialized niches in the shrimp market is essential for profitability at both the vertically integrated and subsistence level. Ingenuity, continual government support, and specialization are essential for the survival of this industry in Panama and Aguadulce. The industry will have to compete in the current globalized economy but it should not be a hindrance.
Chapter Four:

Aguadulce Field Visit 2004:

Aguadulce, officially established on October 19, 1848, is a predominately agricultural town located in the Coclé Province. The Coclé Province is divided into six districts: Antón, La Pintada, Natá, Olá, Penonomé, and Aguadulce. It is known as the land of salt and sugar, “la tierra de la sal y la azúcar.” It is located on the Pacific coast with a tropical climate that is dry. The town is 157 miles from Panama City near the Pan-American Highway. Aguadulce in the 1970s was one of the first areas in Panama that shrimp aquaculture developed with the support of the government, initiated by President Omar Torrijos and Ralston Purina with their two facilities. The first commercial larval production facility of the Americas was built in Veracruz with the grow-out facility in Aguadulce, under the company name of Agromarina de Panama. These two private facilities and a government run facility, Divisa Freshwater Culture Experimental Station built in Santa Maria, Herrera Providence, were influential in the advancement of the shrimp aquaculture industry for Panama and Aguadulce. Agromarina started operations in Aguadulce in 1974 with 90 acres and expanded to approximately 4,670 continuous acres (1,890 hectares). In 1980, they also built a processing plant facility. The grow-out farm and processing plant was a large employer for the town in the 1970s-1990s, prior to the invasion of Panama in 1990 (Operation ‘Just Cause’ launched by the US to remove Noreiga) and the spread of the White Spot Syndrome Virus.

The town of Aguadulce in 1970 had a population of 20,236 with a total of 3,892 occupied homes. Of these homes, only 545 or 14 percent did not have potable water, and
368 or 9 percent had no sanitary services (see Figure 4.1 and 4.2). Around 1,104 or 28 percent had soil floors, and 1,772 or 46 percent had no electricity. An estimated 13,742 or 68 percent of the total population of Aguadulce were 10 years and older with 1,715 or 12 percent being illiterate. Of the same population 10 years and older, 1,526 or 11 percent worked in the agriculture sector. There were 3,712 children attending primary school between the ages of 7 and 15, with 293 not attending within this same age group.

In 1970, there were 25 building used for primary educational purposes (grades 1-8) with 18 schools, 116 classrooms, 137 teachers, and a 28:1 student to teacher ratio (see Figure 4.4 and 4.5). There were 3,805 registered students with an attendance level of 3,629 or 95 percent (see Figure 4.6). At the secondary level, (9-12 grade), there were 5 buildings used for educational purpose with 3 schools, 39 classrooms, 45 teachers, and a 26:1 student to teacher ratio. There was a secondary enrollment rate of 1,191 and an attendance of 1,148 or 96 percent (see Figure 4.4-4.6). Attendance at both primary and secondary level was very high at around 96 percent, showing a significant interest of parents wanting a better future for their children in the town of Aguadulce.

As for medical data, in 1979, the providence of Cocle had 2 hospitals, 11 centers, and 20 sub-centers. Aguadulce had 116 beds available for medical purposes with 28 doctors, 6 dentists, and 23 nurses (see Figure 4.9).

---

In 1980 the population was 26,192 with 13,097 men and 13,095 women (see Figure 4.1). There were 19,673 that were older than 10 years old and of this number 1,546 or 8 percent were illiterate. As for employment, of the 7,277 total employed population, 1,169 or 16 percent were employed in agriculture activities. The town had 5,334 occupied homes with 330 or only 6 percent that did not have potable water and 191 or 4 percent without sanitary services (see Figure 4.2). A higher number, 877 or 16 percent of homes had soil floors and 1,447 or 27 percent had no electricity. As for primary education, there were 22 schools with 169 classrooms and 172 teachers (see Figure 4.4 and 4.5). There was a 29:1 student to teacher ratio with 4,906 enrolled and 4,564 actually attending. The attendance rate was 93 percent (see Figure 4.6). Secondary schooling had 4 buildings, 3 schools, and 68 classrooms with 132 teachers and a 24:1 student to teacher ratio (see Figure 4.4 and 4.5). There were 3,202 students enrolled with 2,793 attending and an 87.2 percent attendance rate (see Figure 4.6). As for health care, there were 169 beds, 35 doctors, 6 dentists, and 22 nurses (see Figure 4.9).

In 1990 Aguadulce had a population of 32,434 with 16,195 men and 16,239 women (see Figure 4.1). Of the population, there were 25,464 older than 10 years old, and only 963 or 4 percent of this age group were illiterate. There were 9,650 individuals employed with 949 or 10 percent working in the agriculture sector. As for housing, there was an increase in occupied homes being 7,289. Of those homes, 775 or 11 percent had soil floors, 238 or 3 percent had no potable water, 198 or 3 percent had no sanitary

services, and 1,125 or 15 percent had no electricity (see Figure 4.2). For primary education there were 25 schools with 171 classrooms and 184 teachers (see Figure 4.4 and 4.5). There were 4,701 students enrolled with 4,397 attending and a 93.5 percent attendance rate (see Figure 4.6). The student to teacher ratio was 26:1. Secondary education level had 7 schools with 89 classrooms, 184 teachers, and 3,776 enrolled. Approximately 3,689 actually attended at a 97.7 attendance rate (see Figure 4.4-4.6). The secondary level had a higher attendance rate than primary level. The student to teacher ratio was also lower at 20:1. The health sector had a reduction in the number of hospital beds to 128, an increase of doctors to 48, an increase in dentists to 9, along with an increase in nurses to 35 (see Figure 4.9).

In 2004, the Contraloria de Panama published a statistical book for the Providence of Cocle that presented better in-depth information about Aguadulce for the period 1996-2000. The greatest increase in construction was noticed in 1999, when the total values for construction doubled from $2,612,929 Balboas in 1998 to $4,430,891 Balboas in 1999 (see Figure 4.3). The non-residential construction had the largest increase for this period. The municipality budget of Aguadulce during the 1996-2000 period had a small surplus every year with the largest surplus also in 1999 (see Figure 4.7). As for employment options, the largest employer was in the mechanical repair and wholesale

---

business with 2,674 employed of the occupied population who was older than 10 years old.  

In Aguadulce in 2004 when the first field visit was conducted, there were 30 schools with 244 classrooms available for primary education and a total of 318 teaching staff at both the private and public schools (see Figure 4.4 and 4.5).  

There were 5,487 students enrolled at primary schools, for the 2004 academic year (see Figure 4.6). Along with 7 schools, 104 classrooms, and 345 staff assigned for secondary education with 4,780 students enrolled in 2004 (see Figure 4.4-4.6). The options became limited for colleges and universities, which are located in the urban centers along with the technical or vocational schools. Panama has one of the highest primary enrollment levels of 97.8 percent in Latin America, resulting from primary education being mandatory and free of charge.

The educational system of Panama is based on the Law 47 of 1946 with modifications and amendments by Law 34 of July 6, 1995. Article 1 of Law 47 states that education is a basic human right that cannot be denied on the basis of age, sex, ethnicity, religion, social status, or political affiliation. The state is responsible for organizing and directing this public service to all. The state is also required to validate the authenticity of degrees awarded at all public and private institutions. Panama spends approximately 4.5

---

86 Dirección de Estadísticas y Censo de la Contraloria General de la República de Panamá. Situación Cultural: Educación Ano 2004, Cuadro 511-10 and Cuadro 511-12.
percent of their gross national product (GNP) on education according to ECLAC statistics.  

Children between the ages of six through fifteen are required by law to attend school. This is based on an eleven year schooling program. Primary schooling, “educacion primaria”, begins at the age of six through eleven. Later, students enter pre-middle schooling, “educacion premedia”, between the ages of twelve through fifteen. Upon completion of primary and middle school the student must choose from two types of secondary school programs: an academic-oriented program or a vocational.

The academic-oriented program consists of two three year cycles. The first includes a standard curriculum; Spanish, social studies, religion, art, and music. The second cycle consists of two academic courses of study in the arts and sciences, leading to college admission or a less rigorous course of study, which signals the termination of formal education.  

In addition to the academic program, students can choose a vocational secondary schooling program which offers professional or technical courses aimed at preparing the student with the technical skills required for employment after graduation. This program is also divided into two cycles. Students can choose from a variety of classes in agriculture, art, commerce, and industrial trade. Almost one-quarter of all students choose this type of course work.

Admission to the university requires a “bachillerato”, a graduation certificate awarded after completion of the academic oriented course of studies. The baccalaureate is

---

usually indicative of middle-class statues. The oldest, largest, and most noted is the National Institute (Instituto Nacional) in Panama City for baccalaureate certificates. It is known as the Nest of Eagles (Nido de Aguilas) for drawing in many future public officials and political activism. The University of Panama grew out of this institute and was founded in 1935. It is the largest university in Panama.

Higher education in Panama dates back to 1749 with the founding of Jesuit University. Unfortunately, it had to close in 1767 when the order was driven out. Another college, Colegio del Istmo, was started in the early nineteenth century, but the school never prospered. Prior to 1935, students who wished to attain a university degree had to go abroad, until the University of Panama was established. A second university, the University of Santa Maria la Antigua, opened in 1965, as a private Roman Catholic institution. Later in 1981, the Technical University opened. The number of private and public universities continues to increase at a steady rate. In 1995 there were only 4 universities in Panama and by 2004 it increased to 30, resulting in an increase of private institutions.91

As for health services in Aguadulce in 2004, it had one large hospital with seven health facilities and two sub-centers. The hospital had a capacity for 197 beds. There were 104 doctors registered in the city with 88 nurses (see Figure 4.9). Public health services are directed by the Ministry of Health, whose programs include free health examinations and medical care for the needy, health education, sanitation inspection,

hospital and clinic construction, and nutrition services. As of 2002, total health care expenditure was estimated at 2.3 percent of GNP according to ECLAC.\textsuperscript{92}

Sanitation and water treatment is another service provided in Aguadulce and throughout Panama. While average water and sanitation coverage in Panama is high by regional standards, there are still gaps in rural and indigenous areas. Access to improved water supply is estimated to be 75 percent in rural and 56 percent in indigenous areas in 2004. Sanitation coverage is estimated at 94 percent in rural areas (27 percent for septic tanks and sewers) and 39 percent in indigenous areas (0 percent for septic tanks and sewers). Urban coverage with sewers and septic tanks is estimated at 75 percent, but it is only 45 percent in the lowest quintile in urban areas. In 2004, the sewage system in Aguadulce and Pocri were updated as part of a three-phase project approved by ex-president Mireya Moscoso at an estimated cost of $13.3 million Balboas. The project included the installation of 40.6 km of pipes, 550 inspection chambers, 2,500 residential connections, as well as a pump station and water-treatment facility. This would benefit 30,000 residents in the town. The 2004 sewage system dates back to the 1940s.\textsuperscript{93}

Service quality is often poor in areas officially defined as having coverage. While there are no reliable data on service quality, there is anecdotal evidence and frequent press coverage of supply interruptions. Although water quality is perceived as being good, there is only limited data on water quality, especially for rural areas. Less than one-

\textsuperscript{93} The American’s Intelligence Wire. 2004. “Aguadulce-Pocri Sewage System PI Work Begin-Panama.” Article #A121054064.
fifth of wastewater collected receives any form of treatment according to World Bank estimates.\textsuperscript{94}

Extreme poverty is one of the key characteristics of Panama’s “dual economy” where almost 69 percent of the population lives in poverty and of those 37 percent, or over 1 million, live below the poverty line. The rural communities are the ones mostly affected with the highest levels of poverty and extreme poverty. Farming, sugar cane and salt production are the main industries in Aguadulce. Fishing is no longer a viable industry for income generation. Unfortunately, many families still depend on fishing as their main livelihood and new job opportunities are being generated at a slow pace. The local fishermen must take an active part at searching for other job alternatives.

The aquaculture industry is a valuable alternative to the fishermen, but unfortunately the industry at the present time is unable to generate many new jobs. However, with the continual genetic evolution of the species, improvements of sanitary conditions at the farms, and the use of lower density cultivation techniques, this could increase the viability of the industry once again and make it a key employer for the area in the foreseeable future. Other options are available in the sugar mills, salt refinery plants, fertilizer manufacturing facilities, agriculture, and construction. For example, in the summertime, there are increased employment needs for picking and packaging watermelon and cantaloupe that are being exported to the United States and Europe. Another option includes working in the construction sector where numerous jobs are generated, although starting salaries will be very low since training and apprenticeship maybe required. In 2004, there were 311 private construction projects at a value of

\textsuperscript{94} World Bank. Report Number AB3081.
3,485,044 Balboas.\textsuperscript{95} The prosperity of this municipality is evident but changes do not happen overnight. Industries are existant that can provide employment to a limited number.

New employment options have also benefited women. In the past their options were limited to housekeeping, working at a local restaurants or stores, or helping their husbands. Today the shrimp processing plants only hire women. This has given them other opportunities for generating income and supporting their family. Many women in Aguadulce are not married and are single-family households. In 2005, there were 163 marriages and 30 divorces.\textsuperscript{96}

Adding extra disposable income has posed some problems in Aguadulce, women are starting to gamble. The first casino opened in the downtown area of Aguadulce in 2001, with women being the predominate customers playing the slot machines. The men, on the other hand, use their extra income on alcohol at the local bars. These two spending habits are not facilitating economic growth in the local community and diminish household savings.

We must look at the positive components of a municipality in transition. As more services are required, more jobs will be generated. With job generation a larger tax revenue base will develop. More taxes will equate to better roads, more money for city improvements, and public works projects. Everyone will benefit from a municipality that


\textsuperscript{96} La Dirección de Estadísticas y Censo de la Contraloría General de la República de Panamá. 2005. \textit{Estadísticas Vitales Vol. 1 Matrimonios y Divorcios}, Cuadro 221-19 and Cuadro 221-05.
has prosperity and room for growth. Aguadulce has numerous industries which can facilitate this growth including aquaculture.
Figure 4.2
Information of Occupied Homes in Aguadulce 1970-2000

Source: Cocle Y Sus Estadisticas 1996-2000

Figure 4.3
Values of Construction for Aguadulce 1996-2000

Source: Cocle Y Sus Estadisticas 1996-2000
Figure 4.4
Number of Classrooms in Aguadulce: 1970-2004

Figure 4.5
Number of Teachers in Aguadulce for Primary and Secondary Level: 1970-2004
Figure 4.6
Student Enrollment in Aguadulce for Primary and Secondary Level: 1970-2004
Figure 4.7
Aguadulce's Budget: 1996-2004

Figure 4.9
Important Health Care Statistics for Aguadulce 1979-1999
Field Visit Interviews and Findings for 2004:

Methodology:

In 2004, a general overview of the industry was studied and reported. A more in-depth case study was later conducted in 2010. A survey was administered to processing plant and field employees, managers and owners, government officials, along with the artisanal community (fishermen). Numerous interviews were conducted to understand the socio-economic impact the shrimp aquaculture industry provides for Aguadulce. The survey had both closed and open-ended questions allowing the participants to discuss their personal view on the current and future outlook of the industry. The combination of
qualitative and quantitative analysis allowed for a better understanding of the industry. Knowledgeable informants provided a historical perspective and insightful information about the current and future outlook of the industry at both the town and national level.

Panama Pacific Farms Inc.:

As stated previously, Panama’s first successful commercial shrimp farm, Agromarina de Panama, S.A. located in Veracruz and Aguadulce on the Pacific coast, started operation in the 1970s. It was supported by Ralston Purina, an American company that applied shrimp farming technology developed in Texas and Florida by US scientist. Agromarina became the first commercial larval production facility in the Americas.97 The hatchery was in Veracruz (approximately 10 miles from Panama City) and the grow-out farm was located in Aguadulce (approximately 125 miles from Panama City). The hatchery and grow-out ponds were built in 1974. Over the years these facilities underwent significant improvements to increase productivity.

The grow-out facility had approximately 4,670 contiguous acres (1,890 hectares) of which approximately 3,770 acres were developed into reservoirs, a nursery, and grow-out ponds along with roads, dikes, canals, and pumping station areas. The farm had 92 ponds in operation varying in size from 5 to 53 acres. The farm was located on Albinas (salt marsh) with White (Laguncularia racemosa) and Red Mangroves (Rhizophora mangle) predominating the farm landscape.

The facility had two pumping stations with a pumping capacity of 150 million gallons of fresh seawater per day. These two stations pump water into large reservoirs that connect into twenty miles of canals, providing water to the ponds, research laboratories, and a maintenance facility. The grow-out facility also had a processing plant on the premise. The plant had a capacity to process, package, and freeze approximately 83,400 pounds of shrimp per day. In addition, it had a freezer storage capacity of approximately 200,000 pounds per day with stand-by electrical generators and a constant supply of fresh water for making ice.

Agromarina of Panama suffered significant financial setbacks with the invasion of Panama in 1990 (Operation ‘Just Cause’ launched by the United States to remove Noriega) and with the spread of the White Spot Syndrome Virus in the late 1990s. By 2000, Agromarina of Panama had to close its doors due to financial mismanagement. In February 2002 all the facilities were purchased by Panama Pacific Farms, and the farm operated under a new management. In 2004, the facility had shifted operations from semi-intensive to extensive production. It employed 87 full-time employees and 83 seasonal employees during harvests. The grow-out farm produced approximately 3,500 lbs/per hectare. The cost of production was estimated at $0.99 per pound shipped. The shrimp were fed pellet feed twice a day and used 5 feeder trays per hectare as control measures. The shrimp were harvested at approximately 110 days; they weighed 13-15 grams at 60 days with a survival rate of 60 percent.

The processing plant employed 60 women and 4 men, worked two 12 hour shifts, 6 days a week, during the harvesting season. They were paid $0.92 Balboas an hour, plus an additional bonus given at the end of the year. The women were responsible for cutting
and de-veining, grading by size and weight, and packaging the shrimp in boxes. The plant processed 4,000 pounds per hour or approximately 15,000 pounds per day. The men were employed two per shift in the processing plant to work in the freezer area. These men work the same hours as the women to facilitate the movement of larger boxes for final packaging and shipment. The employees were given one half-hour lunch or dinner break depending on the shift and two 15 minute breaks throughout the day. They all wore plastic shoes, hair nets, gowns over their clothes, and a mask in the processing plant when working directly with the shrimp, in compliance with European Union (EU) certification requirements. In addition, they placed labels on each box detailing including place of origin, plant registration number, date of packaging, expiration date, and type of shrimp. The plant also conducted its own quality control measures by randomly selecting sample shrimps. These shrimp were measured, weighted, and checked for deformations. Further monitoring was conducted on the temperature, chlorine and bi-sulfite levels in the holding tanks on a constant basis (see Exhibit 1).

The main obstacle encountered by the farm was finding healthy larvae to stock the ponds. In November 2004, the farm had 80 percent of the nauplii with growth problems, thus drastically reducing productivity. The current owner planned to open the hatchery in Veracruz with possible joint ventures to increase productivity of healthier nauplii. The owner’s intensions were to run a vertically integrated farm with a bio-security crop.
Survey Conducted at Panama Pacific Farms Inc.:

The employees at this farm were interviewed on November 10-11, 2004. A written questionnaire was handed to them. Either the farm manager or president prior to distribution read the questions. No alterations to the questions were necessary and complete access was granted to the interviewer. The individuals were asked their job titles at the farm, salary, number of children, marriage status, age, sex, and time spent in the town. They were also asked if their children went to school and what the future plans for their children were. Comments were noted on their opinion of the future of the aquaculture industry and their job security. Please see appendix for a sample of the survey conducted (see Exhibit 2).

Overall the individuals were interested in answering the questions without hesitation. Women were much more approachable than the men at the facility. All the women employed worked at either the processing plant or in the office. Men exclusively worked in the field either harvesting the shrimp or working on mechanical problems and were encountered at the pumping stations or throughout the farm. Most of the employees surveyed had lived in Aguadulce their entire lives with their parents only attaining primary education. Many of the women surveyed were single and saw the processing plant beneficial, as it provided them financial independence. All the individuals surveyed who had children wished to provide a better future and pathway to attain a higher level of education for their children. They were well aware of the importance of higher education and the potential it offered.
As a general consensus, the employees felt aquaculture was important to their town. They were optimistic about the future of aquaculture and felt the economic conditions were overall improving in Aguadulce. They were very content with the working conditions at the facility. They were proud of their work and sincerely liked the current management with no desire for union affiliation. It was a pleasant experience visiting the facility and having the opportunity to interview the employees.

**Small Aquaculture Farm Owner:**

On November 10, 2004, Pedro Brietio was interviewed. He had water and land concessions for 21 hectares of albinas. He divided the hectares into 7 ponds under extensive cultivation, with one hectare pond being the most productive according to his personal experience. The ponds were stocked with wild *P. Stylirostris*, instead of *P. Vannamei*—which are more resilient but have fewer quantities available—at a stocking density of 6 shrimp per square meter compared to the previous year which he only stocked 4 shrimp. Feed trays are placed at a ratio of 15 for every hectare. He harvests the shrimp at 120 days with an average weight of 16-18 grams. The ponds are cleaned every 3 years with calcium carbonate at a ratio of 100 pounds per hectare.

Significant financial losses were incurred as a result of the White Spot Syndrome Virus. Prior to the outbreak, he was producing 800 pounds per hectare with natural tidal change with no feed added and harvesting at 46 days. Today he produces 180 pounds per hectare with a pumping system, feed, and harvesting at 120 days. It takes a lot more labor hours to produce less shrimp, but he was confident and optimistic that the shrimp
productivity levels were on the rise. He did comment about the need for the government to provide better technical assistance, since only one biologist works for the cooperative in his area.

Local Fishermen:

A local fishermen native of Aguadulce was interviewed on the same day. He was married with three children. Two of his sons were fisherman at 18 and 20 years old, and a daughter who worked in a fertilizer plant at 22 years old. The fisherman, his father, and his children only stayed in school until sixth grade. While his two sons wished to work at the local aquaculture farms, the father wished his sons would find other employment option outside the fishing or aquaculture industry. This is because in his own lifetime, he had witnessed a dramatic change in the amount of shrimp and fish caught.

The fisherman interviewed discussed his daily activities and the hardship involved in this industry. The fisherman owned a small wooden boat powered by a 15 horse-power engine. He works with an assistant. They both used nets for fishing. The fishermen work six days a week (Monday-Saturday), except for four months in February, March, September, and October which are illegal to catch shrimp. There were approximately 100 artisanal fishermen families living in the vicinity of Aguadulce according to the fisherman. These families live with very limited resources.

The fisherman interviewed noticed catches are becoming much smaller for all the fishermen. To him, the first reason fewer shrimp are being caught is because of the mesh size. Fishermen were having problems with the government who allow mesh sizes of
greater than 3.5 inches; he felt that 2.75 inches was the necessary size. The second problem he encountered is the competition between the local fishermen and the large Chinese fishing vessels off the Panamanian coastline. These vessels were fishing without any quotas since the Panamanian government does not have the manpower to monitor them. Julio, the fisherman, even stated that they are moving in closer to the shoreline. The conditions of the local fishermen were not viewed favorably; they were making less money each year without any other alternatives. The local aquaculture industry was not large enough to absorb them. The fisherman and his wife currently live on $5 a day after his fixed operating cost of $15. The fisherman, stated that wild caught shrimp was sold at $0.50 Balboas per pound in the local market.

One of oldest fisherman in the area was also interviewed on November 12, 2004. His father died fishing when he was 40 years old. The older fisherman had a stroke recently and is unable to continue fishing. He misses it dearly but does not see a future in it. He lives without medical benefits seeing as he was unable to pay social security taxes while he was a fisherman. He would have worked for the aquaculture farms if their hourly pay were higher. He had nothing negative to say about the industry and stated that it was a better alternative for the younger fishermen in the area. He also discussed the drastic decline in the number of shrimp and fishes caught in the area, and addressed the problem with the net size and the increase number of Chinese fishing fleets located outside their shores.

He was very friendly and helpful throughout the interview. His wife was also present and showed me around their home. She helped her husband when he was fishing and would go out with him on their boat. She stated that most of the women would do the
do the same by helping their husbands. She was very concerned about her husband’s health and upset at the lack of assistance from the government. She only wished medical assistance would be made available by the government. She was a strong spoken woman expressing her thoughts about his medical needs.

Other fishermen from Aguadulce were interviewed on November 12, 2004. These men had all worked as fishermen for their entire lives with primary education, no higher than 6th grade. The men interviewed were between the ages of 29-40 years old. Most of their fathers were fishermen. The fishermen worked 6 days a week for 7 to 11 hours, and earned between $5-10 Balboas a day. Many of the men interviewed did not mind working in the aquaculture industry if only the pay was better. They were all in search of a better standard of living, which fishing was not providing. The general outlook for the future of fishing was pessimistic.

Some of the men interviewed had small children. They all agreed that a better future was necessary for their children. They all wanted their kids to go to school beyond their own level of education. All the fishermen interviewed did not foresee a positive future for their children and were very concerned. The fishermen also stated the same problem of the large Chinese trawlers fishing off Panamanian shores and how that had affected the area. The fishermen had also noticed that more of their friends were no longer fishing and working in other local jobs such as taxi drivers, construction workers, and mechanics.

All the fishermen interviewed were very friendly and open to answering all questions. Every fishermen interviewed was extremely frustrated with the future outlook
of their occupation, along with not being able to find other job opportunities in the area that paid better salaries. On observation, these two issues combined added to a rise in alcoholism and gambling that is noticeable among the single or unmarried fishermen. Gambling was also prevalent among single women, as one new casino had just opened in the downtown area of Aguadulce with slot machines that was visited by the interviewer.

All the fishermen interviewed in the survey lived in concrete block homes with tin roofs, running water, electricity, and public sanitation. There was a general sense of pride of owning their homes and taking care of them. To share the expenses and live in a better home, multiple generations lived together including fathers and mothers living with their children, children’s spouses, and grandchildren. This community was truly yearning a better life for themselves and future generations.

**Altrix Processing Plant Employees:**

On November 12, 2004 interviews were conducted at Altrix de Panama S.A. This was a shrimp packaging and processing plant located on the city limits of Aguadulce. Nestor Moreno, Human Resources Director, graduated from the University of Panama earning a bachelor’s degree in Human Resources. As the interviews began, Moreno was very hesitant to answer any questions, although he understood the nature of the visit. The interviews were very restricted especially as he selected the individuals who were interviewed. He was very protective of the information the employees provided. The employees interviewed were also very nervous and uneasy. The workers were neither
friendly nor willing to answer any of the questions providing a contrast to Pacific Farms, where everyone was friendly and willing to answer.

All of those interviewed were females, since at the processing plant, they hold the majority of jobs. Most of the women had lived their entire lives in the vicinity of Aguadulce. Prior to working at the facility, they had worked as housekeepers or were housewives. All the women interviewed had a primary education level of sixth grade, as did their parents. The employees interviewed earned an average of $1.20 Balboas per hour, a much higher hourly wage than Pacific Farm workers. All were optimistic about the future of aquaculture. They stated that their pay was higher than other facilities and that was important to them.

The plant employees’ are all members of a union, the National Syndicate of Workers in the Industries of Agriculture, Ranchers, Dairy, and Similar (Sindicato Nacional de Trabajadores de la Industria Agropecuaria, Ganadería, Leche, y Similares.). The union agreement was officially signed and adopted on June 11, 2001 by the facility. It defines and protects employee rights, along with the employer’s responsibilities. The plant in accordance with the union agreement must provide a safe working environment. For example, they are to place first-aid kits in all departments, and any other areas of which are essential. They must have a vehicle ready and accessible 24-hour a day for transportation of any employee who is hurt to the nearest health facility. Everyone must have adequate access to water fountains or water jugs filled with clean, fresh, and cold water at the employer’s expense. The employer must also maintain bathrooms that are clean and sanitary along with a designated locker area. This area must have lockers for every employee and an adequate area for them to change. Furthermore, a designated
dining area and restaurant must be provided. The employees must receive a meal of a
minimum equivalent price of $1.25 Balbos per day. The designated dining area needs to be maintained by the employer.

The employer must also provide uniforms and safety equipment for all its employees based on the nature of their work. The uniforms are provided for both permanent and seasonal employees, with completely new uniforms once every June. If the uniforms are worn or defective the employer must change them at that time. The types of uniforms are explicitly defined in the union bi-laws. For example, male permanent processing plant employees receive three jeans, six sweaters, and one pair of plastic boots. And female permanent employees receive six sweaters, four gowns, one pair of plastic boots, and five pairs of socks.

Vacation time is also defined in the bi-laws. Permanent employees are allowed 30 days of vacation time with 26 days paid based on the average salary paid throughout the year. This amount must be paid in full three days before the employee leaves on vacation. Additional payments are extended for births, deaths, and marriages. For births, one day is paid in full to the husband or companion along with $50.00 Balboas for baby essentials. During a civil marriage, one day is also paid in full. As for deaths in the family, the death of a father, mother, husband, wife, or children, are paid three days in full. Employees are also paid in full for working until noon on December 24 and December 31. In addition, for the holiday season, permanent employees who have worked six consecutive years or six seasons are entitled to six paid days and those who have worked three years or three seasons but less than six receive four days. Those who have worked less than three and greater than one year or season, receive one and a half paid days. On December 23 of
every year the employer is responsible for providing Christmas gift bags for all the employees; permanent employees will receive a bag with a minimum of items valued at $20, seasonal $15, and contract $10 Balboas. The contract employees must be working until November 30 of that year.

The plant offers scholarships and school supplies to the children and step-children of the employees who have worked a minimum of one year. Scholarships are provided for primary, secondary, and college levels. The amounts are as follows: primary will receive $15, secondary $20, and college $30 Balboas per month. The employer is also responsible for school supplies of all the dependent children of the employees. Permanent employees will receive four books of two hundred pages, two pencils, two pens, and one eraser. Non-permanent will receive two books of two hundred pages, two pencils, one pen and eraser.

The bi-laws of the syndicate are designed to protect the employees by establishing specific guaranteed rights for permanent or seasonal workers. It defines holidays and vacation time, breaks during working hours, and above all promotes a safe working environment. The syndicate’s main objective is to promote a productive working environment for both the employees and the company.

**Mayor of Aguadulce:**

On November 11, 2004, the Mayor of Aguadulce, Alonso Nieto-Rodriguez, the Legislature, Noriel Castillo, and Dr. Yovenal Martinez were interviewed. These men were extremely helpful and generously provided any information that was required
during the interview. They seemed interested in their work and wanted to make a positive contribution to the local economy. The interview gave an overview of the community at large and the major problems encountered.

The first problem mentioned and most relevant is the lack of funding from the central government. The municipality only received between 0.02-0.09 percent of the national budget according to the Mayor. The municipality produced very limited revenues from taxes; no revenue is generated from land and water rights or concessions from the aquaculture farms since those fees are directly paid to the central government. The municipality did receive the registration fees of the processing plants within the city limits, but this sum was much lower than what was generated from the water and land rights paid by the aquaculture farms. The necessary budget for 2002 was $750,185 Balboas and they only collected $711,120 Balboas, which was the same budget of 2000 (see Figure 4.7). There was no increase for 2004, in a district of over 40,000 inhabitants. The municipality was running at a deficit and is only able to pay the basic cost of operation, mainly salaries, per diem, public services, police, cost of representation, transitory costs, transportation costs, and vacation time. Unfortunately, the municipality has no money remaining for investments or community improvement projects. Please refer to the appendix for the complete 2004 budget (see Exhibit 4).

The Mayor was also concerned with the state of the city roads. The budget was unable to cover for any repairs, along with not having any assistance in renovating the port from the central government. The estimated cost of rehabilitating the port is $14.7 million Balboas. The port, if efficiently maintained and managed, would provide additional financial assistance, create additional jobs, and increase the amount of trucks
registered in Aguadulce. The city would then receive the registration fees based on the tonnage capacity of the trucks. Another advantage would be job creation by the port authority and large multinational shipping corporations. These jobs additionally would create indirect jobs at local restaurants, shops, and the construction sector which is beneficial to the town. The port would be used by the salt, sugar, fertilizer, and shrimp industry in the area instead of having to transport all the goods to the Panama City port which is over two and a half hours away. The Aguadulce port would create a quicker route for transporting goods.

**Local Entrepreneur:**

Luis Dutari-Estevez has been a permanent resident of Aguadulce for almost his entire life. He received a Bachelors of Science in Agriculture from Louisiana State University, Louis has been extremely fortunate in his business endeavors. He owns a dairy and cattle farm, has partial ownership in one of the local salt refiners, is a developer, insurance broker, and has a teak plantation. Diversification has been the key for developing his fortune in Aguadulce. He was interviewed on November 12, 2004 and was my host. He is very well respected and has provided work for many in the local community.

Dutari-Estevez has witnessed many of the changes of which the shrimp aquaculture industry has brought to Aguadulce. The changes have been gradual in his opinion as the shrimp industry has provided work for small agricultural farmers that lived in the outskirts of the city and some fishermen. The women were the ones which have
truly benefited from the processing plants, since these jobs are solely given to them. The shrimp industry helped the community grow in the 1990s as more investment opportunities were brought to the area, but it all came to a standstill with the spread of the White Spot Syndrome Virus. The Mayor and Dutari-Estevez stated that around 4,000 jobs were lost during the outbreak, a significant impact to the 40,000 plus inhabitants. Thankfully, there was a sense of optimism along with a gradual increase in the shrimp production levels. Other industries are assisting in the financial development of Aguadulce according to Dutari-Estevez.

In 2004, he noticed significant improvements. One indicator was an increase in home sales. In his residential project, an increase was noticed in the sale of homes to employees from the sugar mills, Nestle Corporation, and the new regional hospital. The hospital has generated a small professional community of doctors, nurses, and medical technicians. The local sugar mills have also generated specialized workers; tool makers, mechanics, welders, tracker operators, and refrigerator repairmen with a higher level of income and education. As more money is generated by these employees other services are required, resulting in new restaurants and stores opening in the downtown area. A prosperous change is being noticed in Aguadulce.
Table of Data Gathered in 2004:

Field Workers and Processing Plant Employees

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Sampled</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Number of Females</td>
<td>25</td>
<td>61%</td>
</tr>
<tr>
<td>Number of Males</td>
<td>16</td>
<td>39%</td>
</tr>
<tr>
<td>Average Age</td>
<td>35.9</td>
<td></td>
</tr>
<tr>
<td>Average Amount of Time Living in Aguadulce</td>
<td>27.3</td>
<td></td>
</tr>
<tr>
<td>Average Amount of Hours Worked</td>
<td>12 hours/6 days a week</td>
<td></td>
</tr>
<tr>
<td>Average Amount Earned</td>
<td>$13.34 Balboas per day</td>
<td></td>
</tr>
<tr>
<td>Average Education Level</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Average Number of Kids</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Number of Individuals that Wish Their Kids Work in Aquaculture</td>
<td>16</td>
<td>39%</td>
</tr>
<tr>
<td>Number of Individuals that Wish Their Kids Stay in Aguadulce, Panama</td>
<td>27</td>
<td>66%</td>
</tr>
<tr>
<td>Number of Individuals that See “Positive” Aquaculture Future</td>
<td>27</td>
<td>66%</td>
</tr>
<tr>
<td>Number of Individuals that See “OK” Aquaculture Future</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>Number of Individuals that See “Negative” Aquaculture Future</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>Number of Individuals that See “Uncertain” Aquaculture Future</td>
<td>10</td>
<td>24%</td>
</tr>
</tbody>
</table>
## Coastal Community

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Sampled</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Number of Females</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Number of Males</td>
<td>11</td>
<td>100%</td>
</tr>
<tr>
<td>Average Age</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Average Amount of Time Living in Aguadulce</td>
<td>42.7</td>
<td></td>
</tr>
<tr>
<td>Number of Individuals Who Have Lived in Aguadulce Their Whole Life</td>
<td>8</td>
<td>73%</td>
</tr>
<tr>
<td>Average Amount of hours Worked</td>
<td>6.95 hours per day/6 days a week</td>
<td></td>
</tr>
<tr>
<td>Average Amount Earned Per Day</td>
<td>$7.91 Balboas a day</td>
<td></td>
</tr>
<tr>
<td>Number of Individuals Who Wish to Work in Aquaculture Industry</td>
<td>8</td>
<td>73%</td>
</tr>
<tr>
<td>Average Education Level</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Average Number of Kids</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Number of Fishermen that their Father was a Fishermen</td>
<td>8</td>
<td>73%</td>
</tr>
<tr>
<td>Number of Individuals that Wish Their Kids Stay in Aguadulce</td>
<td>4</td>
<td>36%</td>
</tr>
<tr>
<td>Number of Individuals That See “Positive” the Future of Fishing</td>
<td>1</td>
<td>9%</td>
</tr>
<tr>
<td>Number of Individuals That See “Negative” the Future of Fishing</td>
<td>10</td>
<td>91%</td>
</tr>
</tbody>
</table>
Chapter Five:

Aguadulce in 2010:

Aguadulce, Panama continues to be a predominately agriculture city within the Province of Cocle. It is divided into five neighborhoods: Pocri, El Cristo, Barrios Unidos, El Roble, and Aguadulce. This town shows to prosper gradually since the last visit in 2004. The Pan-American Highway has been expanded to four lanes of traffic which makes the two and a half hour commute quite comfortable from the capital. The city continues to grow and offer new potentials but at a very slow pace. Changes have occurred in both the public and private sectors. Complications continue to emerge in the public sector, especially with tax distribution between the local community and the central government. This chapter will address both the positive and negative changes that Aguadulce has undergone since November 2004.

The main industries for Aguadulce continue to be sugar, salt, and farmed shrimp. The approximate surface area for the town is 466.4 km² with a population of 47,775 in 2010 with 23,891 men and 23,884 women. The town continues to have a well organized center with banks, restaurants, and shops. The number of banks servicing the town has increased substantially since 2004 with BBVA, HSBC, and Banco Universal opening new branches along with Global Bank and Banco Nacional expanding their operations. New employment options are also becoming available with Coca-Cola, Feduro, Kellogg of Panama (a medical distribution company), Binbo, and Taste Choice opening facilities in the town. Feduro was a very small company and they have tripled the

---

98 El Instituto Nacional de Estadísticas y Censo (INEC) de la Contraloría General de la República de Panamá. Panamá en Cifras 2006-10, Cuadro 211-03.
amount of employees to currently 100 individuals. New stores have opened including SuperCarne, True Value, and Decoranica (which sells household items). The National Institute of Culture recently opened an art school and a library with funding from the central government.

Primary education continues to be mandatory and free from the ages of 6-11. This is based on Law 47 of 1946 modified by Law 34 on July 6, 1995, which states that education is a right provided by the state without any discrimination based on sex, religion, economic position, or political views. In 2010, there were 4,999 students enrolled in primary school (1st-6th grade) with a teaching staff of 290. There were 5,021 students enrolled in middle and high school with an additional 346 staff member.99 For this same time period there were 31 primary schools with 277 classrooms and 11 schools with 163 classrooms for middle and high school.100 The public secondary, middle, and high schools, have expanded the number of students that can attend by adding two cycles per day. The University of Panama extension program near Aguadulce has added more courses to its curriculum along with expanding the facility size. In 2009, the latest data available showed there were 709 students enrolled at the facility with 694 at the bachelor level and 15 at the post-graduate level.101 Panama has one of the lowest illiteracy rates, of only 3.15 percent for individuals older than ten, in Latin America.

100 El Instituto Nacional de Estadísticas y Censo (INEC) de la Contraloría General de la República de Panamá. Situación Cultural: Educación Ano 2010, Cuadro 511-10, 511-12, 511-19 and 511-20.
The public health sector has also seen an increase in funding. In 2010, Aguadulce had two hospitals, seven health centers, and one sub-center. A new hospital was built after 2004. The number of beds available at the hospitals was reduced to 161 with a total of 30 doctors, 22 dentists, and 24 nurses, from the last data available that included Aguadulce as a category. Public health services continue to be run by the Ministry of Health, whose programs continue to include free health examinations and medical care for the needy, health education, sanitation inspections, hospital and clinic construction, and nutrition services.

Sanitation and water treatment continues to be a problem for Aguadulce. A pumping station and water treatment facility was built in Aguadulce after 2004 which was part of a three phase project approved by ex-president Mireya Moscoso at a cost of $13.3 million Balboas. This facility was burglarized and is finally operational with two of the three generators replaced. Garbage is also a problem for the town since no landfills are available due to the high cost of building and maintaining them. A garbage collection fee of $2.00 Balboas a month is charged to all residents for pick-up and disposal of garbage that is burned in an area outside the city limits. Very few pay this monthly fee. Many of the homes have wells but they are running low and water must be brought in by trucks to fill tanks near the homes. Unfortunately this is very inefficient and costly. The central government had planned building an aqueduct system from Rio Santa Maria in Herrera to cover the complete district of Cocle at a cost of $38 million Balboas. Funding is still pending with no future date set for construction.

---

Aguadulce continues to have a serious problem with the distribution of funds from the central government. Their budget is unable to fund major road repairs within the city limits. For 2004-2009, only one road was added leading to Salado, along with 4 kilometers of asphalt laid on internal roads within Aguadulce. The budget for 2009 was only $986,710 Balboas compared to $711,120 Balboas in 2004. Please see Appendix for a copy of the 2009 budget (see Exhibit 5). The revenues received since 2003 have increased steadily but are unable to keep pace with all the structural repairs necessary for the town. The port has not received any further funding from the central government and is currently unusable. Concession fees from land and water used by the aquaculture facilities are not being enforced by the central government. Both the concession fees and the port are possible income generators for the town unfortunately the central government is not placing a priority on these issues.

New employment options have emerged since 2004 with the opening of the new hospital, Coca Cola plant, and new banks which have brought more professionals to Aguadulce. New stores have also opened including Spigal, Orange, and Chapulin, that increasing employment options. A third casino opened since 2004 requiring additional employment, although this is not considered desirable for the town. Sugar production also increased since 2004, resulting from an increase in the importation quota with the US, requiring additional personnel. As employment options increased positive changes were noted in the construction sector with seven new housing communities being built. In
2009, $2,193,197 Balboas was spent on residential construction which included both new homes and additions to existing homes.\textsuperscript{104}

Crime has gone up since 2004 specifically with drug trafficking becoming a problem according to government officials. Aguadulce has progressed since 2004 with more job options available but the limited budget from the central government has placed strains on the infrastructure of the town especially with increasing population growth. More homes are being built without proper sanitary conditions.

Aguadulce continues to be a town in transition and growth potential but the question remains, is shrimp aquaculture a viable job generator? Shrimp aquaculture has definitely gone through major transitions with the outbreak of White Spot Syndrome Virus or “Mancha Blanca” and the reduction in price paid in the international markets (see Figure 5.1). In 2004, there were 88 shrimp farms in production; this number was drastically reduced to only 34 by 2010. The number of processing plants changed from three to two along with a decrease in employment. The processing plants have also reduced the number of months in operation from 11 to 9 months and sometimes only 6 months due to the reduced quantities of shrimp being produced at the local farms.

Field Visit 2010:

Methodology:

The field visit in 2010 was much more in-depth than the previous visit of 2004. The same survey was used among the processing plant and field employees, managers and owners, along with artisanal fishermen. A larger number of individuals were interviewed at all levels. Government officials provided more in-depth information of the current and future outlook. Again, quantitative and qualitative analysis allowed for a better understanding of the socio-economic impact this industry has on Aguadulce and Panama. Knowledgeable informants provided a comprehensive understanding of the industry as a whole along with their interpretations of the direction the shrimp aquaculture will follow.

In March 2010, 24 of the 34 shrimp farms were visited and interviews were conducted of both employees and owners. Numerous questions were asked from the length of time in operation, size of farms, type of feed used, method of operation, salaries, their opinion of the industry’s future, education level of employees and their families, size of their families, and amount of hours worked. The questionnaire tried to assess the socio-economic condition of the individuals employed by the shrimp aquaculture industry in Aguadulce (see Exhibit 3). The two processing plants were visited and employees were also interviewed, along with the local artisanal fishermen. It was important to understand how this community viewed the shrimp aquaculture industry and the potential it has for generating income.
The data gathered showed interesting information. Many of the farms visited were both family owned and run (seventeen farms), or were owned by large vertically integrated corporations; Grupo Farragon, CAMACO, Marine Shrimp Farms, and NALMA. The general consensus was that the family owned farms were slowly being sold off to larger corporations resulting from lack of government support and funding. In 2010, there was no financial assistance from the National Bank. Another problem encountered by the farmers was low survival rates of approximately 51 percent with White Spot Syndrome Virus still affecting the farms. They were also having problems with the price paid for shrimp, at an average price $1.50 to $1.70 per pound for a size of 14-17 grams. This price is significantly lower than what was paid in late 1990s according to ARAP contributed data (see Figure 5.1). They must compete with Asia and even Ecuador and Honduras. The shrimp farms visited had an average grow-out of 120 days with the family owned and operated being extensive, while the larger farms semi-intensive.

Shrimp aquaculture continues to be labor intensive but the amount of individuals employed is less since fewer farms are operational. The small farms had an average of 3 employees working full-time with an additional 10 part-time or seasonal workers during harvest while the larger farms and processing plants can employ an average of 107 full-time or part-time individuals. The largest permanent employer was CAMACO who owns a processing plant, Altrix, and grow-out farm. They employed up to 334 temporary or seasonal workers during harvest. The owners of the family owned farms usually have a second job and shrimp aquaculture is no longer their sole business. It is estimated that
over 5,000 direct and indirect jobs have been lost since the outbreak of White Spot Syndrome Virus in 1998.

The farm workers and processing plant employees were also interviewed to assess their present and future outlook of the aquaculture industry and its effects on their economic well-being. Fifty-three females and sixty-five men currently employed were interviewed. The median age was 39 with an average education level of 9th grade. They worked 12 hours a day for 6 days a week at an average rate of $13.82 Balboas per day. Over 50 percent of the employees felt positive about the shrimp aquaculture industry. Only 11 individuals of those interviewed, had a second job. The shrimp industry had given an alternative employment for women especially in the processing plants. The general outlook of all employed was of a job that was very labor intensive with long hours. Workers were very optimistic since they had a job. The economic outlook of those employed was positive.

The next group interviewed was of artisanal fishermen. Around 75 fishermen answered a questionnaire with similar questions about their ages, sex, marital status, number of children, highest education level attended, and amount of money earned per day. Their outlook was very different from the shrimp farm workers. Only 6 women and 69 males were interviewed, this industry is male dominated. All levels of fishermen and even buyers answered the survey. The median age was 45 with an average education level of 7th grade. Their salary was slightly higher at $16.18 Balboas a day but it was not constant. Their hours also varied depending on the tide with an average of 8 hours. Around 41 of the 75 interviewed wanted to work in the aquaculture facilities if jobs were available. The general impression of the fishermen was that the oceans are overharvested.
They do not see a future for the next generation. Employment options in Aguadulce are very limited since the shrimp farms are not hiring. Alcohol addiction continues among the fishing community and fights occur often. Drug trafficking is becoming a concern for the government of Panama specifically within the fishing community.

The shrimp aquaculture industry is going through a transition from small family owned farms to a few large corporations that are vertically integrated. The only way for the shrimp industry to survive in Aguadulce and compete internationally will have to be through vertical integration. The smaller farms will have to focus on selling their product to Panamanian consumers. Other production options are being explored at the DIVISA Experimental Station that could become viable for the small family run farms with the production of grouper, snapper, tilapia, clams, and even oysters. Unfortunately, shrimp aquaculture at present cannot support a large quantity of employment with the competition from Asia, Honduras, and Ecuador and the challenging global economic condition. Shrimp aquaculture is providing employment for over a 1,000 individuals, directly. Shrimp aquaculture will continue to provide employment for Aguadulce but at a much lower rate of growth than in the 1990s, prior to the White Spot Syndrome Virus outbreak. Shrimp aquaculture will continue to be a job generating option for Aguadulce and Panama at a much lower level than was previously anticipated.
Ex-President Richardo De La Espriella:

Ricardo De La Espriella was interviewed during both field visits in 2004 and 2010. Numerous changes were evident between these periods with the economy tripling at an explosive rate. In the last five years, the country has experienced 6 percent growth rate per year. Panama has witnessed infrastructure growth with new streets being built, hospitals, power plants, and water treatment facilities. There has also been an increase in tourism and the hospitality industry with the opening of four new first class hotels in the capital. Additionally, Copa Airlines had made Panama its hub and will expand the size of the international airport. A new port was built in Colon, increasing tourism as more cruise
ships come to Panama. The canal enlargement project with an estimated cost of $5.25 billion Balboas will add an additional 10 to 12 percent growth to the existing canal with ports receiving 4 to 5 times increased activities especially in the container industry in the capital and Colon. The economy was at an upward swing with the unemployment rate down and exportations are up.

This economic growth fueled by the construction industry, banking, tourism, and transportation was facilitating an increase in the upper and middle class. As this middle-class grows, it will create additional indirect jobs. The only concern with this rapid growth is an increase in migration from the countryside, placing great strains on the social system in the capital. Migration is also high from Colombia, Ecuador, and Venezuela although the latter migrants are wealthier. Panama is a country of 3.5 million inhabitants with a predominantly service industry which makes Mr. Espriella very concerned about such rapid growth and the length of the international recession. He sees similarities of the bubble effect occurring in the US, especially with real estate investments.

The main focus for the future of Panama is how the government will handle the social problems of educating and housing the extremely poor that will not benefit from the economic growth of the country. The education system needs to incorporate better training programs which will keep up with the service industries operating in Panama. The education system is very closely tied with the employment potential of the country. Hand-outs from the government cannot be seen as the alternative for unemployment because this will place further strains on the social system. The federal system needs a continuous development plan at the national level that will be followed through from one
president to the next. Consistency at the national level is very important for the future of Panama.

**Interview Ministro de Desarrollo Agropecuario (MIDA), Victor M. Perez:**

On February 1, 2010, the Minister of MIDA, Victor M. Perez, was interviewed. He stated that the shrimp aquaculture industry has placed environmental impacts on the town of Aguadulce. The town had lost mangrove areas along with affecting the salt marshes. He owned land in Aguadulce for many years and has witnessed the changes in the topography of the area resulting from the industry impact. The Bay of Barita had very productive farm land. Unfortunately the shrimp farms have changed the topography of the area with tidal variations that have altered the rivers. They were over-flooding their banks in the rainy season resulting from the shrimp farms that have divided and filled the marsh area. These areas are no longer serving as the nurseries for wild fish and shrimp. In his opinion, shrimp aquaculture is not viable. All his friends and family who started shrimp farms are not successful. With only a few lasting, shrimp farms prove to be a short-term business.

Other viable alternatives were needed for the continual progress of the aquaculture industry through government sponsorship programs and international funding throughout Panama and Aguadulce. The Canadian government is currently funding a small-scale research facility to test the viability of producing genetically altered salmon since this species is not allowed to be produced in Europe. Perez also discussed his latest trip to Costa Rica where he visited a tilapia farm that is the largest producer in the
Southern Hemisphere. This farm reused all the run-off water, which had elevated levels of nutrients to irrigate and fertilize the surrounding farms. This was an example the Minister wished to implement in Aguadulce for the farm land near the shrimp farms. Another option discussed for Aguadulce is to convert the old shrimp farms that are no longer in production into algae ponds. This algae can be used for freshwater and ethanol production; this process is still experimental and very expensive. The Minister was very concerned with the disappearance of smaller businesses in Aguadulce since the central government is favoring large ones. Small businesses are not being protected in his view and that needs to be addressed.

**Interview Dr. Ricardo Pretto Malca:**

Dr. Pretto is an advisor to the Ministerio de Desarrollo Agropecuario (MIDA) and is considered one of the pioneers of the shrimp aquaculture industry in Panama. It was a great honor to have met and interviewed him. He had witnessed firsthand all the changes the aquaculture industry has undergone since its origin in Panama. The interview began with a historical overview of the industry from the beginning in the 1970s. Agromarina was the first commercial shrimp farm operational in Panama along with Ruben Espanol and Faustino Cabadas. Agromarina is no longer in operation under the original owners and has changed ownership twice, fortunately Espanol and Cabadas, are still in operation in Aguadulce and all three facilities were visited in 2010. Agromarina started its operations with 35 hectares under a pilot program that was a secret at the initial phase. This later grew to be the largest shrimp farm in Panama that Dr. Pretto worked for. This
farm in the initial phases grew wild caught shrimp and the feed was brought from the US. Agromarina also became the first shrimp farm to produce wild caught seed to re-stock their ponds in Panama. The other farms in Aguadulce that started production in this time period also used wild caught shrimp prior to the outbreak of “Mancha Blanca” (White Spot). As the industry grew, a niche developed for feed production in Panama. Today the farms uses pellet feed that are manufactured in Aguadulce, LARRO is one of the largest producers and is a subsidiary of CAMACO that is another pioneer in the industry. CAMACO has over 1,000 hectares in production along with a processing plant that is still in production today. Both the shrimp farm and processing facility were visited. As for Faustino Cabadas he started with 12 hectares and currently has 700 hectares in production, along with a processing facility. Financial hardships have hit all the pioneers in the industry resulting from reduced prices paid in the international market and increasing operation cost.

The White Spot Syndrome Virus outbreak changed the production methods for the shrimp farms. The outbreak forced producers to use more advanced technologies so much so that the smaller farms were unable to compete and produce a profitable product. Most of the small farms have become rudimentary. Dr. Pretto believed the best alternative was marine fishponds that offer a higher-value product. He recommended changing the shrimp farms into fish farms for production of snapper, grouper, and snook. He believed Panama should follow the Asian example of rural aquaculture and produce higher protein fish. ARAP needs to place more emphasis on mariculture activities that allow for the artisanal fishermen to raise fish in cages with better food conversion rates by using natural feeds such as phytoplankton or even mollusks. Hatcheries are also
needed to be set up for the rural communities to have accessible stocking populations. Aquaculture will continue in Panama due to large amount of research funding from USAID, Canadian International Development Agency, Japan, and the World Bank along with a continual support from the government. The academic sector in Panama needs additional support since the National University of Panama is no longer offering an advance degree (Masters) in aquaculture. Aquaculture will continue to be an important industry for Panama but additional adjustments and changes are necessary for the continual productivity of the industry. Small shrimp farms will disappear and only the large fully vertically integrated will remain in operation.

The biggest question in Dr. Pretto’s mind was what occurred to Panama’s shrimp aquaculture industry. In the 1970s, they were one of the pioneers with research being conducted at all levels. The USAID conducted the Pond Dynamics/Aquaculture Collaborative Research Program from August 1, 2001 to July 2002 in Panama, gathering research on pond construction, depth, size, temperature parameters, and even nutrition. Panama was at the center of shrimp aquaculture. In Panama, they were able to determine the best parameters to grow *P. vannamei*, growing best in the rainy season. All eyes were on Panama and everything changed. The National Bank was lending money to all who were interested in starting a shrimp farm, prices paid for shrimp in the international market was high, and the industry experience vast growth. The Association of Shrimp Producers was also very active during this time by hosting seminars, regional meetings, and annual conferences. This facilitated accessibility to technology and information transfers between all the farmers in Panama. Research was conducted by USAID, FAO, World Bank, Japanese corporations, and US universities. Unfortunately, everything
changed after the White Spot Syndrome Virus outbreak and the declining price paid for shrimp in the international market.

In his opinion, Panama has to change to intensive production of shrimp in small ponds with increased level of bio-security and with the rest of the ponds being converted to fish production of grouper, snapper, and even tilapia. This is the best alternative for aquaculture in Panama. Shrimp cannot continue being the only product harvested, and other alternatives are necessary along with increased support from the central government and the National Bank.

Interview Alonso Nieto (Previous Mayor of Aguadulce):

On March 17, 2010 the previous Mayor of Aguadulce, Alonso Nieto, was interviewed since the current Mayor, Omar Cornejo, was being treated for eengue at the national hospital in Panama. Mr. Nieto was interviewed in 2004 when he had just started his 5 year term in office. In 2004, the shrimp farms were starting to recuperate from White Spot Syndrome Virus with a 30-40 percent survival rate. Since 2004, the shrimp farms and processing plants have fewer jobs available. Vigomar and Pacific Farms were the largest employers in Aguadulce closed for a while, reducing employment options. In 2004, there were approximately 3,000 direct and indirect jobs provided by the industry. By 2010 that number was reduced by 40 percent. In 2010, only 34 of the original 87 shrimp farms were in operation. In his opinion, the industry is suffering as a result of improper commercialization and the reduced price paid for shrimp in the international
market along with the competition from Ecuador and Honduras, which are considered the region’s largest competitors.

Aguadulce in 2004 had two thousand homes added to the aqueduct system (first phase). A water treatment plant was built in Aguadulce, which was burglarized and closed down. By 2010, it was still not operational. Between 2004-2009 crime level were stable with drug trafficking increasing and becoming a concern. No new primary or secondary schools were built during his term in office. One new private clinic did open. A new paved street was built to El Salado along with 4 kilometers of asphalt laid in internal roads throughout Aguadulce. There was an additional lane added to the Pan-American Highway from the Shell Gas Station to Divisa. Commercial along with residential construction increased, especially with addition of new homes. New stores also opened such as Spigal, Orange, El Chapulin, and Super Carnes. Production of sugar increased with the US increasing its importation quota. The port, as of 2010, has no new plans for construction or dredging. The port in the past provided many jobs in Aguadulce along with tax revenue.

In 2010 the central government gave families a bonus of $20.00 Balboas per student for the school year. Unfortunately, this was not enough because parents have to continue paying for uniforms and transportation that many claim is very expensive for their households. Books were provided at the schools at no further expense to the families. Schools also provided for the students backpack or “mochilla” with some school supplies, but the kids throw them out. The education system continues to make improvements although increased funding is required to add more classrooms for accommodating increasing population.
According to Nieto, the town has made many positive changes but still many remain unemployed. Aguadulce was the capital of the Cocle Providence 100 years ago then the capital changed to Penome. Today, it has tourism helping Penome’s economy by providing many jobs in the hospitality and construction industries. Unfortunately, Aguadulce, does not have any tourism to help their economy with very few working outside the city limits. In Nieto’s opinion, many are just looking for short-term opportunities without a clear long-term plan. The government at both the local and federal level is also following short-term plans that do not facilitate expansion of the social programs required by the growing population.

**Interview Luis Carlos Ramos (Treasurer of Aguadulce):**

Luis Ramos has been the treasurer of Aguadulce for six years and has witnessed drastic changes in the town that is becoming very bureaucratic. His first concern discussed was the plan to build a second port in Salado instead of fixing the existing port. The costs are much higher to build a completely new port. The decision to build a new port is still in preliminary study phase and nothing further has been planned. A second project of relevance to the district of Cocle and Aguadulce is the installation of an aqueduct line. The estimated cost of the project is $38 million Balboas and the complete district will have access to this line. Currently, most of Aguadulce’s residents use well water or water that is brought in with trucks to fill water tanks within each housing community, this is very expensive and inefficient. The aqueduct project is necessary for the residents of Aguadulce to have clean potable water. A third concern discussed was
how to manage all the garbage produced. Currently, there are no landfills and the garbage is being deposited and burned just outside the city limits. The collection fee is $2 Balboas a month with the majority of the residents not paying for the collection service.

He then discussed the changes Aguadulce has undergone as a result of the aquaculture industry especially with the women. Prior to the spread of “Mancha Blanca”, many women were working in the processing plants, creating two income households. The community was prospering, but once the outbreak hit many lost their jobs. The hardest hit was Barrio Unido where many of the men also worked in the aquaculture industry or owned heavy equipment that were rented and used by the shrimp farms. Once the production levels dropped they were unable to pay the loans and their equipment was repossessed. Aguadulce was greatly affected, but fortunately the town continued progressing but at a much slower pace.

The production cost of shrimp has increased resulting from higher operating cost of feed and fuel. People are managing better the farms, but unfortunately the profit margins are very low. Ramos was still optimistic about the future of Aguadulce, although there is a lack of infrastructure and federal financial support. New businesses have recently opened in the town such as Coca-cola, Feduro, Kellogs of Panama, Binbo, Taste Choice, and a medical distribution company. Feduro tripled its operations and hired one hundred employees. New stores and restaurants have also opened: SuperCarne, TrueValue, Decoranica, and PioPio. Along with large banks like Banco General, BBVA, HSBC, Banco Universal, and Global Bank who expanded its operations along with Banco Nacional. These new businesses have opened other opportunities for the residents of Aguadulce.
The education system has also improved with the addition of another private school and a second cycle of morning or afternoon classes to the secondary school. The university added more classes and expanded its center size to accommodate more students. The National Institute of Culture (Instituto Nacional de Cultura-INAC) which is funded nationally and locally opened the School of Arts to promote culture. They are in the process of opening a library and already started a juvenile orchestra. Aguadulce with a limited budget is making advancements to their education system.

In his opinion, the town is prospering and a positive future is foreseeable. Aguadulce continues to be a town in transition but growth is visible. Increase in federal funding is still needed to deal with infrastructure issues of sanitation along with additional road construction. Currently, road construction is at a minimum within the city limits since they are unable to raise funding for it. Other industries discussed are growing in the area along with shrimp aquaculture. The change is gradual with an optimistic outlook.

**Interview Miguel de Leon (Head-Biologist of Ing. Enrique Enseñat Experimental Brackish Water Station in Aguadulce (ARAP)):**

In March through April 1999, the onset of “Mancha Blanca” or White Spot Syndrome Virus began to hit farms in Panama, and in 2000 the virus hit its highest peak. In 2000-2001, a slight recovery began and the farm owners started to place emphasis on better water treatment practices, feed, and pond maintenance. After the onset, larger farms began to genetically select broad stock with better resistance to the virus.
Antibiotics were rarely being used by the large farms, and they starting to use probiotics as recommended by Miguel. The problem with the outbreak was that the smaller farms could not incur the higher price of purchasing the genetically selected variety along with having to deal with the decreasing price paid internationally for shrimp. The operating cost of the industry was much higher for the smaller farms. As a result, many have closed down or are under extensive operation making them no longer profitable.

Only 34 farms remain in Aguadulce, which is a drastic reduction prior to the spread of White Spot Syndrome Virus when 88 farms where operational. In Asia, small cooperatives control the production market and they can produce a product at a much lower price. In Miguel’s opinion, cooperatives for the small farmers could work but with a different management strategy then the current cooperative in Aguadulce which is not doing very well financially.

Tilapia is another possibility to grow mentioned by Miguel. He stated that it would work better in rural communities as subsistence farming and not at a commercial level. There are currently no tilapia processing plants in the area, additionally, for the commercialization of tilapia, genetic research, feed, and technological expertise is also necessary. Shrimp continues to be the number one aquaculture raised product for Panama. Europe is the largest market for Panama with only a few purchased by US. Prices for farmed shrimp have dropped substantially since Miguel started working in the industry.

Miguel began working with aquaculture in 1980. He has been working in the government for 29 years and has been the head biologist of the Ing. Enrique Enseñat
Experimental Brackish Water Station in Aguadulce for 8 years. He has ten employees: five guards, one driver, one secretary, one biologist with a Master’s degree from Germany, one water quality specialist with a bachelor’s degree in aquaculture, and one specialized in fisheries that also has a bachelor’s degree. Their pay scales is as follows: guards $400-500, drivers $500, secretaries $400, biologist with Master’s degree $2,000, water quality specialist with a bachelor’s degree $1,039, and fishing specialist with a bachelor’s degree $1,200 Balboas a month. Miguel is currently finishing his Master’s degree in aquaculture. He also teaches a six week certificate aquaculture program once a year for students in their final year of high school, along with teaching at an outreach center from the University of Panama for extra income. He earns $1,039 Balboas a month at the field station.

White Spot Syndrome Virus continues to be a problem in 2010, as the production dropped from 13.1 million pounds in 2009 to 12.1 million. Shrimp were noticed jumping to the outside of ponds as a possible result of higher temperatures, according to Miguel. They also had problems with the feed and contamination issues which he did not wish to discuss since it was a rumor with no actual scientific facts. Only 2 processing plants remain open VigoMar and Altrix in Aguadulce. The water and land concession fees have not been collected in years since many of the farms are no longer in operation. Miguel did state that the central government is in the process of starting collection again at a rate of $6 Balboas a month per hectare for land concessions and $3 per month per hectare for water concessions.

The shrimp aquaculture industry is definitely in transition in Aguadulce and Panama. The decreasing international price paid for shrimp along with the outbreak of
diseases has changed the outlook of the industry. The industry created many jobs in the
town in the late 1990s, but today that is no longer the case. Assistance is needed from the
central government and the National Bank to facilitate financial assistance. At present
time the large, vertically integrated farms are the only ones that can survive. The smaller
farms which are operational are only productive as a second income for the households.
Miguel does see the continual growth of industry but at a much slower rate than what was
predicted in the late 1990s. Shrimp aquaculture will continue in Aguadulce with fewer
farms in production that are very well managed and vertically integrated.

**Interview Roberto Chamorro (CEO of CAMACO (CANASA original name)):**

Roberto Chamorro is the CEO of Camaco which is owned by a group of investors
from Mexico, they began with 100 hectares in the 1990s. They are one of the largest
producers of shrimp in Aguadulce. They also own Altrix, a processing plant purchased
right before the outbreak of White Spot Syndrome Virus in 1998. Altrix was visited in
2004 and surveys were administered. In 2010, they had 1,138 hectares divided into 265
ponds with an average pond size of 4.3 hectares, 62 ponds at 3 hectares each, and over
100 ponds at 3 hectares under production with 29 additional hectares for broad stock
production that are used to stock their farm and sold to other producers. Their ponds have
a stocking density between 10 to 18 shrimp per square meter at a semi-intensive level
with 1.2 to 1.7 cycles of shrimp production per year. Shrimp food conversion rate is 1.95-
2.23. CAMACO also has two hatcheries: (1) San Carlos in Costa Esmeralda and (2)
Pedasi in Los Santos.
They employ 200-240 permanent individuals that work 48 hours a week. Field help is paid $1.24 Balboas an hour or around $238 a month and technicians earn $1.35 Balboas an hour or $259 a month. The shrimp farm is divided into zones that are 300 hectares with one biologist, one field help, and one technician. There is also a production manager that oversees 1,200 hectares and an operation manager who oversees all activities of the farm including; transportation, communication, maintaining all services, and security. The operation manager then reports to the CEO, Mr. Chamorro. The CEO oversees all operations of the shrimp farm and the two hatcheries. He also is in charge of sales for all facilities. Cash bonuses are given at the end of each year based on the productivity level of the farm.

This shrimp farm is completely vertically integrated and produces genetically selected 10 generation White Spot Syndrome Virus resistant shrimp. They developed their own feed and own a processing plant. The shrimp are fed a pellet diet consisting of mollusce, soybeans, vitamins, and minerals. The shrimp are feed twice a day. They use FDA approved antibiotics when needed with the supervision of their own veterinarian. Probiotics are only used at the hatcheries, not at the grow-out facility.

The government is not supporting the industry and is not giving any incentives according to Mr. Chamorro. In 1999 they were the second largest exporter of shrimp in Panama. They sold 60 percent to Europe, 31-32 percent to US (California), and the rest to Taiwan. In 2009, he sold 180 containers with a total of 7.2 million pounds at an average price of $2.40 per pound with a size of 22 grams. They believe that by selling to a niche market of higher-end restaurants who desire a larger whole shrimp is the best option, since they cannot compete with Ecuador. Their processing plant is also trying to find
packaging alternatives like “easy peal” plastic bags. The processing plant has also changed the size of boxes from 2 kilos to a much smaller one. The industry is suffering as a direct result of increasing operation cost and the decreasing international price paid for shrimp.

**Faustin Cabadas (Shrimp Farm Owner and Processing Plant Owner-NALMA)**

Fuastin Cabadas is one of the original pioneers of the shrimp aquaculture industry in Aguadulce. He stated, “In the beginning no one wanted to get involved in the shrimp farming industry.” Banks were giving money without hesitation prior to the outbreak of White Spot Syndrome Virus in 1998, and around 5,000 workers lost their jobs in the area with $120 million Balboas lost in exportation. Prior to the outbreak of White Spot Syndrome Virus Aguadulce had the highest production as everyone moved to the area from as far as Herrera. Aguadulce became a commerce center for the Providence of Cocle. Ofelia and Nestle opened facilities in the area that also employed many. Unions developed causing problems to the industry in Aguadulce. “Mutual Agreements” between employees and employers were no longer acceptable by the unions. These agreements, in the past, were done between the employer and employee so that an employee could be released from work when the season finished and be rehired once the new season began. Many lost permanent employment as a result of union formation. Cabadas had 5 employees that worked with him for 10 years and once the union formed he was unable to rehire them.
In 2009 there were a total of 88 shrimp aquaculture farms in Panama. About 38 closed with only 34 in operation and, of these, 16 follow extensive operation. At one point he represented ARAP at the national level. Currently, there is no financial assistance from the National Bank and he agrees with the decision of the bank to not grant any new loans. There are approximately 5,000 to 6,000 direct jobs created by the aquaculture industry with the possibility of an additional 5 to 6 jobs created indirectly for every direct job created by the industry in all of Panama. Approximately 65-70 percent of all shrimp produced in Panama comes from Aguadulce.

The five year water concession rights are under negotiation with the central government. The central government is trying to increase the tax rate but nothing further has been done, as there is no true collection enforcement. As a result of fines being very costly and enforcement by government officials, mangrove deforestation has been reduced in the area. The farm owners have also learned that the mangrove area is unproductive and has a very short life-scan of productivity. He also commented about “Ventana Unica” and the need for it to be in ARAP. No one is looking at long term investment in the industry. Concessions are being exploited as a result of short-term decisions being made. In 1990-1998, the shrimp farms were not diversified.

Cabadas is one of the pioneers of shrimp aquaculture in Aguadulce he started with 25 hectares in 1990. By 1998 he had expanded to 250 hectares and in 2003 he expanded again to 600 hectares. Unfortunately by 2010 he reduced his production to only 250 hectares resulting from the reduced price paid for shrimp and the continued problems with WSSV. In June 2007 he received money for investment by the federal bank. Currently, he has 200 hectares under semi-intensive production with only 11 hectares
intensive and 8 hectares that are used as hatcheries. He acclimates the wild caught shrimp for two days before putting them in the grow-out ponds. The reproducers or broad stock are feed poliquetes, oysters, and 45 percent protein pellets. He catches the poliquetes wild and pays a fee to the central government for catching them. They catch them with bike tire pumps. He has been able to produce shrimp without White Spot Syndrome Virus and still uses Calcium to clean ponds after every cycle of production. He follows natural selection with two cycles per year. The intensive ponds are fed by feeder trays and the semi-intensive ponds use the feeder trays only for measurement purpose. He harvested in March with a 60 percent survival rate and sold his shrimp at $1.24 a pound at a size of 12 to 15 grams. He sells mainly to Europe with Spain being his main market. The US only buys tails-only as appose to Europe which buy the whole shrimp. He is starting to sell to Los Angeles, California since they are purchasing whole shrimp for higher-end gourmet restaurants.

Cabadas employs 40 permanent employees. There are 35 semi-permanent at the processing plant and 7 for the shrimp farm. During harvest season he can hire up to 60-80 additional employees for the processing plant. They work 8 hours/6 days a week but can work over-time, with around 9 months of work at the processing plant. In the field, workers can work year round and up to 24 hours. Field-help needs little schooling and are paid $1.24 an hour. Cabadas had one scientist of which he paid $600 Balboas a month, now he has one with a bachelor’s degree at $900 Balboas a month whom is better qualified. He has two technicians at $825 and $925 Balboas a month. The technical supervisor of the farm gets paid $450 Balboas a month and the technician for the farm
gets paid $800 Balboas a month. Intensive shrimp farming is done 4 times a year in his smaller ponds while the larger ponds are semi-intensive at 2 cycles per year.

Cabadas is a member of the Producers Association. Many of the members are in agreement with the inefficiency of “Ventana Unica” and as stated previously, it should be a part of ARAP. He had no problems acquiring his permit for operation. He pays $200 Balboas a year to the Department of Feed Control (Departamento de Control de Alimento) that oversees the production of feed at a national level. He wants to start selling more shrimp to the US, since in the past he was the first producer in Aguadulce to sell to US. In his opinion, Asia’s quality is a much lower grade resulting in a cheaper product that the Panamanian producers cannot compete with. All his facilities are HAZAP certified by the US and European Union. He grows his shrimp to 13-18 grams in 110 days. The farm does not use recycled water.

In Cabada’s opinion, the industry has many problems and lacks support from the central government and the national bank. Tilapia is not the solution because feed is too expensive. They pay $0.10-0.15 cents a pound for Tilapia with a very limited market. He does not feel tilapia is a good alternative. He will continue producing shrimp at his farm. The future of shrimp aquaculture in Panama will be based on vertical integration, government support at the federal level, and finding a niche market for their product.

**Interview Jaime Diez (Regional Director of ARAP-Fishing Section):**

Jaime has 16 years of experience in coastal resource management. He has a Master’s degree in environmental science with a specialization in marine resources. His
Master’s degree costed him $5,000, of which the government was unable to pay for. He has a salary of $2,000 Balboas a month. He has spent almost $3,000 Balboas from his own money for expenses in the office. Just on his cell phone alone, Jamie pays $200 Balboas a month of which the central government cannot pay. He works Monday through Friday 7 am to 8 pm with three other employees, his post is a 5 year elected position. Jaime and his staff are unable to keep up with the workload as a result of having such a large area of jurisdiction. He was in Miguel Leon’s position for 3 years.

There are currently two associations for aquaculture, ASPAC and APAPROC. There are 93 inactive shrimp farms in Panama with 45 percent of these farms in Aguadulce. The providence of Cocle has 60 percent of all the shrimp farms and 61 percent of ponds. Cocle supplies 63 percent of the national aquaculture production for Panama. In 2010, 119 producers of tilapia (rural) in Cocle stocked at 20-400 m² and, in Jamie’s opinion, the effort is not viable for profit. In Panama they are trying to culture poliquetes, worms that can be feed to shrimp. Unfortunately their production is not at a commercial level.

In Cocle, there are about 645 fishermen with only 244 officially registered. The boats usually have three fishermen with a 15-40 horse power engine. There are no fishermen registered that use fishing nets or “attaraya.” Jamie sometimes fishes in his neighborhood with an attaraya. There is a problem with drug trafficking among the fishing community and fishing illegally. His office is responsible for two provinces, 93 km of coastal waters, 3 districts of mangroves in Aguadulce, Nata, and El Roble, and estuaries (Santa Maria, Rio Grande, and Rio Chico). They only have two inspectors to cover this vast area plus evaluate the environmental impact statements for any new
purchases of land near the beach, along with monitoring the artisanal and industrial fishermen in the area. This is too large of an area for two inspectors but unfortunately the central government does not have additional funding to hire more inspectors.

As discussed previously, there are 244 registered fishermen who pay 0.25 cents a month for a fishing permit. Fishermen without a boat can make between $300.00 to $400.00 a month or $10 to $15 Balboa a day. The artisanal fishermen spent their money on drinking and drugs (cocaine). For 30 years, drug trafficking has not been watched. Government officials from ARAP are not allowed to carry weapons for protection. Jamie tried to set up 29 free vocational retraining classes for artisanal fishermen with 3 different shifts (7am-12pm, 12pm-5pm, or 6pm-10pm) to accommodate their schedules and none went. The fishermen do not want to have bosses, they like working for themselves. They fight and steal amongst themselves (boats and engines). Aguadulce has the largest fishing community. There are nine organizations for fishermen: Sindicato Nacional de Pescadores (1), Cooperatives (2), and Associations (6). The district of Cocle has the most problems as a result of them fighting. The European Union placed an embargo from January 1-February 12, 2010 for bad fishing practices on Panama.

Unfortunately, Panama does not have the resources necessary to protect its coastal areas and this is greatly affecting the fish population. International fishing fleets are coming closer to the coast of Panama and over-fishing is adding further strains on the already limited population. The local artisanal fishermen have no desire to change their livelihood at present time.
Interviews at Puerto de Vacamonte, Estacion de Maricultura del Pacifico:

In 2010, the field station at Vacamonte was visited and interviews were conducted. Ingrid Sainz, director of the field station, along with Aristides Frias, Sainz’s lead biologist, were interviewed and a tour of the facility was granted. They were extremely helpful and provided a wealth of information about the current shrimp aquaculture industry and the upcoming programs that the Panamanian government is funding. Questions were submitted prior to visiting the station so that her staff was ready to provide the most amount of information necessary for the visit. Complete access was granted and detailed answers were provided to all the questions submitted.

Ingrid Sainz was interviewed first. She discussed the continuing problem with White Spot Syndrome Virus and that other alternatives were being investigated with funding from the central government. One alternative was the use of cultivating oysters in the outlet channels of the shrimp farms, along with growing native species to the area (Robalo and Tilapia) instead of focusing completely on shrimp production. She explained that the development of ARAP as a separate government entity which covered both the aquaculture and fishing industry was better organized along with facilitating funding for both sectors. The central government continues to see the importance of shrimp aquaculture along with investing in other pilot programs to expand the aquaculture industry. The joining of Panama to OSPECA is positive to the aquaculture industry.

The questions were as follows and were submitted in Spanish:

1. ¿Qué cambios significativos han ocurrido en la industria del cultivo del camarón panameño desde el 2004 a nivel nacional y en Aguadulce? What
significant changes have occurred within the Panamanian shrimp aquaculture industry since 2004 at both the national level and in Aguadulce?

Since 2004, Panama became a member of OSPECA (Organización del Sector Pesquero y Acuícola del Istmo Centroamericano) along with Belize, Costa Rica, El Salvador, Nicaragua, Guatemala, and Honduras. This organization was developed for facilitating the exchange of knowledge, protecting the environment, and developing regional trade agreements for aquaculture products. The Panamanian government is also supporting a program to produce “poliquetes” that are farm raised. They are currently learning about its life-cycle. The program is being conducted with an independent company and the government. ARAP supplies the company with algae that they grow at Vacamonte to feed the poliquete. These worms can be used to feed shrimp in the farms.

2. ¿Es todavía un problema la “Mancha Blanca”? Is White Spot Syndrome Virus still a problem? White Spot Syndrome Virus is still in the area because companies did not spend adequate funding on studies related to pathogens, along with taking further environmental precautions. Up to 3,000 individuals lost their jobs as a result of the White Spot, within 15 days all shrimp was dead in the farms. Blue crab was considered a carrier of White Spot Syndrome Virus in the beginning. But as of two years ago the shrimp have naturally built immunity to the White Spot. Frias used the example of N1H1 and how immunity is built within the human and animal population. An authority from Japan came to Panama to conduct a study on how to minimize the outbreak of White Spot Syndrome Virus and he told the Panamanians to use Chlorine. They use complete
water exchange for large farms and ozonification systems for water used in the hatcheries, this is very expensive. Faragon is selling “mega larvae” and in Frias opinion, as a scientist, he does not know which is better the gene modified variety or the naturally selected ones. He also believes the White Spot Syndrome Virus has been controlled but once the conditions are correct it can return.

3. ¿Cómo ha afectado las exportaciones Asiática del camarón cosechado en fincas a las exportaciones panameñas a la Unión Europea, los Estados Unidos y Japón? How has the exportation of farm raised shrimp from Asia affected the Panamanian market which exports to European Union, United States, and Japan? The exportation of shrimp from Asia has greatly affected Panama. In 2007 they witnessed a significant decrease in exportation of shrimp. It takes between 90-120 days for the shrimp to reach 15 to 16 grams. In the winter time Asia cannot produce shrimp because the temperature is too cold. Asia also sells their shrimp at 15 to 16 grams which competes directly with the farms in Panama. Price and volume is affecting the market. Asia produces shrimp at a cheaper price and a higher volume. Now in Panama companies are trying to produce Tilapia instead of producing shrimp although P. vannamei continues to be the shrimp of choice for production in Panama. The problem with Tilapia is that you need more machinery to collect and cultivate it, increasing cost. They harvest Tilapia at 1 kilo.

4. ¿Han habido nuevas leyes desde el 2004 que afecten la industria? Has there been any new laws affecting the industry since 2004? ARAP was only established 3 years ago. They are trying to achieve better enforcement of the land
and water concessions. He was unable to provide any new laws relevant to shrimp aquaculture.

5. ¿Cómo ha afectado la recesión economía global a la industria de camarón cosechado en Panamá y Aguadulce? How has the global economic recession affected the shrimp aquaculture industry in Panama and Aguadulce? Only 33 producers remain in operation in Aguadulce. The industry has suffered greatly not only from the global recession but during the outbreak of White Spot. The industry is trying to find other alternatives like raising Tilapia.

6. ¿En su opinión, usted creé que la industria del camarón cosechado tiene futuro en Panamá y/o Aguadulce? In your opinion, do you think shrimp aquaculture has a future in Panama and/or Agaudulce. Yes, but other alternatives are necessary like raising Tilapia and Mollusce with shrimp. Also raising native species, Robalo and Pargo.

7. ¿Existe algún programa gubernamental en existencia o en desarrollo para fomentar, promover, subsidiar o financiar la industria? Are there any governmental programs in existence or in development for the promotion, advancement, and/or subsidize or finance the industry? OSPESCA is the current program being supported by the central government which Panama joined. This will facilitate trade and exchange of information within the industry and throughout Central America. ARAP is also working on promoting, supporting, and enhancing the growth of the industry with the use of their research stations and the Panama University. The National Bank was giving loans three years ago,
unfortunately at present time that has stopped. NGOs are still giving grants and assistance for research.

8. **¿Sigue la Ley 40 y Ley 9 de 2000 en efecto para las concesiones del agua y la tierra de las fincas de camarón?** Are Law 40 and Law 9 of 2000 still in effect for water and land concessions? Yes still applied but enforcement limited.

9. **¿En su opinión cree usted que el gobierno está facilitando el progreso de la industria? De que forma?** In your opinion, do you think the government is facilitating the progress of the industry? To what extent? Yes, by continuing the federal funding for the research stations especially the one in Aguadulce.

10. **¿Si la industria del camarón no es viable que otro cultivo cree usted podría substituirlo?** If shrimp aquaculture is not viable, what other culture can be an alternative? The culture of Robalo, mollusce, Tilapia, and Dorado.

11. **¿En qué nivel promedio de producción están operando las fincas de camarones; extensivo, semi-intensivo o intensivo?** What is the average production method for the shrimp farms in operation; extensive, semi-intensive, or intensive? Extensive.

12. **¿Cree usted que la industria en un futuro cercano pueda operar al nivel intensivo?** Do you believe the industry in the near future could start production at the intensive levels? Miguel de Leon at the field station in Aguadulce could answer this question. Miguel’s answer was no.

13. **¿Con respecto a los pescadores artesanales, se han pasado algunas leyes o programas para proteger, complementar o reentrenar a los pescadores artesanales de la zona de Aguadulce?** With respect to artisanal fishermen,
have any laws or programs for protecting, supplementing, or retraining the artisanal fishermen in Agaudulce been passed? ARAP has patrol boats out on the coast to protect national waters. All fishing vessels are required to register their boats but this is only large vessels. A satellite system is being used on all registered boats. A re-education program was funded in Aguadulce but artisanal fishermen did not attend according to ARAP office in Aguadulce.

14. ¿Ha mejorado o empeorado el impacto ambiental del cultivo del camarón en Panamá en general y en específico en la zona manglar de Aguadulce? Has the environmental impact of the shrimp culture gotten better or worse in Panama in general and specially in relation to the mangrove zone of Aguadulce? The National Authority of the Environment (Autoridad Nacional del Ambiente-ANAM) and Authority of Aquatic Resources of Panama (Autoridad de Los Recursos Acuaticos de Panama-ARAP) are forcing companies to do environmental impact statements for new projects. Fines are $300,000 if mangroves are cut plus they must be replanted. ANAN handles the land issues and ARAP handles the water issues. The Ministry of Agriculture Development of Panama (Ministerio del Desarrollo Agropecuario de Panama-MIDA) developed all the laws and policies prior to 1989 for the shrimp farm industry. In his opinion the protection has improved.

15. En su web site no encontramos ninguna referencia a leyes anteriores de Enero de 1989, reglamentaciones anteriores a Julio de 1994 o decretos anteriores de Marzo del 2000. ¿Nos podría informar si existen y donde podríamos conseguir copias? On your website (ARAP) there are no
references to laws prior to January 1989, regulations prior to July 1994, or decrees prior to March 2000. Can you inform me further where these can be found and can I obtain copies? They can be found in MIDA.gov.pan, and ANAM.gov.pan.

The answers to the questions above were provided by Aristides Frias who has more than 20 years of experience and is the field station biologist with specializations in forestry and zoology. He was very helpful in answering all questions. ARAP is also sponsoring a program to grow mollusce in cages for women. This program is designed for women in rural communities as a means of gaining an additional income for their households.

At the field station the general opinion of shrimp aquaculture is that it was a viable industry but the central government needed to fund other alternatives. Shrimp aquaculture was viable for the larger farms but not for the subsistence ones. The operating costs are just too high for the smaller farms. The culture of other fish varieties especially those which are native to Panama are a better alternative. Aguadulce will continue being the center for shrimp aquaculture in Panama but the level of production will be much lower than what was predicted in the 1990s. Employment options will be limited to vertically integrated large farms.
Table of Data Gathered in 2010:

Coastal Community (Artisanal Fishermen)

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers Individuals Sampled</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Number of Females</td>
<td>6</td>
<td>8%</td>
</tr>
<tr>
<td>Number of Males</td>
<td>69</td>
<td>92%</td>
</tr>
<tr>
<td>Average Age</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Average Amount of Time Living in Aguadulce</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Number of Individuals Who Have Lived in Aguadulce Their Whole Life</td>
<td>37</td>
<td>49%</td>
</tr>
<tr>
<td>Average Amount of Hours Worked</td>
<td>8.12</td>
<td></td>
</tr>
<tr>
<td>Average Amount Earned Per Day</td>
<td>$16.18</td>
<td></td>
</tr>
<tr>
<td>Number of Individuals Who Wish to Work in Aquaculture Facilities</td>
<td>41</td>
<td>55%</td>
</tr>
<tr>
<td>Average Education Level</td>
<td>7.2 years</td>
<td></td>
</tr>
<tr>
<td>Average Number of Children</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Number of Individuals Who Wish Their Kids Stay in Aguadulce</td>
<td>34</td>
<td>45%</td>
</tr>
<tr>
<td>Number of Fishermen that Their Father was a Fishermen</td>
<td>22</td>
<td>29%</td>
</tr>
<tr>
<td>Number of Individuals That See The Future “Positive” of Fishing</td>
<td>14</td>
<td>19%</td>
</tr>
<tr>
<td>Number of Individuals That See The Future “OK” of Fishing</td>
<td>13</td>
<td>17%</td>
</tr>
<tr>
<td>Number of Individuals That See The Future “Negative” of Fishing</td>
<td>48</td>
<td>64%</td>
</tr>
</tbody>
</table>
### Field and Processing Plant Employees

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers Individuals Sampled</td>
<td>118</td>
<td></td>
</tr>
<tr>
<td>Number of Females</td>
<td>53</td>
<td>45%</td>
</tr>
<tr>
<td>Number of Males</td>
<td>65</td>
<td>55%</td>
</tr>
<tr>
<td>Average Age</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Average Amount of Time Living in Aguadulce, Panama</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Average Amount of Hours Worked</td>
<td>12 hours/6 days</td>
<td>a week</td>
</tr>
<tr>
<td>Average Amount Earned Per Day</td>
<td>$13.82</td>
<td></td>
</tr>
<tr>
<td>Average Education Level</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Average Number of Children</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Number of Individuals that Wish Their Kids Stay in Aguadulce</td>
<td>77</td>
<td>65%</td>
</tr>
<tr>
<td>Number of Individuals Who Wish Their Kids Work in the Aquaculture Industry</td>
<td>29</td>
<td>25%</td>
</tr>
<tr>
<td>Number of Individuals That See The Future “Positive” Aquaculture</td>
<td>61</td>
<td>52%</td>
</tr>
<tr>
<td>Number of Individuals That See The Future “Ok” Aquaculture</td>
<td>22</td>
<td>19%</td>
</tr>
<tr>
<td>Number of Individuals That See The Future “Negative” Aquaculture</td>
<td>27</td>
<td>23%</td>
</tr>
<tr>
<td>Description</td>
<td>Amount</td>
<td>Percentage</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Numbers Sampled</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Average Time Facility Has Been in Operation</td>
<td>20.85 years</td>
<td></td>
</tr>
<tr>
<td>Facility Operational in 2010</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Average Size of Farms</td>
<td>64.725 hectares</td>
<td></td>
</tr>
<tr>
<td>How Many Farms are Extensive Operation</td>
<td>9</td>
<td>38%</td>
</tr>
<tr>
<td>How Many Farms are Semi-Intensive Operation</td>
<td>13</td>
<td>54%</td>
</tr>
<tr>
<td>Family Run</td>
<td>17</td>
<td>71%</td>
</tr>
<tr>
<td>Average Amount of Part-Time or Seasonal</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Average Amount of Full-Time Employees</td>
<td>13.3</td>
<td></td>
</tr>
<tr>
<td>Average Amount Full-Time Employees Work</td>
<td>8 hours/6 days a week</td>
<td></td>
</tr>
<tr>
<td>Average Salary for Administrative Employees</td>
<td>$511.16 Balboas a month</td>
<td></td>
</tr>
<tr>
<td>Average Salary of Scientist</td>
<td>$890.00 Balboas a month</td>
<td></td>
</tr>
<tr>
<td>Average Salary of Technical or Assistant</td>
<td>$428.24 Balboas a month</td>
<td></td>
</tr>
<tr>
<td>Average Salary of Field Help</td>
<td>$260.47 Balboas a month</td>
<td></td>
</tr>
<tr>
<td>Average Number of Cycles of Production</td>
<td>1.6 a year</td>
<td></td>
</tr>
<tr>
<td>Amount of Farms that Purchase Postlarvea</td>
<td>15</td>
<td>63%</td>
</tr>
<tr>
<td>Average Price Paid for Wild Caught Postlarvea per 1000</td>
<td>$0.63</td>
<td></td>
</tr>
<tr>
<td>Average Price Paid for Hatchery Raised Postlarvea per 1000</td>
<td>$4.03</td>
<td></td>
</tr>
<tr>
<td>Metric</td>
<td>Value</td>
<td>Percentage</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>Amount of Farms that Allow Natural Postlarvea to Enter Farm</td>
<td>5</td>
<td>21%</td>
</tr>
<tr>
<td>Number of Farms that Use Antibiotics</td>
<td>4</td>
<td>17%</td>
</tr>
<tr>
<td>Number of Farms that Use Probiotics</td>
<td>3</td>
<td>13%</td>
</tr>
<tr>
<td>Number of Farms that Use Calcium After Harvest to Clean Ponds</td>
<td>18</td>
<td>75%</td>
</tr>
<tr>
<td>Average Food Conversion Rate</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>Average Survival Rate</td>
<td>51%</td>
<td></td>
</tr>
<tr>
<td>Average Amount of Protein Feed to Shrimp</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Number of Farms That Purchase Feed From Local Producer</td>
<td>21</td>
<td>88%</td>
</tr>
<tr>
<td>Number of Owners that Have a Second Job</td>
<td>12</td>
<td>50%</td>
</tr>
<tr>
<td>Amount of Owners that See the Future of Aquaculture Industry “Positive”</td>
<td>10</td>
<td>42%</td>
</tr>
<tr>
<td>Amount of Owners that See the Future of Aquaculture Industry “Uncertain”</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td>Amount of Owners that See the Future of Aquaculture Industry “Negative”</td>
<td>11</td>
<td>46%</td>
</tr>
</tbody>
</table>
Chapter Six:

Comparisons of Findings:

The town of Aguadulce was visited on three separate occasions in 2004, 2010, and 2011. Interviews were conducted to access the socio-economic impact the shrimp aquaculture industry had on the coastal community (fishermen), farm workers and owners. Government officials were also interviewed to access their opinion of the current and future outlook of the industry. The interviews were conducted on a volunteer basis and subjects were extremely interested in voicing their opinions when answering the survey. The following conclusions were derived from the interviews to access the viability of the shrimp aquaculture industry in Aguadulce.

In 2004, the sample size was much smaller than in 2010. The 2004 trip was designed to gather a general overview of the industry since it was the first visit to the country. Sampling during the 2004 growing season was very interesting to the study resulting from an increased optimism among the growers and workers that the White Spot Syndrome Virus was under control. In 2010, the optimism had diminished; White Spot Syndrome Virus continued being a problem and many of the farms in the area had closed down. For the small farms that were in operation, the owners needed a second job to support their households. As for the larger farms, they had either changed owners or were under complete vertical integration. The large farms were extremely concerned about the increasing operating cost and the reduced price paid in the international market for farmed shrimp. The three largest producers in Aguadulce, CAMACO, NALMA, and Pacific Farms were vertically integrated. These farms were producing their own feed mix,
stocking seeds from their broad stocks, and owned the processing plants. Through the integration of all these components they were able to control their costs. The concern for the future of the industry was noticeable at all levels of those interviewed.

When the data was compared between 2004 and 2010 changes are visible. In 2004, 65 individuals were interviewed that encompassed fishermen, processing plant and field employees, and farm owners. In 2010, 195 individuals were interviewed from the same group giving a better understanding of the socio-economic impact the industry had on Aguadulce. Also more government officials were interviewed that explained the path the central government was focusing on for the future of the aquaculture industry. In 2004, the government was more supportive of continuing solely with shrimp production but by 2010 that had changed. Shrimp continued being important but other species were being considered at the Vacamonte Field Station, Robalo and Tilapia along with cultivating oysters. These three options were already being cultivated at the station and oyster seedlings were being sent to a rural community for preliminary cultivation. The oyster project was designed for women as subsistence farming.

Aguadulce’s shrimp aquaculture industry has undergone a transition from being a large employer in the area which created employment at both the small family owned to commercially owned and operated. Today, that has changed to one that only offers opportunities at the commercial level with very few that are family operated. In 2004, there were 88 farms in operation, but by 2010 that number had dropped to 34. About 50 percent of those interviewed showed the family owned farms have either closed down completely or they were farmed at an extensive level with owners needing a second job. In 2004, the large farms visited were revisited in 2010 with drastic changes visible.
Production levels continued at extensive/semi-intensive levels for the commercial farms in both 2004 and 2010 but Pacific Farms was sold to new owners and this facility in 2004 and employed 87 full-time employees by 2010 that number was reduced to 75. Pacific Farms was being run at an extensive level and having White Spot Syndrome Virus outbreaks. They also reduced the length of operation time for the process plant from 9 month to 6 months resulting from the production of less shrimp. Pacific Farms under the new management in 2010 was run down with no new infrastructure improvements visible.

The second farm visited, NALMA, was still under semi-intensive operations but the processing plant had also reduced its operating season to 6 months in 2010. The owner was very concerned with the future of the industry and the reduced price paid in the international market. As for the other farms visited in 2010, a total of 24 of the remaining 34 in operation were granted complete access with all the field employees allowed to answer the questionnaire. Interviews were conducted among all levels employed at the farms; no limitations were placed on their answers. The average amount of employees working at the facilities on a full-time basis was 13 with an additional 17 added during harvest season and working 8 hours a day/6 days a week. The average salaries for administrative personnel was $511, scientist $890, technical assistant $428, and field help $260 Balboas a month. These farms had an average size of 65 hectares in production. The smallest farm visited had 3 hectares in the production while the largest vertically integrated had 1,138 hectares. The majority, 54 percent, were operated at a semi-intensive level and the remaining extensive.
The smaller extensive farms were purchasing both their feed and postlarve from
the larger vertically integrated ones or allowing shrimp to enter their farms with no
intervention along with not adding any feed. The average price paid for wild caught
postlarve was $0.63 per 1000 and $4.03 Balboas for hatchery raised. LARRO, owned by
CAMACO group, produced 87.5 percent, which is most of the feed for the area. The
average survival rate of all the farms was 51 percent with 1.6 cycles of production a year.
The smaller farms were only producing shrimp once a year but leaving the shrimp a
couple of weeks longer than the 120 day cycle to produce a larger shrimp. Feed price was
a concern for all farmers although the extensive farmers were not adding feed. In 2004,
shrimp was sold at $1.30 per pound and that number had dropped to $1.24 Balboas by
2010 for size 12 to 15 grams. The main buyers for Panamanian shrimp continue being the
EU and the US.

As stated previously, the number of individuals interviewed in 2004 was much
smaller than 2010 at both the processing plants and the field workers at the farms. In
2004, 41 individuals were interviewed at processing plants and farms. In 2010, there were
118 individuals (see Figure 6.1). In 2004, a larger percentage of females were
interviewed at 61 percent compared to 45 percent in 2010 (see Figure 6.2 and 6.3). The
employees of both the processing plants and field workers received a much lower salary
per day when comparing “constant” Balboas from 2004 to 2010. When taking into
account the Consumer Price Index (CPI) from the World Bank in 2010, they only earned
$7.82 a day. The length of hours was the same at 12 hours/6 days a week. The average
age for those employed had changed from 36 in 2004 to 39 in 2010 (see Figure 6.4). The
average education level had increased from 7 to 9 years of schooling, although no educational increase was necessary for their positions (see Figure 6.5).

The owners and workers in 2010 were very concerned with the future of the industry since many of their friends had either stopped producing shrimp or had been laid-off. In 2004, 66 percent felt positive about the future of the aquaculture industry and in 2010 this positivity had changed to 52 percent (see Figure 6.6). In 2004, the workers were also more optimistic of wanting their children to work in the industry at 39 percent compared to 25 percent in 2010 (see Figure 6.7). The workers at both the processing plants and farms felt that their jobs were labor intense and desired for their children to find work in another industry.

As for the coastal community or artisanal fishermen, there were a much smaller number of 11 individuals interviewed in 2004 compared to 75 in 2010 (see Figure 6.8). In 2004, 100 percent of those interviewed were men and in 2010, 92 percent were men and 8 percent were women (see Figure 6.9 and 6.10). The age distribution of the fishing community was very similar in 2004 where the age was 44 compared to 45 in 2010 (see Figure 6.11). Changes were evident from 2004 to 2010. In 2010 they continued discussing the problems of reduced catches and the concern that the allowed mesh size was too small for the fishers to catch any fish. The large international fishing vessels continued coming closer to the shoreline with minimal government intervention. An interesting fact discovered was that only 25 percent in 2010 of those interviewed actually owned a small boat (see Figure 6.12). In 2004, their pay was much lower so the fishermen were more open to the idea of working at the shrimp farms. In 2004, 73 percent were interested in working at the shrimp farms and by 2010 it had dropped to 55
percent (see Figure 6.13). When taking into account the CPI for calculating “constant” Babloas from the World Bank, the fishermen did receive a better salary in 2010 than in 2004. They were paid $9.15 Balboas in 2010 when using 2004 as the base year.

Interviews conducted at the aquaculture facilities showed very few listed fishing as their previous employment. The question was then asked at the ARAP office in Aguadulce of why were so few fishermen working in the aquaculture farms? Their response was that fishermen did not like having a boss. They work their own hours with minimal restrictions. The ARAP office organized a retraining program for the local fishermen by offering 29 classes at three different shifts: 7am-12pm, 12-5pm, or 5-10pm. The class schedule was posted and not one individual signed up to take the classes. ARAP also explained the problem that most fishermen have the lowest education level remaining at the 5th grade in 2004 compared to 7th grade in 2010 (see Figure 6.14). Their parents’ education level was not much higher than those interviewed as the father had the highest level attained of 5th grade in 2004 and the mother had the highest level of 6th grade in 2010 (see Figure 6.15). Another interesting fact noticed was that in 2004, 73 percent of those interviewed had fathers as fishermen, but that number was completely different in 2010 being 29 percent. Since the sampling size was much smaller in 2004, the percentage in 2010 seemed to be a better representation of the fathers’ employment (see Figure 6.16). The officials also discussed the problem of alcoholism among the fishermen which was also evident in 2004.

The local fishermen were starting to notice issues with drug trafficking and it was also discussed at length with the local government officials. The officials stated that their concern was that limited budget that did not allow for increased police patrols. The town
was in the process of setting up a volunteer watch group. The mayor was very happy with the progress of the volunteer group and their efforts. The main concern with the fishing community is the future outlook of their catches that are drastically reduced. They were interested in other job opportunities but the reality was that they were not willing to put the effort, as stated above with the retraining program with zero attendance.
Table Comparing Data 2004 and 2010:

Field Workers and Processing Plant Employees

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers Sampled</td>
<td>41</td>
<td>118</td>
</tr>
<tr>
<td>Percentage of Females</td>
<td>61%</td>
<td>45%</td>
</tr>
<tr>
<td>Percentage of Males</td>
<td>39%</td>
<td>55%</td>
</tr>
<tr>
<td>Average Age</td>
<td>35.9</td>
<td>39</td>
</tr>
<tr>
<td>Average Amount of Time Living in Aguadulce</td>
<td>27.3</td>
<td>29</td>
</tr>
<tr>
<td>Average Amount of Hours Worked</td>
<td>12 hours/6 days a week</td>
<td>12 hours/6 days a week</td>
</tr>
<tr>
<td>Average Amount Earned</td>
<td>$13.34 Balboas per day</td>
<td>$13.82 Balboas per day With Adjustment for Inflation the “constant” price was $7.82 Balboas per day</td>
</tr>
<tr>
<td>Average Education Level</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Average Number of Kids</td>
<td>2.3</td>
<td>2.6</td>
</tr>
<tr>
<td>Percentage of Individuals that Wish their Kids Stay in Aguadulce</td>
<td>66%</td>
<td>65%</td>
</tr>
<tr>
<td>Percentage of Individuals that Wish their Kids Work in the Aquaculture Industry</td>
<td>39%</td>
<td>25%</td>
</tr>
<tr>
<td>Percentage of Individuals that See “Positive” Aquaculture Future</td>
<td>66%</td>
<td>52%</td>
</tr>
<tr>
<td>Number of Individuals that See “Ok” Aquaculture Future</td>
<td>5%</td>
<td>19%</td>
</tr>
<tr>
<td>Number of Individuals that See “Negative” Aquaculture Future</td>
<td>5%</td>
<td>23%</td>
</tr>
</tbody>
</table>
Coastal Community (Artisanal Fishermen)

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Individuals Sampled</strong></td>
<td>11</td>
<td>75</td>
</tr>
<tr>
<td><strong>Percentage of Females</strong></td>
<td>0%</td>
<td>8%</td>
</tr>
<tr>
<td><strong>Percentage of Males</strong></td>
<td>100%</td>
<td>92%</td>
</tr>
<tr>
<td><strong>Average Age</strong></td>
<td>44</td>
<td>45</td>
</tr>
<tr>
<td><strong>Average Amount of Time Living in Aguadulce</strong></td>
<td>42.7</td>
<td>33</td>
</tr>
<tr>
<td><strong>Average Amount of Hours Worked</strong></td>
<td>6.95 hours per day/6 days a week</td>
<td>8.12 hours a day/6 days a week</td>
</tr>
<tr>
<td><strong>Average Amount Earned Per Day</strong></td>
<td>$7.91 Balboas a day</td>
<td>$16.18 Balboas a day With Adjustment for Inflation the “constant” price was $9.15 Balboas per day</td>
</tr>
<tr>
<td><strong>Percentage of Individuals Who Wish to Work in Aquaculture Facilities</strong></td>
<td>73%</td>
<td>55%</td>
</tr>
<tr>
<td><strong>Average Education Level</strong></td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td><strong>Average Number of Children</strong></td>
<td>3.2</td>
<td>2.6</td>
</tr>
<tr>
<td><strong>Percentage of Individuals Who Wish Their Kids Stay in Aguadulce</strong></td>
<td>36%</td>
<td>45%</td>
</tr>
<tr>
<td><strong>Percentage of Fishermen that their Father was a Fishermen</strong></td>
<td>73%</td>
<td>29%</td>
</tr>
<tr>
<td><strong>Percentage of Individuals That See The Future “Positive” of Fishing</strong></td>
<td>9%</td>
<td>19%</td>
</tr>
<tr>
<td><strong>Percentage of Individuals That See The Future “Negative” of Fishing</strong></td>
<td>91%</td>
<td>64%</td>
</tr>
</tbody>
</table>
Graphs Comparing Data Field and Processing Plant Employees 2004 and 2010:

**Figure 6.1**
Comparison Number of Field and Processing Plant Employees Interviewed in 2004 and 2010

**Figure 6.2**
Percentage Interviewed Field and Processing Plant Employees by Sex 2004

- Number of Females: 61%
- Number of Males: 39%
Figure 6.3
Percentage Interviewed Field and Processing Plant Employees by Sex 2010

Number of Females 45%
Number of Males 55%

Figure 6.4
Comparison of Age Distribution Field and Processing Plant Employees 2004 and 2010

Average Age
Figure 6.5
Highest School Level Attended by Field and Processing Plant Employees 2004 and 2010

Figure 6.6
Comparison of Field and Processing Plant Employees who see "Positive" the Shrimp Aquaculture Industry
Graphs Comparing Data of Coastal Community (Fishermen) 2004 and 2010:

Figure 6.7
Percentage of Field and Processing Plant Employees that Wish their Children Work in the Aquaculture Industry 2004 and 2010

Figure 6.8
Comparison of Fishermen Interviewed in 2004 and 2010
Figure 6.9
Percentage of Fishermen Interviewed by Sex in 2004

Males 100%

Figure 6.10
Percentage of Fishermen Interviewed by Sex in 2010

Number of Males 92%

Number of Females 8%
Figure 6.11
Comparison of Fishermen Age Distribution in 2004 and 2010

Figure 6.13
Percentage of Fishermen Wanting to Work in Aquaculture Industry 2004 and 2010
Figure 6.12
Comparison of Fishermen that Own a Fishing Boat 2004 and 2010

Figure 6.15
Comparison of Highest Education Grade of Fishermen's Father and Mother
Figure 6.14
Highest School Level Attended by Fishermen 2004 and 2010

Figure 6.16
Percentage of Fishermen's Father Being a Fishermen 2004 and 2010
Conclusion:

The shrimp aquaculture industry has been a part of Panama’s history since the 1970s. It was one of the first countries in Latin America to establish a viable commercial shrimp farming industry, resulting from the support of the central government. The support was initiated by President Omar Torrijos in the 1970s and continued with international funding, as stated in previous chapters. The central government continues to support shrimp aquaculture but the future is not as certain as it was in the 1980s and 1990s before the outbreak of White Spot. Small family owned farms are no longer viable options due to rising operating cost and the reduced price paid for shrimp in the international market. Vertically integrated large farms are the viable option for the shrimp
aquaculture industry in Panama. This is the trend in Aguadulce. Originally, a family ran small farms and no additional jobs were needed in providing their income source, but today that is no longer the case. They have either closed down completely or have additional jobs to make ends meet.

The following conclusion was derived: the future of shrimp aquaculture is no longer a viable alternative to promote job production in Aguadulce at the expected rate of the 1990s. After the outbreak of White Spot Syndrome Virus the industry changed completely. Optimism was documented in 2004 but by 2010 that had all changed. Most of the farms were no longer in production and employment options were limited at both the operating farms and the processing plants. The viability of this industry for Panama will be based on an increased effort of the central government and ingenuity from the owners of the farms in finding a niche market for a product that is better produced. The current farms are producing a larger shrimp that is EU certified which is sold to higher-end restaurants and consumers that desire a healthier alternative to the Asian produced shrimp. Vertical integration will become the norm with a few family owned farms staying in operation. Perhaps the answer to the shrimp aquaculture industry will be diversification of producing both shrimp and fish with modifications made to the local processing plants to accommodate both products. Panama has tropical weather that facilitates year round production which could accommodate numerous fish species production along with shrimp. The viability of this industry for Aguadulce is limited in the employment options available. The shrimp aquaculture history for Panama is very similar to the agriculture industry of the US, where small family owned farms are the minority and large commercial operations are the norm. The outlook is of large vertically
integrated farms taking over and being the creators of jobs for the town. Job generation will be closely tied to the global world economy and the price paid in the international market.

Another model more closely tied to shrimp aquaculture is the Ecuadorian production model of which very large vertically integrated corporations purchase the smaller farms that are no longer in operation. The Ecuadorian shrimp aquaculture industry in 2011 exported 73 tons of shrimp with an estimated value of $465.8 million Balboas and produced approximately 500,000 direct and indirect jobs. Aguadulce’s shrimp farm industry will resemble Ecuador’s with just a very few groups in production and very few job created, since Panama’s industry is much smaller. The employment options will be available but much more limited than what was predicted in the 1990s.

The current major groups producing shrimp in Aguadulce are Farallon, CAMACO, and CPS. Their shrimp is sold predominantly to Europe and high-end restaurants in the US. These companies are all EU certified. The farms owned by these groups were all visited in 2010. Their production levels were stable at CAMACO and Farallon but not at the CPS facility. The CPS group that purchased Pacific Farms, formally AgroMarina, was having noticeable problems with White Spot Syndrome Virus and was only producing extensively in most of their ponds except for a few that were semi-intensive. As for CAMACO and Farallon these facilities were running at the lower end of semi-intensive levels with concerns of White Spot. The managers of the facilities discussed the White Spot Syndrome Virus issue but stated that it was the current norm that needed to be watched at all times, but was not jeopardizing production levels. The managers of these two facilities were more concerned with the decreasing price paid in
the international market for shrimp and the quality produced from their competitors in Asia that in their opinion was flooding the market purposely. Farallon and CAMACO have been in production since the 1980s and have never stopped production. They are the two main employers for Aguadulce, along with CPS.

Panama in the 1970s was the innovator of the shrimp aquaculture industry for Central and South America with the assistance of the government and international funding from FAO, USAID, and Japanese corporation, as stated previously. What occurred to an industry that was well organized, had government support, and was very prosperous for Aguadulce in generating income and jobs? White Spot Syndrome Virus hit both Panama and Ecuador at around the same time. Ecuador continued with its production steadily increasing and Aguadulce fell behind to an almost non-existent industry. In 2009, Aguadulce produced 13.1 million pounds of shrimp and by the following year it had dropped to 12.1 with only 34 farms in production and two processing plants.

Government officials and owners agree that the biggest obstacle encountered by the industry has been the reduced price paid in the international market for shrimp. The growers are unable to keep their operating cost down to be able to compete with the Asian producers. The Asian production model is completely different from the one followed in Panama. In Asia most of the farms are subsistence farmers that are part of a so-called “cooperative” that is owned by very large vertically integrated corporations. Subsistence farmers purchase all the supplies from the cooperative and then sell their shrimp for pennies on the dollar to buyers. These buyers are integrated into the large
corporations. These large corporations basically own entire towns and villages. In Panama, individuals have complete control of their farms.

The question still remains: why the drastic collapse of the shrimp aquaculture industry? Government support is limited. The National Bank is no longer giving loans to encourage the industry, higher level degrees of Masters’ or doctorial are not being offered at the universities, enrollment is down for certificate programs, and the government sponsored labs are looking into production of other species such as grouper, snapper, and tilapia. Maybe the answer to the industry is producing shrimp in conjunction with a fish or polyculture. Another alternative is producing a high-value shrimp that is organically certified free of antibiotics and pesticides. The price paid for the shrimp is higher and they are no longer in competition with Asia. The Asian shrimp on numerous occasions has been documented having high levels of chloramphenicol known to produce Aplastic Anemia in humans and numerous other chemicals that are carcinogens.

When this research began, the general understanding was that shrimp aquaculture was a viable job generator for Aguadulce. Men and women were employed and the town had prosperity. Women benefited the most at the processing plants. As the research draws to a close White Spot Syndrome Virus continues being a problem with production at extensive levels for the smaller farms and semi-intensive for the well organized and vertically integrated. The shrimp industry will continue in Panama at a very small level with three or four major producers finding a niche market in the US, Japan, and EU that demands a product with minimal pesticides and antibiotics. The future of the industry is completely different than what was expected in the 1990s. Panama is not expected to reach the production levels of Ecuador, Mexico, and Honduras which are the major
shrimp producers in Latin America. Panama’s industry will remain small and other alternatives need to be supported by the central government and entrepreneurs.

On the current path with minimal government support, the future of shrimp aquaculture for Aguadulce and Panama is no longer viable. In 2012, the production was still at 13 million tons with no further documented increases. VigoMar, one of the pioneers of the industry in Aguadulce and a large employer, is currently rented by a Chinese company that is processing fish is imported from Asia. Very few employees are necessary for processing the fish at VigoMar with many women losing their jobs. To add further stress on the industry, a new disease called Early Mortality Syndrome (EMS), has been documented in China, Vietnam, Malaysia, and Thailand causing mass mortalities in both *P. monodon* and *Litopenaeus vannamei*, killing the shrimp in the first ten to thirty days of culture in grow-out ponds. EMS seems to affect farms that have more than 5 years of production and those close to the sea that use very high saline water. Unfortunately, no documented pathogen has been found. This syndrome would be detrimental to the shrimp aquaculture industry of Aguadulce and Panama. Government officials at ARAP have asked for a band on fish and shrimp importations from Asia from the central government and nothing has been done.

In my findings the only viable alternative feasible for the shrimp industry in Aguadulce is producing an organically certified shrimp. This product can be sold to high-end restaurants in Europe and the US along with grocery stores like Whole Foods who specialize in selling organic products. This niche market has done well for organically certified coffee from Mexico. This market is very small and limited but profitable. The larger vertically integrated (Pacific Farms, VigoMar, and CAMACO) farms and
processing plants in Aguadulce are already EU and HAZAAP certified. This eco-labeling would require for a shrimp that is environmentally sustainably and raised with minimal to none antibiotics added throughout the grow-out process. Unfortunately, Panama cannot compete with Asia, Ecuador, Honduras, and Mexico so the alternative is finding a niche market. The future of Panama’s shrimp industry remains very unstable. Jobs will never reach the number predicted in the past. The small family-owned farms will remain as subsistence or completely disappear. The future of the aquaculture industry for Panama and Aguadulce will probably move to fish culture with a very small and limited shrimp production. Aquaculture is no longer a lasting partnership but rather a broken one.
Aguero, Max, and Exequiel Gonzalez. "Aquaculture Economics in Latin America." FAO.

The American’s Intelligence Wire. “Aguadulce-Pocri Sewage System P1 Work Begin-Panama.” Article #A121054064.


Boisier, Sergio. "Is there Room for Local Development in a Globalized World?"


Cardoso, Fernando Henrique. "Beyond Economics: Interactions between Politics and Economic Development."

Coastal and Marine Ecosystems-Panama. EarthTrends, 2003.


Cruz-Torres, Maria Luz. "Globalization, Natural Resource Degradation, and Rural Communities in Northwestern Mexico."


---. "Making an Income From Fisheries." FAO.

---. "Number of Fisheries Doubled Since 1970." FAO. Internet.


---. "Visión General del Sector Acuícola Nacional: Ecuador." FAO.


Fishery and Aquaculture Country Profile: Panama. FAO.


García, Norberto E. "Empleo y Globalización En América Latina. (Employment and Globalization in Latin America. with English Summary.)."


Jory, Darryl, and Jose Martinez. "Shrimp Culture in Panama: A Success Story Continues." Aquaculture Magazine (July/August 1998): 91-.


Lopez, Javier. INFOPESCA FAO GlobeFish. www.globefish.org


Williams, Meryl. "Are High Seas and International Marine Fisheries the Ultimate Sustainable Management Challenge?" Journal of International Affairs 59 (Fall 2005): 221-35.


