The Role of Allfish in the Global Seafood Industry
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# TABLE OF CONTENTS

I. EXECUTIVE SUMMARY ........................................................................................................... 6-11
   1. THE GLOBAL SEAFOOD INDUSTRY
   2. IMPAIRMENTS TO DEVELOPING FISHERIES
   3. SEAFOOD ORGANIZATIONS AND ASSOCIATIONS
   4. ALLFISH
   5. CONCLUSION AND RECOMMENDATIONS
   6. ORGANIZING THE GLOBAL SEAFOOD INDUSTRY
   7. MEASURING UNDERDEVELOPED FISHERIES AND FARMING RESOURCES

II. OVERVIEW OF THE GLOBAL SEAFOOD INDUSTRY ..................................................... 12-16

III. DEFINING THE GLOBAL COMMERCIAL SEAFOOD INDUSTRY ................................. 17-40
   1. RESOURCES SECTOR
   2. PROCESSING SECTOR
   3. MARKET SECTOR
   4. THE GLOBAL SEAFOOD SUPPLY CHAIN
   5. DEFINING THE RESOURCE AND FISHERIES
   6. DEFINING THE WILD CAPTURED FISHERIES SECTOR
   7. DEFINING HYBRID FISHERIES
   8. DEFINING THE AQUACULTURE INDUSTRY
   9. DEFINING THE PROCESSING SECTOR OF FISHERIES
   10. DEFINING THE MARKET SECTOR OF FISHERIES

IV. MAJOR INDUSTRIES OF THE GLOBAL SEAFOOD INDUSTRY ....................................... 41-76
   1. GROUNDFISH INDUSTRY
   2. TUNA INDUSTRY
   3. SALMON INDUSTRY
   4. SHRIMP INDUSTRY
   5. PELAGIC INDUSTRY

V. DEFINING THE STRUCTURE AND ORGANIZATION OF FISHERIES ............................. 77-86

VI. FISHERY DEVELOPMENT PATHWAYS ............................................................................. 87-103
   1. HONDURAS TILAPIA FISHERIES CASE STUDY
   2. TANZANIA FISHERIES CASE STUDY
   3. NAMIBIA FISHERIES CASE STUDY
   4. LAKE VICTORIA PERCH CASE STUDY

VII. ALLFISH ......................................................................................................................... 104-106

VIII. CONCLUSIONS ............................................................................................................... 107-111

IX. RECOMMENDATIONS ...................................................................................................... 112-115

X. LIST OF TABLES AND FIGURES .................................................................................... 116-117
INTRODUCTION

The International Coalition of Fisheries Association commissioned ISC to assess the feasibility of continuing the Allfish program beyond the current funding model. The Allfish partnership was established and funded in 2009 between the International Coalition of Fisheries Association (ICFA), World Bank (WB), Food and Agriculture Organization (FAO), and the Global Environmental Facility (GFF). In providing 2010 funding, the partnership has emphasized the need for Allfish to build a permanent governance and financial support structure to support its mission. The objective of this report is to study and determine the feasibility of achieving industry support for the Allfish mission, and to make recommendations, if necessary, to accomplish the task provided industry supports the mission. Should industry not support the current mission, the study should make recommendations on how the mission could be modified to gain industry support. The study will address a series of questions and tasks in trying to meet the above objective, including the following points:

1. Is there industry support for the Allfish mission?
2. If so, is that mission strong enough to fund the program?
3. Does the International Coalition of Fisheries Association have the credibility to build the public and private partnerships?
4. If required, what changes would ICFA have to make in the Allfish mission to forward participation in the program by industry?
5. Describe the fisheries and aquaculture industries.
6. How do the sectors operate and what are the supply chains?
7. What are the development issues?
8. How are the fisheries and aquaculture sectors organized?
9. Who represents the industry and how do they do so?
10. Are there benefits to industry of this broader engagement?
11. What are the recommendations of the study?

The study will first examine how the Global Seafood Industry is organized currently. It will then examine the obstacles developing fisheries have in entering the established GSI along with case studies of several fisheries that illustrate development issues. Sections are devoted to current seafood organizations and how they represent the different fisheries, sectors, and industries, and a section is devoted to describing and discussing the Allfish current vision, goals, and mission along with recent accomplishments. The conclusion and recommendations section will compare industry needs and the current Allfish mission for alignment and recommendations should modifications be necessary to obtain longer term industry or other alternative funding support.
I. Executive Summary

The Global Seafood Industry

The Global Seafood Industry is not a united single industry but rather combinations of different seafood industries that historically have had little to no association with each other. There is also not a clear definition of what identifies or comprises a particular seafood industry, and often within an industry there may be sub industries that are grouped for various reasons such as Wild Salmon as opposed to Farmed Salmon. However, no matter how an industry is identified the one constant characteristic is that they are all made up of multiple fisheries. Sometime hundreds of different fisheries can make up a single industry such as the shrimp industry; or it can be based on a multitude of different species that come together to form a market force like the groundfish industry or it can be made up of a single type of fish like the tuna industry. Groundfish, Pelagic, Salmon, Shrimp and Tuna industries are some of the largest industries that make up the GSI representing about 72 million metric tons of the 225 million MT that make up the GSI. Each industry has faced changes in recent years either due to the growth of aquaculture within the industry, management, or environmental pressure, and almost all have been affected by market pressures either in demand or in other social forces.

Each industry is an accumulation of many fisheries. A fishery is generally a mass of fish that is based one or a combination of the following: fish species, a jurisdictional authority, farming or harvesting method, or geographical identity. Within each fishery there are typically three (3) sectors: a resource sector, made up of fishing or farming activities; a processing sector, that includes harvesting, wet processing, and further processing; and finally a market sector, which includes sales, marketing, distribution, and the end users.

Impairments to Developing Fisheries

There is without question considerable concerns starting a new seafood ventures in the developing and underdeveloped world ranging from lack of infrastructure, to more complex government or science issues such as an instable government, poor jurisdictional authority or oversight of resources, local or national corruption, lack of science based information on resources, inability to understand environment impact, and local laws and regulations. These fundamental issues cause instability and uncertainty that create a difficult environment for business to operate and prevent the very investment needed to build wealth and value from the resource. History has shown that many underdeveloped nations sold to foreign flag vessels access to their fishery resources often without understanding the impact it would have on the resource. This often left the developing countries resource in a diminished state and the local population with a bad experience working with the developed world GSI. These ventures, being either fishing or farming, brought little to no wealth to local business and certainly did
little for the local population. This experience has understandably resulted in a lack of trust by developing countries in working with the developed GSI, yet to fully gain the value of their resources access to the developed GSI is needed as opposed to just utilizing the local fisheries for subsistence purposes. By accessing global markets developing nations can add value to resources, particularly if they can be competitive not only in fishing or farming but also in processing. The keys to success are working in partnership with a creditable industry partners, a stable reliable and trusted government, a science based resource management system to create a sustainable economic and environmental model and an opportunity for the local populations to improve their standard of living. Countries which utilize their fisheries or water resources properly and build an industry that provides employment and adds value to the basic resource for export will be profitable for all the stakeholders building economic wealth for investors and local populations while building foreign currency reserves for governments. There are excellent examples of this model such as the Regal Spring Honduras Tilapia operation which has been a successful business venture for Regal Springs, the Honduras government, the local population, and the western markets it supplies.

In developing new fisheries much can be learned from the history of other successful fisheries such as those that make up the groundfish industry. The groundfish industry started out as a North Atlantic cod and haddock industry and eventually became a worldwide whitefish business. It includes many species from many fisheries and geographic areas around the world, including both WCF and Aquaculture products from developed and underdeveloped nations and markets that today are interconnected around the world. By carefully examining the evolution of the current seafood industries and their respective fisheries, a road map to a successful fishery can be found; but for this map to work in today's complex world, developing nations wanting to enter the global industry need governments or outside assistance to provide the vehicle to make it happen. The cost to develop a new fishery is high; the entry bar is much higher than in the past, between ENGO scrutinizing development and market demanding 3rd party certifications, investors are very cautious in entering new ventures. To proceed with development, a stable honest political environment and a desirable sustainable resource that is properly managed and regulated must be present. With these fundamentals in place the developing nation can partner, if desired, with private industry that will bring know how, market knowledge, and access to capital needed to provide the engine of success. To fuel the engine, government must provide an environment that will ensure rewards both to the entrepreneur and improves conditions for the local population; it must also include some form of property right for either the fishermen or the farmer to ensure long term economic and environmental responsibility.

**Seafood Organizations and Associations**

There is not a single international organization that represents the Global Seafood Industry. The closest to any type of global organization is ICFA which is an organization of organizations as opposed to an industry organization. As mentioned earlier, the Seafood industry in actuality is a loose affiliation of many fisheries that based on certain influences and characteristics form into industries. These industries often do not have any affiliations with each other and in most instances are not even globally organized. Of all the seafood industries currently only the Tuna industry can project its needs on global...
issues though its international organization ISSA. Several of the other industries have international affiliations but are not organized to advocate a global position with policymakers, and most of the rest of the industries have no ability to project needs or interest beyond a regional international area such as North America or Europe.

Since the GSI is made up of thousands of fisheries and farms that form to create the many different fishery and aquaculture industries it is easy to understand why there are also hundreds of different organizations and associations that make up the industries. The seafood industry organizations are diverse and complex representing specific geographically or jurisdictional areas, types of species, sectors of fisheries, type of fisheries, or single purpose issues. These organizations can range from international groups and coalitions such as ISSA, ICFA, or AIPCE-CEP; to national organizations like NFI, NZSIC or JFA; to regional organizations like FCC or AFDF; to local organizations like BC Frazier River Salmon Trollers Associations.

GSI organizations also tend to divide into resource, processing, or market sector driven organizations. Resource sector organizations tend to be very specific and focused only on resource access issues such as species, jurisdiction, gear type, or geography and thus tend to be more local or regional in nature. Processing sector organizations tend to group around specific needs like safety, manufacturing practice, or labor issues and tend to be regional in membership. The Marketing sector organization’s mission tends to deal with keeping demands up and markets open, often dealing with the bigger picture issues of national and international food safety, market access, tariffs and duties, and national and international government issues. Membership tends to be regional, national, or international companies whose focus is sales, marketing, or distributions oriented. Many companies are members of multiple organizations particularly if they are vertically integrated or have interest in more than one sector.

By the nature of the organization based on their mission the attitude toward of membership varies considerably by sector organization. As an example, resource sectors organizations tend to have the least in common with their counterpart from other industries. This is primarily due to the specific nature of their organization mission that generally is species, or jurisdictional driven and has a goal to first and foremost secure access to the local fish or water supply for the group they represent. But on the other hand the market sector organizations that are less specifically fishery driven and more focused on general seafood market issues have more in common across industry and will often represent membership from a multiple of seafood industries. Processing sector companies tend to support the sector they are most closely aligned with; therefore, harvesting and wet processing operations generally support resource sector organizations since their fates are closely aligned while further processing companies generally support market sector operations since their fixed assets are less resource specific but more market driven.

The structural difference caused by the different missions and the geographical size of the different organizations can at times cause conflict within that industry and even lead to the sector organizations having more in common with their counterpart from another industry.
Allfish

As mentioned in the introduction, Allfish is a partnership between ICFA, GFF, FAO, and World Bank. A three year funding grant by World Bank was given in 2009 to establish the Allfish organization and implement its vision to bring seafood industry organizations and government policymakers from developed countries, along with their counterparts in developing countries, together to share knowledge and best practices on fisheries management, develop benchmarks, share concerns, and speaking as a voice for the global seafood industry in the developed countries global policy debate. Its further vision is to help improve fisheries management in developing countries and create sustainable economic development through sustainable resources.

To organize and build the organization, ICFA was designated the operating partner and in 2009 appointing Stetson Tinkham as Executive Director. In 2009 the goal and mission were written, a communications system established, and in September of that year a Stakeholders stocktake was done that looked at potential partners for future Allfish projects.

By the end of 2009 and into 2010 the organization had begun work on several projects to develop sustainable business models for different fisheries in developing nations. As an example of their efforts, Allfish gave a $50,000 grant in partnership with industry match of $400,000 to build a management system in Indonesia to sustainably manage the Swimming Blue Crab fishery. They also funded several others, small but similar partnerships, which have shown promise in helping to fulfill their mission to create sustainable economic and environmental fisheries.

The conceptual idea of Allfish is to create a global seafood organization that would act as a voice to coordinate activities relating to environmental and economic sustainability of the industry. To develop the concept we must first ask, “Does the concept address a common need of the industry, and if so how could it be achieved?” Historically, when problems besiege one fishery the effects have a tendency to spill over to other fisheries. The result is generally a negative effect on all other fisheries leading to loss revenue, increased regulation and market sensitivity. Although these issues are often very specific in nature and very isolated to a single fishery, negative effects hurt all industries in the market and thus undermine the economic sustainability of a fishery. Therefore, Allfish may be the common thread that binds the global seafood industry and its markets and helps to keep them open and maintain public opinion of fisheries positive.

With so much diversity, it is hard to imagine an organization that can effectively accomplish this task in an advocacy manner. But it is possible to imagine an organization that could manage information that assists and helps fisheries to organize and to deliver accurate, timely, and positive information to the public. The mechanism for this is examined later in this report.
Conclusion and Recommendations

Allfish has managed in a short time to accomplish a lot with very little, but to meet its multiple goals of bringing the global seafood industry together with policymakers and promoting responsible fisheries, particularly in developing countries and, secondly, to be the global seafood industry’s voice and vehicle for coordination of efforts to make commercial fisheries and aquaculture production both environmentally and economically sustainable (EES) for wealth creation, will take time. The Allfish funders provided a three year grant as seed money to get Allfish organized and established with the intent industry should take over and self fund the organization by the end of the grant. To date that has not happened; not because Allfish has failed but because it will take more time and some modification to the mission to make it work. Timing is everything and in this case Allfish may have been a little too early for industry to fully grasp the need for such an organization, and given the broadness of the vision significant, obstacles have to be overcome to make Allfish successful before funding runs out.

There are two fundamental obstacles that must be overcome; the individual seafood industries must first organize before being brought together as a GSI; and secondly the underdeveloped fisheries must be measured to determine their individual ability to be a sustainable business model and if not, what must be done to obtain that position.

Organizing the GSI

Historically there was little need for the seafood industries and fisheries to organize globally. Each industry has operated independently and dealt as required with their local, national or regional international governments to meet their needs. However, in today’s world of globalized trade and activist global stakeholders, including all types of NGOs as well as other resource based industries competing for access and control of the waters and oceans of the world a need definitely exists to organize the GSI. Without a unified global voice the fisheries and the various seafood industries will find themselves at a great disadvantage in the global arena unable to protect the long term interest of both the developed and undeveloped fisheries. Some leaders within the individual industries see the need and moves are afoot to organize some industries, but it will take time to make it happen. Allfish needs to pursue an active course first meeting with the different industry leaders and encouraging them to form international advocacy and science groups for their industry and to further encourage those newly formed groups to meet with their counterparts from the other seafood industries to form a global alliance. The new alliance should convene an annual forum to discuss both scientific and global advocacy issues affecting the common industry with the goal to protect access to markets and resources. Once the alliance is established industry membership for participating organization should fund the program. Allfish’s role in the organization should be that of secretariat with the goal to keep cost low.
Measuring Underdeveloped Fisheries and Farming Resources

The demand for seafood is projected to keep growing putting pressure on fisheries already stressed. Without help many of these underdeveloped or over exploited fisheries will continue to fish until they no longer can find fish or lose their economic ability to harvest. Given Allfish mission to help build sustainable fisheries in the developing world, it is necessary to qualify and evaluate their current conditions and help build a plan to correct any issues that prevent meeting that goal. It is not practical to evaluate all the fisheries but proving the value of evaluating and building a road map to a sustainable business model could open funding opportunities from many sources. With the limited time and budget constraints facing Allfish it should undertake in 2011 a review of at least ten (10) fisheries from the developing world. Using a modified FPI (fishery performance indicators) system that is designed to evaluate and classify the status of a fishery base upon main drivers that will determine the ability of a fishery to achieve an EES status as the audit tool. After classifying the 10 the top scoring five (5) will undergo an in-depth FPI review. The Strategy and action plan should then be developed for the two top scoring fisheries from the review. The goal beyond just fulfilling the Allfish mission and demonstrating the value of FPI’s as a tool and path for a successful fishery is to also stimulate interest from both the public and private sector to fund continued evaluating of developing nations’ fisheries with the objective of finding partners to help develop sustainable economic and environmental fishing or farming business in the developing world.
II. Overview of the Global Seafood Industry

To understand the Global Seafood Industry (GSI), it is necessary to understand the environment within which it operates. GSI is one of the three human groups that actively harvest animal and plant products from the world’s lakes, rivers and oceans. The other two human groups which utilize aquatic resources are subsistence fishermen and the recreational fishing industry. In addition to these three human groups, other mammals and invertebrates, both terrestrial and aquatic, compete for these resources. The impact on these four user groups, along with a number of other factors, must be considered when managing the harvesting of seafood from the global waters.
For centuries, the waters and oceans of the world had no restrictions, and fishermen fished where and when they wanted. However, as modern fishing technology advanced, the effects of commercial fishing began to put pressure on resources. Nations soon realized the value of their resources and the need to manage them. These realizations led countries to assert jurisdiction over the waters and coastal oceans surrounding their nations and establish regulations to manage and control the aquatic world, not only for its plant and animal products, but also for minerals, oil and other natural resources.

In today’s modern world, fishermen no longer can drop a net, trap, pot or line in the water without permission from some authority, whether it be local, regional, national, or international. In many cases, a combination of authorities from different jurisdictional levels is required to grant fishing rights or licenses. Today, almost all waters in the world are managed to some degree, and fishing is only one of the many activities that compete for use of the waters and their contents.
Through international agreements, nations and regional stakeholder bodies manage the utilization of the inland, coastal and international waters and control those who will have access to them. Scientific tools are employed in almost all fisheries in the developed world to manage stocks at sustainable levels and measure the environmental impact of fishing on the biomass. Fisheries are monitored not only by governments, but also by non-governmental organizations (NGO’s). Restrictions are placed on who can harvest, when and where the resource can be harvested, how much can be harvested, as well as the methods used to extract the resource.
In the developed markets of the western world, consumers demand and expect the seafood products they consume to come from well managed and sustainable resources. To accomplish this, nations must have scientific data to assess the condition of local fisheries. This requires the use of surveys, on-board observers, accurate records of landings, and other data collection methods as tools to accumulate the information necessary for proper management of the resource. This information is also necessary to satisfy requirements for third party certifiers whose standards are increasingly being adopted by major retail markets around the world.

In the less developed countries, these management issues can pose significant barriers in developing commercial fisheries for the higher paying markets. Nations need scientific data and methods for measuring the health of fisheries in order to prove sustainability of resources. Assuring sound management practices in many of the under developed nations is difficult since often no scientific research has been done. Without scientific data, poor management practices are often employed that lead to these fisheries not being able to meet third party standards for certification, thus blocking access to some of the world’s most profitable markets.

In the developed world, management of the resource started to take effect in the mid 1970’s as nations imposed control over their Exclusive Economic Zone (EEZ). In 1977, a 200 mile territorial zone took effect, at which point nations were able to claim exclusive rights over marine resources from their own coasts extending out to 200 nautical miles. As nations exerted control of their marine resources, uncontrolled fishing by foreign fleets was reduced, which eventually led to leveling off of fishing activity. Meanwhile, the science of fishery management was improving. This combination of lower exploitation rates and improved management led to a decrease in overfishing and healthier stocks.

Today’s fisheries in many parts of the world are better controlled and a stabilization of the wild capture fisheries harvest can be expected. Currently the world’s waters yield about 90 million metric tons annually (See Fig 1 Wild Capture fisheries 1950 to 2008). However, the demand for fishery products is significantly higher than the current yield and it is increasing constantly. World population growth and the increasing demand for seafood products in the developing world are creating a higher per capita consumption rate of seafood products. There is also a growing base of urban middle class families with more disposable income who are demanding more seafood as part of their daily diets. This is putting added pressure on already overburdened wild capture fisheries.

To meet the growing demand for fishery products, scientists and entrepreneurs experimented for years with aquaculture as a way to make up the difference between supply and demand. Today, aquaculture is no longer an experiment; it is the future and the only way the seafood industry can keep up with the rising demand for fishery products.

Although aquaculture is an absolute necessity in order to meet the global demand for seafood, it has created some new problems in the competition and management of water resources, and it is often in direct conflict with the wild catch fisheries (WCF). Aquaculture fisheries will continue to grow and will soon be the major supplier to world seafood markets (Fig 2 aquaculture fisheries 1950 to 2008). Its
growth, however, will not come without serious challenges from other concerned users regarding the source of feeds, pollution from farming operations, available water space and usage, as well as a host of other environmental issues that must be solved to keep the growing industry sustainable.

In many ways, the aquaculture industry is a more science oriented industry than its cousin the WCF since it must produce product beginning from an egg as opposed to hunting and capturing a fully grown wild fish. Aquaculture requires more biological sciences, more long term capital investment and more operating capital to function.

As this report will show, at the resource level there is very little in common between the aquaculture industry and the WCF. More importantly, it will also show that, even within their own respective divisions, the variety of species, geography, management know-how, and market requirements make them both very different businesses with different issues and different business models. There is no such thing as a homogenous global seafood industry. GSI is a term that only generally describes aquatic activity, much like animal or crop farming. Like their terrestrial counterparts, the only common denominator for the aquatic industries is the end consumer.
III. Defining the Global Commercial Seafood Industry

The Commercial Global seafood industry can be broken into three distinct sectors: resources, processing, and marketing. There are vertically integrated companies that own or have access to resources, harvest the resources, process the product, and in some cases even do their own marketing. Typically, only the smallest of fisheries perform water to plate functions, and this is mostly only found in small towns or villages where a fisherman or farmer supplies their own shop or restaurant. In general, the industry separates its activities between the three sectors primarily because each sector requires its own expertise. That is not to say that all companies are either farmers or fishermen handling just one phase of an operation. In fact, there are many companies that perform several tasks such as fishing, harvesting, and first processing. Some larger multinational companies are seeing the process all the way through to processing and market. However, the discipline needed for each sector is unique and requires considerable expertise and know-how in order to compete in the Global Seafood Market.

Figure 4  Global Seafood Sectors

Resources Sector
The resource sector is divided into three different production methods: fishing, ranching, and farming. Each method is further divided into a number of different factors such as species, farming or fishing method, and geographic location and jurisdiction, which includes regulations and management schemes. For the purpose of this report the wild capture fisheries are referenced as WCF or fishing, Hybrid Fisheries, which includes ranching, mariculture or enhancing activities all designated as “HF,” and aquaculture is farming.
Processing Sector

The processing sector divides into several different functional operations regardless of the resource. The actual process may differ only slightly but the functional operation is commonly dictated by species, market requirements and local laws and regulations. Processing begins the moment the fish leaves the water so the first processing step is harvesting and is typically done by the fisherman or the farmer. The harvesting step, more than any other step in the process, will determine the longer term quality and value of the end product. Therefore, depending on the downstream requirement, the product will either be kept alive in a water tank system or it will be slaughtered and then preserved in preparation for the next step in the process. Once the product is stabilized, it can either ship directly to the market if the product is already in the desired market form, or it most likely will go to a first or wet processing plant where it will be either dressed, butchered, cooked, filleted or picked depending on the species and market requirements. Depending on a variety of issues, the product can move through several different wet processing operations before it is ready for packing. After completion of the wet processing operations, the product is then either moved to the market or will proceed to a further processing plant that will convert the product into a final market form ready for distribution.

Market Sector

The global seafood supply chain is as diverse and fragmented as the resource. In today’s global seafood industry, many products are moved around the globe before they are put on a plate. The location of the processing facility once the fish is harvested is dependent upon many factors, but the length and speed of the supply chain will be dictated by the market form. Product going into the fresh market must move fast and therefore processing is often done close to the resource, even if the end product will be sold half way around the globe. Products targeted to the frozen, canned or preserved markets have other factors that affect how and where the product will be processed.

Clearly, each fishery operates differently. In the groundfish industry, for example, each species that makes up the industry has particular characteristics that may dictate a different path through the supply chain. There are many factors that determine how the supply chain works. The obvious factor is species, but physical location of the resource, the size and abundance of the product, timeliness to the market, quality and value of the catch, market demand, price and product form will all influence how the supply chain works. In the wild capture fisheries, few of the above factors are controllable and therefore the chain tends to adjust more around the biology, location and market. By contrast, in the aquaculture fisheries, opportunities exist to control some of the characteristics such as physical location of the harvest, size, abundance and timeliness of the catch which allows better control over the supply chain. Other issues also can affect how the supply chain works such as history, traditions, local, regional, or national regulations and laws, and economic issues such as incentives, taxes, and banking. In the following sections, each of the major industries will be explained as to how the resource, processing, and market sectors work to make that industry different form the others. The report will examine how these differences affect the way the industry operates or how fisheries within that industry work.
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Clearly, each fishery operates differently. In the groundfish industry, for example, each species that makes up the industry has particular characteristics that may dictate a different path through the supply chain. There are many factors that determine how the supply chain works. The obvious factor is species, but physical location of the resource, the size and abundance of the product, timeliness to the market, quality and value of the catch, market demand, price and product form will all influence how the supply chain works. In the wild capture fisheries, few of the above factors are controllable and therefore the chain tends to adjust more around the biology, location and market. By contrast, in the aquaculture fisheries, opportunities exist to control some of the characteristics such as physical location of the harvest, size, abundance and timeliness of the catch which allows better control over the supply chain. Other issues also can affect how the supply chain works such as history, traditions, local, regional, or national regulations and laws, and economic issues such as incentives, taxes, and banking. In the following sections, each of the major industries will be explained as to how the resource, processing, and market sectors work to make that industry different form the others. The report will examine how these differences affect the way the industry operates or how fisheries within that industry work.

Defining the Resource and Fisheries

In defining the fishery, it is necessary to understand the different combinations that exist within each sector and between the sectors. The chart below shows the global seafood industry resource matrix to illustrate the potential different combinations of fisheries that exist. Each block represents a division within each sub sector that can define a fishery.

<table>
<thead>
<tr>
<th>Fishery Resource Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCF</td>
</tr>
<tr>
<td>Jurisdiction</td>
</tr>
<tr>
<td>Geography</td>
</tr>
<tr>
<td>Species</td>
</tr>
<tr>
<td>Vessel Type</td>
</tr>
<tr>
<td>Gear Type</td>
</tr>
<tr>
<td>Hybrid</td>
</tr>
<tr>
<td>Jurisdiction</td>
</tr>
<tr>
<td>Species</td>
</tr>
<tr>
<td>Method</td>
</tr>
<tr>
<td>Aquaculture</td>
</tr>
<tr>
<td>Jurisdiction</td>
</tr>
<tr>
<td>Species</td>
</tr>
<tr>
<td>Method of Farming</td>
</tr>
<tr>
<td>Geography</td>
</tr>
</tbody>
</table>
The Wild Capture fisheries are by far the most complex since the combinations of fisheries are numerous. Each category can have multiple divisions that can create unique fisheries due to regulation and management schemes that dictate very different rules for different types of gear or vessel. Therefore a fisherman who fishes for a particular species using a particular type of gear on a certain size vessel may be under regulations completely different than another fisherman in the same area fishing the same species but using differ gear or a different vessel size. Thus, because of management regulations, the two fishermen may see themselves competing for the resource and will organize into different groups to defend and represent their fishing division.

A good example of complicated fishing divisions can be found in the wild pacific salmon fisheries. The major catches of wild salmon take place in the North Pacific mainly by Russia, the United States and Canada. Each country has jurisdictions and there are also some international treaties to manage transnational migrations. There are four major pacific wild harvest salmon species: King (Chinook), Sockeye, Coho and Pink, each representing a different value, volume, market segment and management regime. The sectors are further defined by gear and vessel type. The majority of wild salmon are caught by three completely different gear and vessel types, each with its own restrictions and limitations. Trolling vessels commonly called Trollers use hook and line. Purse seiners use an encircling net and Gillnetters use a suspended net that entangles the fish. Each of these gear/vessel types has its own management scheme. Trollers in northern waters, for example, are given transferable quotas, but gillnetters and purse seiners are managed by frequent openings and closings of fishing days as a means to control escapement. In addition, each gear type has restrictions in terms of mesh size, net size, and fishing times. And, in Alaska, the size of salmon purse seine vessels is limited to 58 feet. So even though fishermen are catching the same species in the same jurisdiction in the same area, they operate in entirely separate fisheries competing for resource with very little in common at an operational level. With this diversity, fishermen tend to organize themselves according to the parameters of the management regulations controlling their fisheries, the geographic areas in which they fish, and the gear type they employ. This is particularly typical where the fisheries are made up of small independently owned vessels.

The Pacific salmon example becomes more complicated quickly when individual stocks, river runs, migratory patterns, and genetic divisions are taken into consideration. In British Columbia alone there are 93 separate stock groups to manage. Many more exist in Alaska, and the lower Pacific Coast. Salmon begin life in rivers and streams and are programmed to return to the same river to spawn. Each river has its own genetic finger print. To keep stock levels high, many rivers are stocked with farm raised fingerlings. This process is known as enhancing the fisheries. However the farmed breeds may not have the same genetic marker as natural stock. This may be irrelevant to the management scheme but could make a substantial difference to a certification body that must certify the river for sustainability. This new market requirement to have third party sustainability certification on WCF may motivate a group of fishermen to split off from another group and choose to have their fishery certified. This creates a separately managed fishery with certain market advantages over the same species harvested from a nearby river. Put another way, a group of fishermen can choose to have an single species from a certain river certified sustainable thereby gaining market advantage for this species of salmon harvested from a
specific river. The precedent for this is MSC certification of Fraser River sockeye in British Columbia. Salmon are migratory so there is an issue of jurisdiction. Salmon spawned in a stream in British Columbia could be caught by a trawler off Alaska as a by-catch. Thus there is an interaction between two separate fisheries that have no common jurisdiction other than international agreements and treaties. Since some of the fish programmed to return to a certain river in BC have been caught by a U.S. trawler in Alaska, the BC fisherman will never get that fish causing him economic hardship. This creates an emotional response that ripples up to the state departments of both countries.

Using this example of the British Columbia wild caught salmon industry as an illustration; the combinations of diverse interest could multiply to over 279 just within this fishery.

![Figure 6 British Columbia Wild Caught Salmon Industry Example](image)

The concept of organizing just one fishery sector like Wild Pacific salmon becomes extremely difficult given all the different variables outlined above. The added dimensions of different languages, cultures, laws, and management schemes over three different nations overwhelm the local boat owner who finds little benefit in organizing at the resource level. The average small boat owner has a lot of day to day issues to work through just to get the net in the water. Thus when considering the concept of organizing the WCF into a single global seafood organization, it would be necessary to find common ground and common need, and common mission that would offer enough value to inspire a local boat owner to give either time, money or both to the organization.
Defining the Wild Captured Fisheries Sector

Within the WCF sector, there are five unique characteristics that define a fishery. The diagram below breaks down the major characteristics that define how the fishery functions, and in many cases, defines business model that will be used to commercialize the fishery operating within the WCF.

![Diagram](image)

**Geography**

Geography defines the aquatic environment in which the fisheries operate, be it either fresh or saltwater. Once the geographic environment is established it influences many other aspect of how that fishery will function including jurisdiction, species, vessel and even harvesting and processing techniques. The illustration below lists the major aquatic environments in which fisheries operate.

**Freshwater**
- Ponds
- Lakes
- Streams

**Saltwater**
- Estuaries & Beaches
- Coastal
- Off shore
- High Seas

![Aquatic Environment Geography](image)
Jurisdiction
Jurisdiction includes the legal and regulatory framework in which a fishery must operate. If jurisdiction is within a nation’s Exclusive Economic Zone, then licenses are issued by that nation. There are very few if any places left in the world that allows fishing without some sort of authority approving of the practice. It is certainly not permitted in the developed and emerging nations who are in most cases participants in international fishing treaties to manage stocks.

Many fishery resources are migratory in nature and can move from one jurisdiction to another. Without treaties it would be impossible to manage these stocks. Regional Management Fishery Organizations (RMFO) have been established to deal with highly migratory high seas species such as tuna. In other cases, regional nations that have an interest in a particular stock have organized to manage transboundary stocks such as herring. But these efforts are only at a very high level of jurisdiction. Within each nation and within each type of fishery, a myriad of regulations exist that dictate how the fishery is managed.

The most basic jurisdictional issue is how a nation or regional area treats the ownership of the fishery and who should have rights to it. Some nations see fishery resources as state owned property and only grant state owned fishing vessels access. Other countries allow open access where licenses are given to anyone who requests it or pays a fee. Still other countries grant limited access regulating how many vessel or types of gear can operate in a given area. Finally, there are the nations that grant fishing licenses and access to a fishery as a property right to those who control the license.

Beyond access to the resource, jurisdiction will often influence the way the product is harvested and processed. Local regulations and culture can influence everything from the type and size of vessels that will be used to where and how the fish will be landed. Jurisdiction in today’s complex fishery world is by far the most complex part of fishing. This report is not intended to describe the complexities of fishery politics or laws, but to only highlight the fact they can affect and in some ways define a fishery.

Gear Type
Gear Type is dictated by several factors including the species to be fished, the geography of the fisheries, the jurisdiction and even the market. Irrespective of whatever limits or parameters that establish the type of gear to be used, the gear in many cases will define a given type of fishery. Again, using the BC salmon fishery as an example, the gillnet fisherman have a number of different associations that represents just BC Gillnetters usually by a river or area. Examples include the Area E (Fraser River) Gillnetters Association or the Area D (Johnstone Straits) Gillnetters Associations.
Vessel Type

Gear type and vessel type are closely inter-related and both are factors in identifying a fishery. Vessel size and type are often dictated by geography. A vessel that will operate on the hi-seas for months at a time has quite different requirements than a vessel operating in local waters and returning to port every day. Sea conditions also contribute to vessel design. An example of this is the double ended salmon and albacore trollers that must run dangerous coastal river bars. Species hunted will also influence vessel design. A large mid-water trawler seeking pelagic species such as Alaskan pollock needs a lot of horsepower to tow nets, whereas a longline cod vessel requires a solid platform but does not need the power or a large holding capacity. Some fisheries require fast boats that can move quickly as the resource shifts. The degree of processing to be done on-board is a major factor in vessel design. Processing can range from simple gutting operation to the high speed production of boneless skinless fillets. These are some of the environmental and economic factors that will determine a vessel type and size. Often, culture, social issues and regulations will override the environmental and economic factors to dictate what type and size vessel will be used in a given fishery.
Species

One of the most important characteristics of a fishery is the species that will be fished. Today more and more fisheries are based on target fishing and therefore the fisheries are organized and recognized by species. The Northern cod fisheries, the Gulf of Mexico shrimp fisheries and the South African hake fisheries are examples of targeted fisheries. Organizations are often formed around the species. The GSI is made up of hundreds of species that move to markets. Listed below are the main groupings of species that make up the global seafood industry. Only the major categories are listed, but each category includes hundreds of individual species that make up the GSI. Using salmon as an example again, there are five commercial species of salmon: Atlantic, king (chinook), coho, sockeye and pink. Each fishery has its own licensing requirements, management plan, market value and processing requirements. In addition, some of the species are both wild caught and farmed-raised. However, the chart below only lists them as salmon under the “Diadromous” category.

<table>
<thead>
<tr>
<th>Aquatic Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Kelp, Seaweed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crustaceans</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Crab, Krill, Fresh Water Crustaceans, Lobster, and Shrimp</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diadromous</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Eel, Salmon, Trout, Shad, and Sturgeon</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fresh water</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Cars, Tilapia, and Catfish</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marine</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Groundfish, Flatfish, Bream, Pelagic, Tuna, Shark, and Ray</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Molluscs</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Scallops, Mussels, Clams, Abalone, and Squid</td>
</tr>
</tbody>
</table>

Defining Hybrid Fisheries

Hybrid fisheries are a combination of wild harvest and farming techniques and include fish ranching, certain forms of mariculture, and enhancement fisheries. From a management perspective they can fall between the licensing and management required for wild harvest fisheries or can be treated more like a true aquaculture model. In most cases the industry becomes susceptible to a little bit of both regulatory authorities, meaning the business must have the rights to access the wild harvest fisheries and must also have the licenses required for operating a farming operation.
Ranching
Ranching as typically defined in the seafood industry involves first harvesting fish from a wild captured fishery and keeping it alive while it is brought into a facility that will hold and feed the animal until it grows to a size where it can be taken to market for a higher value. A good example of this type of fishery is the Bluefin tuna industry off the west coast of Mexico.

Mariculture
Mariculture by definition is the cultivation of marine organisms by exploiting their natural environment. In the early years of the aquaculture industry before hatchery knowhow and technology was well developed, the first business ventures utilized the wild spawn of a product and then controlled its grow-out until the product was ready for harvest. By growing the wild product in a controlled environment the culturist could better control and harvest a product suitable for market. This method had an advantage over the wild harvest in that it resulted in a cleaner more uniform product that could be grown in a very controlled area. This system works especially well for certain types of shellfish. Examples of mariculture fisheries include mussel farming where underwater nets or ropes are seeded and the mussels grow naturally using the local nutrients, and the farmed clam industry where seed clams are implanted in the bottom strata and harvested when they reach market size.

Enhanced
An enhanced fishery as opposed to a ranch fishery spawns the fish in captivity and then released to the wild. In the enhanced fishery the product is hatched from the spawn stock and raised in a hatchery until it has grown to a size that will allow surviving in the wild once released. The product goes through all the early stages of growth like a farmed product but once released it enters the waters and must seek food to survive. A common example of an enhanced fishery is the Alaskan salmon fishery.

<table>
<thead>
<tr>
<th>Ranched</th>
<th>Maricultured</th>
<th>Enhanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Born in wild</td>
<td>Born in wild</td>
<td>Born in captivity</td>
</tr>
<tr>
<td>Captured and fed</td>
<td>Corralled but not fed</td>
<td>Released to the wild</td>
</tr>
</tbody>
</table>

Figure 12: Hybrid Fishery 1

Hybrid fisheries can take in place in either a fresh or saltwater environment and jurisdiction is very dependent upon local laws and regulations. The operation of hybrid fisheries in and around a wild harvest fishery can cause conflict and complications with local fishery management officials, and at times, gear conflicts with other local fisheries. This is particularly true in the mariculture area where the
stock is often considered part of the wild stock due to its ecological load on the environment and the wild stock.

Figure 13: Hybrid Fishery 2 Example of Hybrid species by category

<table>
<thead>
<tr>
<th>Enhanced</th>
<th>Maricultured</th>
<th>Ranched</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Salmon</td>
<td>• Mussel</td>
<td>• Lobster</td>
</tr>
<tr>
<td>• Trout</td>
<td>• Scallop</td>
<td>• Crab</td>
</tr>
<tr>
<td>• Bass</td>
<td>• Clam</td>
<td>• Tuna</td>
</tr>
<tr>
<td></td>
<td>• Abalone</td>
<td>• Prawn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cod</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Eel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clam</td>
</tr>
</tbody>
</table>
Defining the Aquaculture Industry

The Aquaculture fisheries are best defined by the characteristics that account for the specific variables of each fishery. The diagram below illustrates the difference characteristic that make up each component that identifies a particular aquaculture business.

In the early days of the aquaculture industry, the primary driver was just the ability to grow a particular species within a given geographical area. Channel catfish, for example, was successfully raised in the southern part of the United States beginning in the early 1970’s and became one of the first successful U.S. aquaculture industries. Channel catfish is a very hardy fish and disease resistant compared with many other species. With these characteristics, and plenty of available water acreage, the local industry flourished and grew to fulfill local demand. By the early 1990’s boneless catfish fillets were being sold all around the US to fill market demand left by the lack of available WCF fishery products. But catfish faced limitations, not because of farming constraints, but rather due to the lack of market enthusiasm for the product which often had a strong flavor and an off white color.

By the mid 1990’s research at universities had improved hatchery and grow out technology to the point where various species with significant market appeal could now be transplanted to other areas of the world. This opened an explosive growth of new aquaculture business around the world and eventually led to the point where the industry could out-grow the demand. This shifted the aquaculture model to a market driven model as opposed to the WCF that are resource driven due to limited resources. Today, unlike the early aquaculture industry, the decision on what to grow and where to grow it is driven by the market’s desire for a given species. Vertically integrated companies search worldwide for locations that will meet the requirements they need to build large industrial farms and processing complexes. Today,
the species, more than any other characteristic, defines the fishery and all other factors become secondary. It should be noted, however, that determining where to build farms and a processing complex is a complicated process involving many factors including environmental, social, political, logistical, economic, and technical issues.

**Geography**

The geography defines the environment in which the fisheries operate. The main environmental issues are fresh vs. salt water, water temperature, and overall climatic conditions. When choosing a location, the geographic environment will determine what species can be raised. For example, tilapia grows best in fast running fresh warm water therefore a tropical river or lake is desirable. Salmon, on the other hand, need cold water and both require a fresh water location for the hatchery. The geography will influence many other aspects of how a fishery functions including jurisdiction, farming method and even harvesting and processing techniques. The illustration below shows the different aquatic environments where aquaculture operations exist.

![Freshwater vs. Saltwater Geography](image)

**Jurisdiction**

Jurisdiction as it relates to farming in the aquaculture industry is different from that of the WCF in that most aquaculture operations require permits and licenses but are not generally part of an overall fishery management scheme. Generally, all farms require some type of license and environmental permits for use of the land and water areas where product will be grown. The permits typically limit the species and the volume of fish or shrimp that can be grown within the designated area. In many cases it also limits the farming methods that can be employed.

The principal behind WCF management is based on stock abundance and effects on other species within the eco system. Management of aquaculture farms is centered on the environmental impact of the farm on the local ecosystem. This includes for example, restrictions on non-native species, escapement issues and prevention, feed types, waste build up, use of antibiotics, water quality, gear impact, bio security, harvesting techniques, and hazardous materials storage. In addition to these responsible manufacturing practices, farms are required to observe regulations that affect farmed or processed products. These include both international regulations and local laws such as specific harvesting requirements.
Farming Methods

There are many different farming methods employed in the aquaculture industry. The decision of which method to employ is driven by many factors including the species, geography, laws and regulations and also the economics. As genetically modified organisms and trait specific genetic selection become a bigger part of the industry, more efficient technology can be employed for grow out. Improvements in cage design and feeding systems will result in more offshore farms relieving pressure in coastal waters. See figures 16 and 17 below for a list of the different types of farming methods.
Aquaculture Methods

Open Pond or lake
- One of the most common methods of farming typically used for freshwater finfish and shrimp

Rope or seabed
- Typically used for mussels, clams and scallops

Raceway
- Used for finfish can be either flowthrough or re-circulations

Tanks (Recirculation, flow through) indoor outdoor
- Currently used mostly for shellfish, small finfish, and hatcheries
- New technology driving new uses for larger finfish

Cage (Open and closed) inshore and lakes
- Used mostly for finfish

Submergible cages
- Primarily use offshore for larger finfish

Platform and Offshore vessels
- Used as a base for offshore cage farming

Figure 17 Aquaculture Industry 2 Fish farming methods

Species
Biologists have learned to grow many different aquatic species in the last two decades. Advances in husbandry have enabled us to breed more selectively and even genetically engineer some organisms to improve performance of the species. Advancements in grow out technology and feeding systems have improved feed conversion ratios (FCR), and reduced mortality and cost of production. However, in spite of these advances, not all species are good candidates for farming. Many factors must be considered before investing time and money into development of a new species or even increasing production of an already market-accepted farmed product.

Many factors contribute to a successful aquaculture business. Location, regulatory framework, market knowledge, technical expertise, farming experience, financial savvy and farming methods are all
The role of Allfish in the global seafood industry is an important factor contributing to taking the right product to market at the right time. However, picking the right species to farm is the most critical of all decisions. While the counterpart fisherman in the WCF goes down to the sea and delivers the catch within hours or days, farmers’ horizons are much longer.

From the time a decision is made to start a farm until the first product is ready for market, years will go by. Some species will be ready for market in nine months after stocking while others can take three-four years. In either case, it takes a lot of investment, planning and research to enter the industry successfully. One must understand not only the conditions of today’s markets, pricing and availability, but also the conditions and needs by the time the product is ready for market. This is why choosing the right species is absolutely paramount to a successful aquaculture venture. Below is a chart of the current species that are being farmed commercially; not all are financially successful and new ones are constantly coming to market.

![Aquaculture Species Chart](chart.png)
Defining the Processing Sector of Fisheries

The processing sector of the GSI, like the resource sector, is very diverse and includes three functional operations: harvesting, wet processing and further processing. Most all commercial products will pass through the three processing operations before reaching a consumer. The actual process within each operation can differ from one species to another or within a species if the geography, regulations or the market dictate. But the processing operations are quite distinct since they are the connection point between the resource and the market. As noted previously, the degree of vertical integration within the industry varies tremendously, but even within the vertically integrated companies the three processing operations are very common and seldom take place within the same facilities.

Harvesting

Processing begins the moment the fish leaves the water so the first step of the process is harvesting. This operation is often done by the fisherman or the farmer. The harvesting step, more than any other in the process, will determine the longer term quality and value of the end product. Therefore, depending on the downstream requirement the product, it will either be kept alive in a water tank system or it will be slaughtered or allowed to die and then stabilized to prevent further decomposition before it moves to the next step in the process. The harvesting step always begins with the removal of the product from the life support medium. This can be as simple as draining a pond or tank, or as complex as mid-water trawling utilizing GPS and sophisticated sonar. But once the product is removed from the water and allowed to die, the quality begins to deteriorate. Harvesting method and the processing steps immediately following will determine the disposition of the product in the market. Illustrated below are different variations of processing within the harvest division. The process utilized depends upon factors
that are often out of the control of the fisherman or farmer, and are dictated more by regulation and markets.

Wet Processing

Once the product is harvested and stabilized, it will be transported to the wet processing operation. This can be as simple as dropping it from one deck to another or as complex as shipping the product by container half way around the world for processing. The wet processing, or first processing as it is sometime referred to, has become in recent years the most disconnected of all process steps in the supply chain, particularly in the WCF. The harvester for obvious reasons must be close to the resource and the further processors are generally fairly close to the distribution systems and the market. However, once the raw material is frozen or preserved for long haul shipping by the harvester, then the wet fish processing can be done wherever the lowest cost of labor exists. At one time, investment in technology offset the rising labor cost in the countries that fished for the products. But over the last 15 years, wet fish processing has become dominated by low tech and low wage Asian producers, primarily China and Thailand. Wet fish production is now driven by the lowest cost producer for much of the WCF destined for the frozen market.

A completely different scenario has developed in wet processing of aquacultured species. Asia not only dominates wet fish processing of aquaculture shrimp and freshwater finfish, but also the farm production of those species. The model throughout the world in the aquaculture industry has tended to be a more vertical control of operations from farm to processing even in the more developed countries where labor cost are high and investment in automation is the only way to process economically. By having a close cooperation between the farm, processing and market, the industry is better able to control cost and improve quality while quickly adjusting to market trends. This is a luxury that the WCF seldom enjoys.

Irrespective of where the product is sent for processing, the wet processing is about transitioning the product from a whole form into more valuable parts, and stabilizing it for the next step in the process.
Below is an illustration of the different functions of wet fish processing operations. The illustration is intended to show the different steps that can take place, but each species will be processed slightly differently where market requirements dictate what must be done in the operation. Some of the resulting products are sold fresh, but not all will directly enter the market after wet processing. Some will go to further processing which is covered in the next section.

**Further Processing**

Further processing is the final step in preparing the product for the market. The bulk of the commercial seafood industry products will pass through the hands of further processors. The scope of further processing ranges from large-scale branded international seafood processors doing canned or frozen food products for retail or foodservice, to small specialty processor producing smoked fish or specialty products directly for local markets. Regardless of the size or scope of the company, the further processor is the link for raw product to the market, and it is the role of the further processor to understand the market and the resource and produce products ready for either foodservice or retail channels. Similar to vertically integrated wet processors, further processors almost always buy the raw material well ahead of the market and thus they play a vital role in stabilizing supplies and pricing. Illustrated below are some of the processes that take place within a further processing plant, the illustration is intended to show the various types of operations and process, it is not specific to any given product or species.
Defining the Market Sector of the Fisheries

The market sector is very broad and more difficult to define than the other sectors because it encompasses a wide variety of activities. Once a product is in a market-ready form it will enter the distribution system to be sold either through the retail or foodservice channels for food product, or it will enter one of the other market segments such as the pharmaceutical or industrial markets. However, the distribution system within the Global Seafood Market is monolithic as compared to most other animal proteins and can be very confusing. Seafood can enter the distribution chain several times and can be traded internationally in many different forms before it reaches the end consumer.

The market moves fish all over the world from the moment it is harvested until it is ready for the plate. Distribution of seafood can begin and end at different points in the process depending very much on the type of species and many other market and government variables particularly in the WCF. As an example, a cod fish harvested on a freezer trawler in Norway can be sold, headed, gutted and frozen to a Chinese processing plant in Qingdao for processing into fillet blocks. The blocks would be offered on the open market and may be sold to North America or Europe to a trader who will import the product into a country and then sell the frozen block to a further processing plant in that respective country. The further processor will cut, portion, bread, cook the product and sell it to a distributor who may ship the product to another country to sell in either the foodservice or retail business. In the meantime, at several different points, by-products are being created that will also be sold to different markets around the world such as cosmetics, feed, leather, or nutraceutical (such as omega 3 pills) industries. These are common types of market transactions that take place daily in the GSM, particularly among the players in the WCF sectors.
A lot of work is being done by larger buyers to try to squeeze cost from the system, but surprisingly vertical integration has not driven down the cost in the WCF for a variety of reasons. However the aquaculture business model appears to work quite differently and in that model vertical integration works quite well in both controlling cost and quality. In general, the farming sector is more in control of the growing, harvesting, and wet processing and does not use the system of brokers and traders shipping products in different phases of work in process as does the WCF, at least until the product is ready for the further processors or wholesalers part of the process.

From either the wholesale level or the further processor the products will next be funneled into the general food market distribution chain. That chain is made up of a variety of distribution companies and brokers that typically specialize either in foodservice or retail channels. Brokers, or in the case of larger vertically integrated companies, their own sales force, will meet with the different segments of the foodservice and retail market end users to sell the products. But since food in general is a low cost product in comparison to its distribution cost, it is absolutely necessary to find efficient methods of delivering small quantities of products to a restaurant, grocery store or a hospital at the lowest possible cost. This role falls to the distributor and it is critical for a manufacturer to develop a good relationship with the distributors that can move products rapidly and efficiently to market. Ultimately the product will end up on a consumer’s plate either through the ever expanding foodservice market or the retail market.

The first consideration after harvesting is the market for which the catch is intended. The destination has an effect on the manner in which the harvest is processed, held and delivered. There are four major channels for distribution of GSI products: retail, foodservice, pharmaceutical and industrial. Each channel maintains certain standards and requirements which drive how the product is handled, packaged and delivered. Some fisheries are capable of handling multi-sophisticated processing, holding and distribution techniques and can sell through several market channels. Many smaller operations—especially operations in areas with vast disparities in their catches—are often subject to primitive processing and distribution techniques and are therefore limited in their potential markets. To understand the requirements placed on any fishery or distributor to sell product, an understanding of the needs, requirements, benefits and shortfalls of each market is required.

Typically, in the seafood industry products enter the distribution system in several ways depending on the type and form of the product. Although there is some direct boat to consumer trade most products will pass through the distribution chain. The length of the supply chain will depend on many factors. Ideally the product will go from a boat to a wet processor to further processor and then shipped to a store. This would represent a short supply chain which is appropriate for high volume fisheries that sell directly to end user. But in most cases the chain is much longer with many more hands touching the product. In some cases the supply chain will go from a fishing boat to an auction center then to a wet processor. The intermediate product may then be sent through an exporter to a second wet processor plant and then imported into another country by a trader who then sells to a further processor. After further processing it passes through a broker/distributor before reaching its final destination.
process is much more common in the WCF but is also practiced in certain parts of the aquaculture industry.

Retailers and food service operators, particularly the chain restaurants, work hard at shortening the supply chain to include only those who truly add value. Processors are always being pushed to find new ways of reducing costs. One common method used by further processors is to shorten the supply chain by buying product at the vessels and contracting the wet processing out to a third party while maintaining ownership. This method reduces the number of hands that touch the product and also gives the further processor much better control of the product. The downside is that it requires the further processor to use significantly more working capital since they own the product from vessel to distributor. Retail distributors and foodservice operators prefer this method since it offers better traceability and control over the product.

Given today’s sophisticated MIS systems such as S.A.P., the larger companies have become quite efficient at managing resource planning and tracking inventory. This gives the larger firms a great advantage over smaller less efficient operators. For the small operator to survive in the market they must focus more on niche markets using specialty distributors targeting markets where quality is more important than price.

**Retail**

The first and most familiar market to consumers is the *Retail* market. This is the channel that sells the canned, cured, fresh and frozen products found in local grocery stores, supermarkets, hypermarkets, discounters, clubs, convenience stores, open vendors and specialty fish markets. Products sold in this channel are divided into three main categories; chilled, shelf stable and frozen. Each category has its own distribution requirements and is thus handled by different buyers particularly in large national and international stores. While some retailers will buy from many sources, the larger retailers generally look to consolidate suppliers mainly for logistical purposes. Selling to a larger retailer can be challenging for a small operator who does not have the sophisticated processing system or wide variety of products big retailers demand. This is why small processors often target more of the niche markets or the more specialty retailers like retail fish markets.

There are many challenges in moving product through the retail chain. Retailers today will often limit the number of national brands they carry to two plus their private label brand. Discounting, slotting fees, sampling costs and promotions are an expense carried frequently by the processor or the brand. Also, selling directly to consumers can be complicated given current labeling requirements. The end users are frequently uneducated in preparing the product and uninformed about the safe handling of the product. Some consumers may be driven by quality, others by price and some still are driven by a particular health benefit. Prepackaged products like Fish sticks, fish dips and other processed seafood are relatively easy to market to consumers with product packaging and advertising. However, fresh case displayed products such as fresh fish and shrimp must exhibit a high visual quality and marketing success is highly dependent on the knowledge of the retail seafood worker. Retail seafood case workers must be
able to answer customers’ inquiries about seafood preparation, country of origin, and health and sustainability issues.

**Foodservice**
The second distribution channel is *Foodservice*. This channel consists of restaurants, hotels, casinos, cruise ships, hospitals, prisons, schools and other government and business segments. The restaurant segment can be divided into independent and chain restaurants. Then within these two segments there exist quick serve operations, family casual dining and white table cloth establishments. Each type of restaurant requires a different type of marketing. For example, a high-end restaurant may omit certain center of the plate species that do not appeal to their clientele. These restaurants typically buy from specialty seafood wholesalers who can source unique products. On the other hand, a mom and pop family restaurant will almost always buy their seafood from a broad line distributor.

Success in the foodservice market is dependent on having the right products at the right price for the market, but the most important factor is distribution. Foodservice is all about getting a good product to the restaurant at an efficient cost and the only way to do that is to have a good distribution network. To take on an account that has multiple stores, the manufacturer must have the ability to deliver product quickly and cheaply. Store deliveries are typically small and a manufacturer cannot send a truck 300 kilometers to deliver 5 kg of fish to an operator. The only way to move product efficiently to a restaurant is by consolidating it with other products. The lower the cost of the fish the more likely it will be distributed by a broad line distributor, while the more valuable the seafood the more likely it will be sold through a specialty seafood distributor.

All the factors must be considered when determining to which markets product will be sold. The product will in most cases determine the market outlet. Small catches of unique species will generally appeal to high-end markets. Some fish, due to their efficient manufacturing and high volume low cost, appeal to the more price sensitive markets. In any case, the end-user is a foodservice professional and is normally well educated in seafood preparation. Little is required in packaging aesthetics. However, the relationship created between the distributor, the customer and the fishery is a fragile one. There is less tolerance within this community of professionals for product that does not meet demand and expectation.

**Pharmaceutical**
The third market for human consumption is the *Pharmaceutical* market. This is broken into three submarkets: human supplements, food additives and medicines. These products are very often produced as byproducts to food processing operations in accordance with the regulatory agencies that monitor the manufacturing process (e.g. United States Food and Drug Administration—USFDA). Omega-3 fatty acid supplements, Chitosan, vitamins A, B and D, calcium and zinc can all come from the by-products of certain species of fish. With proper handling, followed by delivery to drug companies for further processing, these products are transformed into consumable products. The second option for this
market is delivery of these raw products to food manufacturers to supplement processed foods. The refined oils can also be specially processed for certain heart and cholesterol medications.

**Industrial**
The fourth and final channel of distribution is the *Industrial* market which consists of products that are not consumable by humans. To provide for this market an efficient manufacturing plan is required which is capable of filtering and holding byproduct for further processing. The sub-markets to the industrial market are: Meals and oils, skins, bio fuels, lubricants and fertilizers. Meals and oils are processed into animal and aquaculture feeds and they are also made into composed fertilizer and liquefied offal. Skins can be processed into cosmetics and leathers. Fish oils can be converted into bio fuels, feeds and lubricants. The benefit of providing byproduct to the industrial market is that it often has less regulation in the form of process treatment than those products manufactured for human consumption.

The markets for fishery products are growing rapidly and the introduction of new species, processing techniques and fisheries will help expand and feed market needs. The art of maximizing any market within the GSI requires both an understanding of the markets for final products, as well as the continued growth of processing technology. A fishery can then focus its yield to the best suited market or markets open to their product.
IV. Major Industries of the Global Seafood Industry

As noted above, the GSI is not a homogeneous industry but an industry made up of many different types of fisheries that operate independently from each other. This section of the report will describe the structure and details of five of the largest commercial fisheries within the global seafood industry: groundfish, tuna, salmon, shrimp, and pelagics. These five were chosen because they represent the five largest international fisheries. Compared to other fisheries they are well organized, global in scope and are products consumed in most nations of the world. The five species also represent the successful evolution of a commercial fishery. For that reason, this report describes a brief history of each business and how markets and commercial pressure forced changes. This is particularly important when considering commercialization of underdeveloped fisheries and how they may learn or follow a path to commercial success. One common denominator that can be recognized in each of the fisheries is that they are organized more commonly by market factors than resource, location or biology. While those traits are important, they can also be obstacles to market growth.

![Major Global Seafood Industries]

Figure 23  Major Global Seafood Industries
**Groundfish Industry**

To understand the groundfish business it is absolutely necessary to understand its history. Up to the mid 1960’s the traditional groundfish industry consisted of two species, Atlantic cod and haddock. Both species were caught from the Northeastern coast of North American to northern waters of Europe. The English, French, Spanish and Portuguese fleets had crossed the ocean to fish cod and haddock in North America for centuries. The product was salted and shipped back to Europe as a daily dietary staple. In the 1700’s the European fleets were joined by the Canadian and American fleets on the Grand Banks, and after World War II the Russian, Germans and Polish fleets also joined in the fisheries all looking for cod and haddock. By the mid 1960’s, the traditional groundfish industry had to expand beyond cod and haddock to meet the ever growing demand for white flesh fish, so soles and flounders were added to the groundfish category.

The primary markets in the early to mid-twentieth century for groundfish were Europe, the eastern United States, Canada, the Caribbean, and Brazil. Traditional product forms were salt fish and fresh headed and gutted fish. By the 1950’s, fresh and frozen fillets also became popular groundfish products. The markets were robust and demand continued to grow both in the traditional markets and beyond. The markets had a growing appetite for fish with white color, flaky texture, and mild flavor. The increased demand put considerable pressure on the traditional and still unregulated fish stocks. To meet demand the fishing fleets spread out across the oceans in search of new species. As the search for fish continued, nations subsidized the building of massive distant water fleets with larger more efficient
trawlers equipped with new fishing and processing technology. By the late 1970’s, a number of new species were finding their way into the European and North American markets from all over the world. However, cod was still king and the fishing effort in the North Atlantic continued to grow. Then in the 1980’s unregulated fishing fleets caused a near complete collapse of the North Atlantic cod and haddock fisheries, which for some communities was an end to a way of life that had existed for hundreds of years.

The resource was gone but the market’s appetite for groundfish was still growing. Once again, to meet the increased demand, the market adapted by expanding the species used in the whitefish trade. By the mid 1980’s, growth in the markets brought the introduction of Alaskan pollock to the United States and European groundfish trade. Traditionally, Alaskan pollock had been caught and used almost exclusively in the Northern Pacific Rim countries. For years, North America and Europe had in effect competed for seafood resources around the world. The introduction of Alaskan pollock into the traditional groundfish markets forever changed the dynamics of the industry and created the first global groundfish market. Countries like Japan, for example, had to compete for the first time for a seafood resource they had always controlled.

The new species entering the groundfish market were coming from very distant places such as South Africa, Argentina, New Zealand and Alaska. The great distance from these fisheries to the markets confined their use to a frozen form. Demand through the 1980’s continued to grow for both fresh and frozen cod in both North American and European markets. By the late 1980’s, Canadian and U.S. cod fisheries had reached a point where they could no longer supply enough fresh fish to meet the requirements of the North American market. Compounding this shortage was a strong market demand in Europe so fish caught in Norway or Iceland was staying in Europe. Strong demand and the growing appreciation of European currencies against the U.S. and Canadian dollars further motivated European producers to sell in Europe.

By the early 1990’s, the U.S. fresh markets had reached such a shortage of fish that something had to be done. Traders, importers and brokers searched the world for new species. But finding high volume fisheries with the characteristic the market needed at the price it could afford was not easy. U.S. traders were now in a global market competing for product against Europe and Japan.

Meanwhile, new aquaculture technology had been emerging in the late 1980’s and the United States had a young new growing industry in the south raising channel catfish. The technology to produce boneless catfish fillets was developed and the market expanded quickly. Catfish grew steadily filling the hole left behind from the cod shortage. Once again, another milestone in the groundfish industry had been passed. For the first time, the groundfish market not only included a farmed species but also included a fresh water species. By the end of the 1990’s, several more farmed raised species had joined the groundfish market including fresh tilapia fillets from Central American; fresh Atlantic salmon from the United States, Canada, Norway and Chile, and frozen pangasius fillets from Vietnam. The groundfish industry had been forever transformed and included dozens of species, both wild and farmed, that competed for market applications of this category.
Coastal nations started to claim control over their territorial waters within the 200 mile zone (EEZ) in the late 1970's and early 1980's. For the first time in history, coastal nations could control their waters and begin to rebuild the fish stocks based on an active approach to stock management. As quota systems were implemented in the over-fished over-capitalized North Atlantic fisheries, further reductions in available traditional fisheries were inevitable. The lack of resource caused many fishing and processing companies to close down or consolidate.

As aquaculture species became a bigger part of the groundfish market, and new wild caught species like Alaskan pollock, hake and hoki supplied the block market, the traditional cod producers found themselves in a weaker position to set pricing than they had been in the past. To offset costs, traders would buy frozen headed and gutted cod from cash strapped Russian fishing companies and send it to plants in China to be thawed and reprocessed into fillets. The fillets were then refrozen and sent to the global markets. As this practice grew it became more difficult for the traditional North Atlantic fishing companies to compete with the low cost twice frozen imported fish. To counter the high cost of production the traditional North Atlantic processors, with little cash to invest and facing uncertain future catches, followed the path of the Russian fishing companies and froze headed and gutted fish and shipped it to countries with a low labor cost to process it into a market ready form. In the transition, traditional processors became marketing companies instead of processing companies.

By the turn of the century most of the North Atlantic and Pacific cod that was not sold in the fresh market, as well as a number of other species, were shipped either to China or Thailand for reprocessing. As China built processing plants and became the center of white fish reprocessing, it also needed an expanded supply of fish to process. Armed with an understanding of the world fisheries, and facing a
growing middle class population, China expanded heavily into aquaculture as a way to control raw material and expand its influence in the world fisheries. As China grew as an export country sending fish to the global groundfish industry, it also started to grow as an importer. Its growing urban middle class families were adapting to western style of living, and they had more disposable income available for seafood products. As a result, demand started to grow domestically for the species China was importing, reprocessing and then exporting. Today China is a growing market in the global groundfish industry and within a year or two will become a net importer of fishery products. The additional demand created by China will once again force change in the global groundfish industry.

**Groundfish Resources**

Current groundfish resources come from a variety of different fisheries that include wild harvest and aquaculture species, both fresh and salt water. Wild harvest fisheries include Alaskan pollock, Atlantic cod, flounders, haddock, hakes, hoki, merluzza, Pacific cod, saithe, soles, redfish, halibut and turbots. The fisheries are harvested from many countries including Norway, Faroe Islands, Iceland, EU, Greenland, Canada, Russia, United States, Namibia, South Africa, Korea, Japan, China, New Zealand, Argentina, Chile, Uruguay, and Peru. The resource management schemes vary from country to country and include everything from open access quotas systems to Individual Transferable Quotas (ITQ's). Some resources are very well managed with significant scientific knowledge while others fisheries lack good scientific data for proper management. A number of the fisheries, for market reasons, have chosen to seek third party certifications such as Marine Stewardship Council (MSC) certification. Other fisheries have not seen a need for sustainability certification or are unable to meet the standard.

Today, the resources are generally much better managed. The over-capitalization and high national fisheries’ subsidies seen in the 1950’s through the 1990’s that brought false economy to fisheries have disappeared. They have been replaced by more stable business models that include property rights, stable quota systems, and third party certification and sustainable practices. These changes have spawned a new generation of professional fishery management and international investment that will drive the industry in the future years. But even with improved management systems and sustainable resources, there will likely be little growth in volume in the WCF. The opportunities will be found in better utilization of the existing harvest by adding value to every ton of fish that comes up the stern ramp. Today the WCF is focused on return per ton of harvested fish as opposed to number of tons of fish harvested.

If the oceans of the world cannot yield higher wild captured catches, the only way to fill the growing demand for seafood is through the continued development and expansion of the aquaculture industry.

The groundfish aquaculture sector is growing fast to meet the demand of today’s markets. Aquaculture makes up 45% (see chart below) of the current groundfish industry; depending on what species are included. This number will continue to grow. Currently the commercial groundfish aquaculture species include cod, catfish, tilapia, turbots and a variety of niche fisheries. Two countries are involved in producing the majority of groundfish species. China produces a large volume of tilapia along with some catfish, and Vietnam produces a large volume of pangasius. Other tilapia producers include Indonesia,
Honduras, Costa Rica, Equator, Israel and Mexico, and there is some minor EU and U.S. production. Meanwhile, U.S. catfish production has been on a steady decline over the past several years and cod production in Norway has struggled to become economically viable. Turbot production in Europe on the other hand has grown but is still a niche market product.

It is clear from the above discussions that wild harvest fisheries are pretty much at maximum sustainable yields (MSY) and the only place for growth in the groundfish industry is from Aquaculture. However, this growth is not without problems. The capacity to grow the aquaculture industry will be limited by water quality and availability of feed materials. Currently fishmeal and fish oil make up a significant percentage of the feed required to grow marine fish and this feed must come out of the WCF. Fishmeal comes from directed fishing for species that have little commercial food value and from byproducts of food fishery processing. In either case the volumes are limited. For long term growth, it will be necessary to develop feeds from other sources and to limit the use of industrial fishmeal and oil to their omega 3 supplement values. For the aquaculture industry to continue to contribute to the groundfish supply, more research and development is needed. Major issues include water usage, pollution, fish diseases, growth rates, water quality, and competitive usage of the coastal areas, and inland lakes and rivers. To grow this sector more open ocean farming and closed inland recirculation farms will be required.

![Wild Groundfish Landings & Farmed Production 1960 - 2008 (FAO 2008) in Metric Tons](image)
Groundfish Processing

Groundfish Processing is divided into three process sectors: harvesting, wet processing and further processing. Harvesting is removing the product from the water and stabilizing it for the next process. This can include doing nothing to the fish other than placing it on ice or in refrigerated water, to deheading, dressing, and freezing. First processing typically involves filleting, skinning, and/or cleaning the fish. It can also include some form of treating and stabilizing the fish for the next process. Further Processing includes the steps needed to make the product consumer ready and can include anything from packaging a fresh fish for market, portioning, breading or cooking. Almost always packaging the product is included in the further processing step.

In the WCF, harvesting of the groundfish species is typically done within a country’s EEZ, usually by a flagged vessel of the country. Once on board, the product must be prepared for its next process which can range from packing in ice, refrigerated sea water, or whole freezing to store for movements to the next process. Most often the product will be bled, headed, gutted or any combination of the above depending on market requirements and proximity to the wet processor. There is also a class of vessels known as catcher/processors that have the capability to harvest the fish and process on board creating a premium frozen at sea product. These vessels are particular effective in fisheries that require large vessels that can operate for long periods far off-shore and handle species that can be processed with a high degree of automation. In existing markets this product, like a fresh product, often brings a premium price over the twice frozen products that have been wet processed in low labor cost countries like China and Thailand. In spite of the premium value of the processed at sea products, there are many fisheries that cannot for various reasons utilize catcher/processor vessels. These fisheries must either gain the premium value by moving the products into high quality fresh markets or choose to freeze round product and send it to Asia for processing.

As described earlier, the development of the wet processing in Asia from frozen raw material has had significant effects on the industry. It has certainly shifted labor from the small seasonal fishing villages around the world to large year-around processing operations that have a consistent supply of frozen product and low labor costs. Typically, the smaller in-country processors invested in processing technology in order to handle gluts of a specific seasonal fish. Asian factories, on the other hand, use low cost labor and are not highly automated. This gives them flexibility to process various species and various size ranges without making major investments in equipment.

Automation in wet fish processing is most valuable in countries with high labor costs, labor shortages, or in fisheries where huge volumes are landed in a short time frame. However, automation comes with an accompanying high investment cost and the need to maintain and manage complex processing equipment. In addition, there are two other major drawbacks. First is the lack of flexibility. Fish filleting machines are limited to a certain group of similar species within a limited size range and cut style. This limits the ability of the plant to adjust to changing market requirements. On the other hand, well trained hand cutters can adapt rather quickly. The second major drawback to automated fish processing, and
possibly even more important since it affects cost even more than labor, is yield. Well trained hand cutters who are properly managed will generally surpass the yield of an automated process. It remains to be seen if this trend can continue. Costs are rising in China and labor shortages will have a negative impact particularly in food plants that historically are not the most desirable working environments. Based on historical trends, these plants will have to automate or production will move to lower cost areas with abundant labor.

The processing sector in aquaculture fisheries operates in a more traditional manner. This sector tends to be vertically integrated, or at least very closely connected with the farmer. Many farms operate in a cooperative environment where the individual farmers pool capital and resources to establish a processing plant. The models of either cooperative arrangements or vertical integrations may vary from fishery to fishery, but in general the link to the farms is very close. In all cases the processing plant is the link to the market.

The aquaculture industry in general has done a good job in keeping the supply chain short as opposed to the WCF where traders, importers and brokers often intervene between the harvest and the market. The majority of aquaculture products are already being raised in areas of the world where low cost and abundant labor is readily available. Therefore there is no motivation to push production to other areas.

Farming decisions can have a significant effect on the cost of processing so the need for a close relationship with the processing plant is more critical than in the wild harvest fisheries. In addition, the high capital investment in farm stocks requires close coordination with the processing plant in order to maximize the market value of the product. For most species the intent is to keep the fish alive as long as possible and therefore the fish is typically kept in water as it is transported to the plant. Once in the plant, wet processing is very similar to the WCF process.

Between the wet fish processor and the distribution system are the further processing companies. They are the link to the market and play a vital role in the balance and stability of the market. The further processing operations must estimate needs for raw material well in advance of orders, keep up with the ever changing market and regulatory requirements while always adjusting to meet the new market trends. These companies may be a branded organization, a private label company, or combinations of both. In any case they must maintain a close alliance with the suppliers of raw materials since they compete with the WCF for their share of the limited resources. They must also maintain a good relationship with their customer base which can include wholesale or specialty distributors, full line distributors, chain restaurants and retailers.

In the further processing business, working capital requirements are high, gross margins are tight, and volume is often the key to a successful operation. In recent years, a lot of effort has been directed to cut costs and shorten the supply chain by using more sophisticated ERP systems and better management data, and cutting out traders and importers by buying raw material directly from the fishing vessels and shipping it to China or Thailand for wet processing. This has shifted some of the value added production
from the further processing facility to the lower labor cost countries like China. This shift has put a lot of pressure on smaller operators, traders and importers who cannot muster the cash needed to float the inventory for such long periods. This trend will have longer term effects in the industry by forcing more consolidation in order to remain competitive.

**Groundfish Market**

As noted earlier in the report, the market for groundfish has continued to grow which increases pressure on the WCF stocks. Most of this growth is coming from developing nations whose economies and cultures are changing as they enter the industrialized world.

Further growth in the groundfish industry will have to come from aquaculture. More farms and new species will be the engine of growth and it can be expected that the market evolution will continue as new species enter the system. In spite of this growth, the groundfish market has always been, and will continue to be, a price sensitive market. Costs will continue to be driven by a consolidation of further processing, specialty and full service distributors, and end users at foodservice or retail. However, reducing costs in the supply chain will be complicated by market complexities. Changing food safety regulations, requirements for traceability and certification, and import restrictions and duties will continue to challenge producers’ efforts to reduce cost.

The groundfish market today looks very different than the industry of just 25 years ago. WCF that is not processed at sea or sold fresh in the market is sent to China for processing into fillets and value added products. Twice frozen block fillets and IQF fillets are shipped to North America, Europe or Japan for further processing and distribution to foodservice and retail channels. Farmed fish and twice frozen products are the dominate products sold in the world groundfish markets. In the United States, five out of the top ten consumed fish are groundfish, three of which are farmed species and the other two are primarily twice frozen products.

<table>
<thead>
<tr>
<th>Top Five Groundfish species sold in the US in 2009 in Lbs per capita</th>
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<tbody>
<tr>
<td><strong>Alaskan Pollock</strong></td>
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<tr>
<td><strong>Tilapia</strong></td>
</tr>
<tr>
<td><strong>Catfish</strong></td>
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<tr>
<td><strong>Cod</strong></td>
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<tr>
<td><strong>Pangasius</strong></td>
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What started out as one groundfish market made up of cod and haddock from the North Atlantic has evolved to include many different species and several different industries around the world. As currency and trade barriers shift product flow, new species that enter the global market must find a place in the pricing structure. Many of the new products have different attributes that affect the price structure and market adaptability. These attributes include size and color of fillets, flake characteristics, and ease of
substitution for the traditional species. Each new product will be evaluated and slotted into its market value accordingly.

Groundfish industry pricing can best be described as a high rise building that has many stories. Each story represents one level in the building and each level has a floor and a ceiling price. A groundfish species resides on each level. On the levels above and below are other species with higher or lower market prices respectively. The level on which a species resides determines its price in the market. Therefore a fish on the 10th floor or level will sell at a higher price than the fish species living on the 6th floor. Within each level the price can vary but only until it hits the ceiling when it bumps against the floor of the fish on the next level. Moving from one level to another is possible, but it generally takes some paradigm shift for it to happen. Generally, moving to a higher level is driven more by the falling value of a fish at a higher level that allows others to move up in the pricing column.

The price level at which a fish resides depends on many factors. These factors are typical of those that set pricing in many different fisheries. Pricing factors include fish size, taste, color, texture of the flesh, consistency of the product, availability, annual variations in volume, common name, country of origin, quality, market reputation, shelf life, and flexibility of the product to be in a fresh, frozen, smoked, or marinated form. In addition to these physical and organoleptic characteristics, there are other conditions that can affect the value of a fish species. For example, certifying a fishery as sustainable may open new markets and increase the value of the product. A species with a unique nutritional value may find niche markets that are willing to pay higher prices. Also, species that have deep traditional or cultural applications may have a different pricing structure.

![Market Price](image)

Figure 28 Groundfish 1 Market Price Influences
Structure & Organization of the Groundfish Industry

The whitefish industry is organized at many different levels because it comprises many species representing many fishery sectors. For this reason, it is made up of the most diverse fishery organizations. At the resource level, organizations in the WCF will represent local and regional fisheries by gear type and species. These organizations are focused on keeping local and regional fisheries open, and they are constantly interacting with government regulators, NGOs and other stakeholders. Since whitefish fisheries tend to be geographically focused, the regions represented can be very small depending on the specific fishery. Examples include lake fisheries or a multi-national fishery such as North Atlantic cod. Fisheries managed under multi lateral agreements will typically be represented by a national organization. Often these national organizations are made up of several local organizations that form alliances. In recent years, some fisheries have organized to form groups that apply for some type of certification of the fisheries such as MSC certification for sustainability. These groups are sometimes coalitions of existing fishery organizations or newly formed only for a specific purpose. There are also technical organizations that are formed around regions and countries. In the United States, fishery development foundations were formed in the 1980’s to promote and develop new products and to improve fisheries’ performance. These organizations are often funded by both government and industry. In Europe and Japan, governments tend to fund companies to do research and development for new products.

Aquaculture fisheries are organized very differently than their WCF cousins. The existing organizations seem to have little commonality across an industry. However, one pattern that seems to exist is that the more vertically integrated an aquaculture fishery, the less it tends to organize as an industry but instead tends to represent itself. For example, the tilapia industry does not have a single organization or even an alliance that works across the industry to advance or represent tilapia. Tilapia companies tend to be very independent and compete against each other. The only link that appears to exist at this time between tilapia producers is complying with standards that will enable them to gain third party certification.

In the catfish industry, either in the United States or Vietnam, the groups are organized mainly for advancing the market. VASEP, the Vietnam Association of Seafood Exporters and Processor; the Catfish Institute (TCI) and the Catfish Farmers of America (CFFA) are focused on industry trade and government issues while also promoting product in the markets. These organizations tend to be more focused, competitive and single minded in their endeavors, but they have also become advocacy groups for their industries at both the market and government level.
**Tuna Industry**

Tuna is a true global industry. It is caught along the equator all around the globe with an annual harvest of over 4.4 million metric tons. Tuna is eaten in almost every country of the world and is one of the most consumed seafood products. The industry is uniquely organized as compared to the rest of the GSI because it is the only major internationally managed seafood industry in the world.

**Resource Sector**

There are twenty-three separate stocks of tuna found within ten degrees north or south along the equatorial zones worldwide. As is the case with most fisheries, local and regional laws, culture and jurisdiction affects how the fishery operates. Tuna is caught using four types of gear: Hook and line, pole and line, long line and purse seiners. The vessels themselves range in size from small long boats for day trips to larger ships that are sustainable for several months at sea. Tuna is harvested globally but the bulk of the fish is caught within 10 degrees north and south of the equator. Most tuna is caught and harvested on the high seas and frozen on board. Fish caught near shore and within steaming distance to a processing facility will hold the fish in refrigerated sea water (RSW) or Ice until it reaches a shore based processing plant where it may be frozen or processed. Very highly valued tuna like bluefin is landed and immediately air freighted to market.

![Figure 29: Tuna Landings 1960 – 2008 (FAO) in Metric Tons](image)

The fishery consists of five species of tuna:

*Skipjack*—accounts for 50% of the world catch. Light meat tuna primarily caught by purse seiners and used as canned meat.

*Yellowfin*— accounts for 30% of total light meat tuna harvest. Primarily caught by purse seiners and
mainly used in canning and portioned loins.

*Big eye*—represents 12% of total tuna catch. Big eye is a large fish with a reddish meat also known as *Ahi*. Primary use is frozen loins or steak used often for sashimi.

*Albacore*—is roughly 6% of the total catch. It is a darker meat tuna that is used primarily for canning and is caught mostly by pole and line and longline.

*Bluefin*—is a premium product used mostly as *sashimi*. It makes up about 1.5% of the total catch and is caught by hook and line, and pole and line.

The migratory nature of these species brands them as an international high sea fishery. They are managed through a series of Regional Fishery Management Organizations (RFMO). There are four RFMO’s worldwide involved with tuna management, with one split into two commissions: the Inter-American Tropical Tuna Commission (IATTC), which is responsible for the Eastern Pacific, and the Western and Central Pacific Fisheries Commission (WCPFC), which is split into two separate commissions: the International Commission for the Conservation of Atlantic Tuna (ICCAT) and the Indian Ocean Tuna Commission (IOTC).
Under the RFMO management system, fishing nations that have historically fished tuna meet annually and set quotas that have been recommended by the scientist. Historically, the political leaders who vote on the quota have not agreed to accept the scientific recommendations, and over the years many stocks have felt the pressure. As happens in so many fisheries, social pressures come to bear on how stocks are managed and the stocks generally lose. Political leaders often do not have the will to restrict fishing and cause economic chaos, particularly when it happens around small nations where fishing activities make up a significant portion of the country’s GDP. Tuna harvesting and processing capacity is considerably higher than the 4 to 4.4 million MT that is landed each year. This is a result of nations encouraging, and in some cases subsidizing, the building of new vessels and processing plants.

There have also been issues between nations involved with the RFMO’s. As tuna migrate through national waters some countries have taken the position to directly manage the fish within those waters. Thus, in spite of international agreements, the effectiveness of RFMO’s as a management organizations is reduced. These unilateral actions by individual nations have caused problems for the industry. As a result, the tuna processors have recently organized to force better management over the stocks.

**Processing**

Processing is much more concentrated in the tuna world than with many other species. Since most tuna is frozen in the round at sea, it is fairly easy to hold and ship product to highly productive and efficient processing facilities located around the world. In the past 15 years many of the older processing plants have closed and production has moved to new facilities built where labor cost is much lower. Today, the major processing centers are in Equator, Trinidad, Mauritius, Sri Lanka, Thailand, Seychelles, Madagascar, Philippines, Papa New Guinea, Fiji, and Samoa. The largest processor is Thailand.

Tuna processing begins on board the vessel at the harvest. The catch is either packed in ice, refrigerated in seawater, frozen in bulk or flash frozen for sashimi grade products. This decision is made based on species and market demands. Most of the fish is frozen and bulk shipped to a shore facility where it is thawed, cooked, loined and canned. This process is labor intensive so the majority of this work is done in the developing world where there is an abundance of low cost labor. The higher grades of tuna such as big eye and some yellowfin are processed into steaks and sold in higher end markets as IQF product.

**Market Sector**

Tuna is sold in nearly every country on earth. The vast majority, 66 percent or about 2.9 million metric tons, are sent for canning. Three major species make up the canned market: yellowfin, skipjack and albacore. The shelf-stable and durable canned product represents an easy, inexpensive and nutritious means of obtaining protein and omega 3 fatty acids into a diet. Big eye, yellowfin and bluefin tuna make up most of the fresh and frozen markets. Tuna represents the most consolidated model in the seafood industry. Only five companies, working under six brands, sell almost two million MT of canned tuna, a little over two thirds of the total canned product, to the US and Europe every year.
Industry consolidation allows for a reduction in traders or brokers. The industry can maintain a very short supply chain compared to that of shrimp or groundfish. Although demand continues to grow, catches have remained stable at between 4 and 4.4 million MT which limits market growth but maintains a steady value on the product. Japan utilizes over 24% of the world tuna resource, mostly in higher end sashimi markets with approximately 500,000 MT of sashimi and 200,000 MT of katsuobushi. The majority of tuna is sold through retail and foodservice channels. With over 65 percent of the world’s tuna production going into canned branded or private label products, the majority of the production will be sold through the retail channel. Tuna is also a very large part of the foodservice channel. Canned tuna is a staple on many menus, and there has been a growing demand for frozen loin and sashimi grade tunas over the past decade.

Structure and Organizations
Unlike many of the other sectors of the GSI, tuna is quite straight forward. There are five commercial species that make up the industry, and like all the WCF access to resource is the major issue facing boat owners. There are numerous organizations that represent local and regional fishing groups. There are also international and national organizations that are very effective in an international fishery where governments negotiate against other governments for access to quotas for their countries vessels. Their goal, like all fishery resource associations, is to keep access open for fishing against competing interests.

The processing sector and market sector are very closely aligned since the very large branded companies control most of the processing operations either through straight ownership or contractual agreement. As noted, their interest is to keep markets open. In the tuna industry, more than most other industries, the market sector also spends a lot of time keeping trade open so product can keep flowing from vessels to plants to market. The tuna industry was the first major commercial seafood industry to experience pressure from the NGO’s to close a fishery for environmental issues. The tuna industry learned quickly the power of the market to react to environmental concerns such as the dolphin safe issues.

Given the problems of overfishing of certain tuna stocks and the poor response by the RFMO’s to face and correct the problem, the industry learned to act rather than react and organized internationally to set up an advocacy group to deal with the sustainability issues. They set up the International Seafood Sustainability Foundation (ISSF) which is an industry/ENGO coalition that uses science to set sustainability standards for all tuna stocks, and uses market pressure to force the RFMO’s to follow the recommendation of the scientific community. In its short existence the ISSF has become an effective tool in helping organize the tuna industry to be an environmentally sustainable industry, and that will help lead to an economically sustainable business.
Salmon Industry

Total global production of trout and salmon is about 3.157 million MT annually based on 2007 figures, but the industry is divided into two very distinctive resources and markets; the WCF and Aquaculture.

Wild Capture Salmon Fishery

Resource

Of the 3.157 million MT of salmon produced in 2007 the WCF accounted for 994,000MT. Although wild catches do fluctuate year to year the overall annual catch has remained somewhat stable in the 800,000 to 900,000 MT range. The fishery is also highly dependent in many areas on stock enhancement of rivers with hatchery fingerlings. Wild salmon is primarily caught in Russian, U.S. or Canadian waters on highly seasonal bases as the fish return to rivers to spawn. However since salmon migrate to sea and live in the ocean after leaving the rivers, there have at times been directed high seas fisheries. In addition, salmon is often a by-catch of another directed fishery. Most fish are caught by gillnetting, trolling or purse seining from late May to September.
Figure 3
Wild Salmon Landings 1960 – 2008 (FAO 2008) in Metric Tons

Chinook/ King Salmon
- Highest value species with the lowest harvest volumes

Sockeye/ Red Salmon
- Good value fishery with some of the largest annual returns

Coho/ Silver Salmon
- Typically troll caught with a mid-range value and historically the smallest of the annual salmon landing

Pink Salmon/ Humpies
- Lowest in value chain but high annual landings

Chum/ Dog Salmon
- Low value suitable for canning

Figure 34
Salmon Species
**Processing**

At harvest the fish are either iced or stored in refrigerated seawater and brought to the processing plant. The fish is then unloaded and sorted prior to primary processing. Depending on the species, the product will be either canned or frozen. Processing plants are often located in very remote locations with limited population so production techniques have historically been driven by speed rather than quality. However, in the past few years the industry has taken advantage of mechanization and is heading, gutting and filleting fish in the primary plants, or just heading, gutting and freezing and sending the fish to China or Thailand for processing into higher value products.

**Market**

The market for Pacific salmon is very different from one salmon species to another. Higher value products like king and sockeye are often sent fresh to the market. Some rivers have taken on a brand value based on the name of the river. In these cases the fish are flown fresh daily to the market where it fetches an incredibly high market price. The Copper River and Yukon River in Alaska are examples of river branding. This type of market however is a very small segment of the industry. The bulk of the sockeye, chum and pink salmon have historically been canned or gutted and frozen. But recent changes in the market coupled with the development of better technology have changed the industry. The higher quality fish such as king, coho and sockeye are dressed, graded, frozen and shipped to Asia, Europe or the United States for further processing. These products bring a good market price and are marketed as “wild caught” to high end restaurants and smoked fish producers. The lower value species and the excess sockeye runs are moved from low value canned products to higher value fillets and portions, primarily for the European and North American foodservice and retail industry. Market value for WCF has been very strong recently for two reasons. First, there is a very successful image building and marketing campaign to bring value to a wild catch third party certified sustainable fishery. Second is the collapse of the Chilean farmed raised Atlantic salmon industry due to disease. Salmon fillets are primarily distributed through the same chain as most groundfish, and in some markets would be considered a groundfish species. Future outlook for growth in the Pacific salmon fishery is probably limited due to limitations of the wild capture salmon resource and the seasonal nature of production.

**Farmed Salmon Industry**

**Resource:**

Farmed salmon production has grown consistently over the past 15 years and as of 2007 had reached an annual total production of about 2.16 million MT, based on four commonly farmed species: Atlantic, coho, chinook, and salmon trout. Salmon farming is done in a number of nations, but Norway and Chile are by far the leaders with Norway producing about 34% of the volume and Chile about 31%. Other high producing countries are Faroe Islands, Shetland Islands, Scotland, Canada, and New Zealand.
Farming techniques can vary depending on locations but in general the industry is moving to closed hatcheries, either flow through or full recirculation for egg and fry production. Grow-out is done in pens or cages depending on the exposure to open water or other environmental issues. There are many technical issues to consider when farming, but the two biggest economic problems in operating a farm are disease and feed cost. Another important issue is obtaining and keeping licenses to farm which includes a host of issues involving location, stocking density, water quality, energy requirements, and sustainable practices. Natural elements such as weather and tides, market and transportation factors, and local and national politics can make it a very risky business. Grow out time can range from 24 to 36 months depending on the species. This time frame requires a lot of capital to be tied up in inventory and also requires long lead time to adjust for market conditions.

**Processing**

Processing wild caught salmon can often be chaotic with gluts of fish overwhelming processors. Conditions in the farmed industry are much more controlled and less seasonal in nature. Depending on the individual farm and national food and agriculture requirements, the fish are either brought to the plant alive or slaughtered and bled at the farm. The fish can be transported by well boat, truck, or barged in bins to the production factory. Once at the factory the product will be primary processed into either a headed and gutted product or fillets depending on market requirements. The process in general is mechanized but some areas of production are still labor intensive such as removing the pin-bones. In the past few years the processing plants have become more sophisticated and have found ways to improve yield and reduce labor. Unlike the wild capture fisheries, the farmed salmon aquaculture industry is much more likely to be vertically integrated, well capitalized, and often publicly traded. Farms
that are not owned by one of the vertically integrated companies are very likely to be a contract producer for a specific operation.

**Market**
Most vertically integrated companies control their product through direct distribution into the country of destination. Since most of the producing countries are not also consuming countries, most farmed salmon is air-freighted, trucked or shipped to final market. Once in the market, the product will enter the same distribution channels as most groundfish, both for retail and foodservice. Markets in Europe and the United States tend to use more fillets and have moved away from dressed product forms, except in high end fresh markets. Frozen fillets are often sold to further processing operations that will continue to add value through portioning, coating, smoking, or packaging. Fresh fillets tend to enter the market and move through the specialty seafood dealers that are better prepared to deal within the fast pace fresh market. Japan, as one of the major users of salmon, tends to purchase headed and gutted product, but Japanese traders buy ex factory and import directly into Japan.

Market potential looks very positive with new markets constantly arising and more and more product moving to other Asia countries in addition to Japan. But the industry must solve some fundamental problems including disease, feed, and water rights before it can grow. The disaster that happened in Chile was a result of fast industry growth and must be taken serious by all sectors of the aquaculture industry.
Structure and Organization of the Salmon Industry

The global salmon industry is obviously divided between the wild capture fishery and the cultivated fishery. These industries are in competition and the volume produced in both industries is impressive. It is not surprising, therefore, that there are numerous organizations representing both groups at various levels.

The aquaculture fishery tends to be vertically integrated and is therefore represented by market oriented organizations. But clearly, these organizations are concerned with more than just the mechanics of marketing farmed salmon. The industry has come under attack from NGO’s and consumer groups for a number of practices that they claim are detrimental to the environment or consumer health. Thus, marketing organizations are forced to defend the industry as part of their effort to market the product. Implicit in this effort is the competition between farmed and wild salmon products. In the future, farmed salmon organizations will also be involved in addressing the various standards that are being developed for farmed salmon. The Global Aquaculture Alliance and the Aquaculture Stewardship Council, among others, are developing standards for farmed salmon. Some of these standards will be required by major purchasers of farmed salmon. This will force the farmed salmon organizations to address these issues.

The wild capture salmon industry representation is primarily focused on securing resources. Many wild salmon groups represent specific geographical areas. Others serve a particular gear type such as gillnet or trolling. Since wild salmon are a trans-boundary resource, there are also international commissions that regulate harvest areas and gear types in an effort to manage the fishery. Resource access is the primary objective of groups representing the wild capture salmon fishery.
Shrimp Industry

The Global shrimp industry is segmented at the top level between cold water shrimp and warm water shrimp. Cold water shrimp are wild caught in both the north Atlantic and the north Pacific. Warm water shrimp are both wild caught and cultivated. Wild caught warm water shrimp are distributed worldwide, but most are captured in near shore salt and brackish water areas of the temperate and tropical seas. Cultivated warm water shrimp include both salt and fresh water species. According to FAO, world production of all shrimp, wild and farmed, was about 6 million metric tons in 2008 with wild caught shrimp contributing about 60% and farmed shrimp 40 percent of the total. The terms ‘Shrimp’ and ‘Prawn’ are often used interchangeably. For the purpose of this summary, the term shrimp refers to salt and brackish water species, and prawn refers to fresh water species.

Figure 37

Resource: Wild Capture Shrimp Fishery, Warm Water

World landings of wild shrimp have been fairly consistent at approximately three million metric tons over the five year period 2003 to 2008, and include dozens of species. Over 50 percent of the world catch is harvested by China and a few other Asian countries. Most of the wild species are being harvested at or above maximum sustainable levels. Thus, there is little harvest growth potential in the wild shrimp sector.
Wild caught shrimp are mostly harvested from various size boats using some form of trawl net. Since shrimp are demersal, the nets are towed along the bottom. In recent years, shrimp trawling has come under fire from environmental organizations as a destructive method of harvest. The environmental concerns include the trapping of sea turtles, non-target species by-catch, and sea bottom disruption. Another method of capturing shrimp is with traps or pots. This method is mainly used for specialty low volume fisheries and is considered to be more environmentally friendly.

Shrimp harvest vessels can be classified in three general categories: local day boats, ice boats, and freezer boats. Local day boats are smaller vessels that fish local coastal areas and deliver their catch daily. The small amount of shrimp that is sold fresh – never frozen – mostly comes from this source. Ice boats are larger vessels that usually fish more distant grounds where trips can last from seven to fourteen days. Freezer style boats take a different approach. They too travel to distant fishing grounds but they can continue fishing as long as necessary since the catch is frozen on-board.

**Resource: Wild Capture Shrimp, Cold Water**

Another wild caught shrimp resource is cold water shrimp sometimes referred to as northern prawn or pink shrimp. Cold water shrimp are an important commercial fishery and are harvested in both the north Atlantic and north Pacific oceans. In the Atlantic, they range from New England in the United States through eastern Canada to Greenland, Iceland, and Norway into the North Sea. In the Pacific, the range is from Russia across the north Pacific and Alaska, and as far south as the state of Oregon in the United States. Major species include Pandalus borelalis, Pandalus jordani and Pandalopsis dispar. Canada and Iceland are the main sources in the Atlantic. In Canada there is an inshore and offshore fishing component. Factory trawlers are used offshore and the shrimp are frozen on board. Inshore effort is by smaller vessels using primarily trawl nets. Cold water shrimp are very small and have
completely different characteristics than the warm water shrimp species. Approximately 500,000 MT of cold water shrimp are harvested annually from the world’s oceans.

**Resource: Farmed Shrimp and Prawns**
The production of farmed shrimp and prawns includes only a few major species and has grown dramatically. The major farmed species include Pacific white shrimp, Penaeus vannamei, tiger shrimp, Penaeus monodon, and China shrimp, Panaeus chinensis. The fresh water giant river prawn, Macrobrachium rosenbergii, is also contributing significantly to the farmed mix. Several other species are also cultivated and each has specific advantages in the aquaculture environment. However, the availability of specific pathogen free (SPF) P. vannamei has accelerated the adoption of this species throughout the world. The Pacific white shrimp accounts for approximately 60 percent of the world’s farmed production.

![Figure 39 Farmed Shrimp Production 1960 – 2008 (FAO 2008) in Metric Tons](image)

Major producing areas by volume are China, Southeast Asia, Central/South America and India. In Africa, where climates and water resources are favorable to shrimp farming, production has been minimal for several years and only a few countries there participate in the global shrimp trade. Production in North America has also been minimal primarily due to high costs, foreign competition and unfavorable climate conditions for outdoor cultivation.

There are various estimates of the growth of farmed shrimp production, but the FAO data indicates a growth rate of about 8% from 2003 to 2008. While there will be ups and downs, projections are for continued growth in most areas, especially in Brazil and India. Growth in the world supply of shrimp will come almost exclusively from farming.
Primary Processing Warm Water Shrimp

Processing of warm water shrimp, both wild and farmed, is similar with the exception of initial harvesting and storage. Shrimp processing ranges from freezing of the whole shrimp, to more labor intensive processes including size grading, de-heading, peeling, deveining, breading and cooking. The minimum processing steps for almost all warm water shrimp include size grading and freezing. The most popular product forms require further processing. Although machinery is available to perform some processing steps, it is still very labor intensive.

Shrimp processing essentially begins at harvest. Wild shrimp are often de-headed on board the boat then iced. In this case, a natural enzymatic reaction in iced shrimp can cause a condition known as blackspot or Melanesis. Although the black spots themselves are not harmful, they reduce the value of the shrimp or can make the quality unacceptable. Therefore, some form of anti-oxidant is usually applied to the shrimp to inactivate the enzyme. Typical of these anti-oxidants are ascorbic acid and sodium metabisulfite. The application of sulfites on board the vessel can also adversely affect shrimp quality if the chemicals are improperly applied. Excessive or improper application of sulfite can discolor and burn the shells appearing as grey splotches. The proper method of application is to dissolve the bisulfite in water at a concentration of 1.25% for a maximum of two minutes. If sulfites are used, the packaging must include sulfites on the label.

In another variation of wild caught shrimp harvest, the boats freeze shrimp instead of storing them on ice. The harvested shrimp are de-headed and frozen on board thereby greatly reducing enzymatic activity and preserving the intrinsic quality of the shrimp. In this case, the application of anti-oxidants is not required at this stage.

Harvesting methods used for farmed shrimp depend on the type of grow out system used. Two basic methods are draining the ponds and fishing the shrimp using nets. Harvested shrimp are often put into ice baths to rinse, chill and stun them. Sometimes the ice bath contains Everfresh, a substance that interrupts the enzymatic reaction described above.

All shrimp, farmed and wild caught, is graded for size. Size determines for which markets the shrimp are most appropriate, the type and extent of further processing, and the price for which the shrimp can be sold. Shrimp size is expressed as count (number of shrimp) per pound. Sizing is also an important variable when cooking shrimp. Consistent sizing allows cooking parameters to be set to maximize yield, avoid overcooking and to assure pathogen destruction.

Manual sizing of warm water head-on shrimp is often done visually. The shrimp are presented on a conveyor belt where workers visually pick out the sizes and toss them into the appropriate bins. Sizing of shell-on head-off shrimp is usually accomplished using a system of roller graders. The shrimp are passed over diverging rotating rollers and fall through the opening according to their width. There is sufficient
The Role of Allfish in the Global Seafood Industry

Correlation between the width of the shrimp and its weight to obtain accurate sizing. Size is the major factor in determining the value of shrimp.

Warm water shrimp have a more extensive sizing system than cold water shrimp. The following table shows typical size designations for three popular product forms of warm water shrimp. The counts represent the number of shrimp per pound.

<table>
<thead>
<tr>
<th>MARKET DESIGNATION</th>
<th>HEADLESS/SHELL-ON/GREEN</th>
<th>PEELED &amp; DEVEINED/GREEN</th>
<th>COOKED PEELED &amp; DEVEINED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra Colossal</td>
<td>Under 10</td>
<td>Under 14</td>
<td>16/20</td>
</tr>
<tr>
<td>Colossal</td>
<td>10/15</td>
<td>21/25</td>
<td>20/30</td>
</tr>
<tr>
<td>Extra Jumbo</td>
<td>16/20</td>
<td>20/25</td>
<td>32/40</td>
</tr>
<tr>
<td>Jumbo</td>
<td>21/25</td>
<td>26/31</td>
<td>42/50</td>
</tr>
<tr>
<td>Extra Large</td>
<td>26/30</td>
<td>32/38</td>
<td>52/60</td>
</tr>
<tr>
<td>Large</td>
<td>31/35</td>
<td>39/44</td>
<td>62/70</td>
</tr>
<tr>
<td>Medium Large</td>
<td>36/40</td>
<td>45/53</td>
<td>72/80</td>
</tr>
<tr>
<td>Medium</td>
<td>41/50</td>
<td>54/63</td>
<td>82/90</td>
</tr>
<tr>
<td>Small</td>
<td>51/60</td>
<td>64/75</td>
<td>92/100</td>
</tr>
<tr>
<td>Extra Small</td>
<td>61/70</td>
<td>76/84</td>
<td>102/110</td>
</tr>
<tr>
<td>Tiny</td>
<td>Over 70</td>
<td>Over 84</td>
<td>112/120</td>
</tr>
</tbody>
</table>

Figure 40  Typical Size Designations for Three Product Forms of Warm Water Shrimp

Primary warm water shrimp processing is labor intensive. De-heading shrimp is a manual process. There have been some attempts to develop whole shrimp de-heading machines but the process is still mostly done manually. In the case of wild caught shrimp this process is commonly done on board the vessel. Farmed shrimp are de-headed manually prior to size grading. Peeling and deveining headless shrimp can be done manually or by machine. In the manual operation, the shell is removed, the dorsal surface is slit open and the vein removed. Machine peeling and deveining reduces peeling labor but requires considerable post machine processing inspection and clean-up work. Shrimp processing is labor intensive so processors prefer to do these operations where labor is cheap.

Further Processing of Warm Water Shrimp

Value added processing of warm water shrimp is usually done in the country of origin where labor is cheaper. In addition to basic green products, there is a large variety of incremental value added products produced. These products include cooked shrimp, many flavors of breaded shrimp, dusted shrimp, battered shrimp, skewered shrimp, and marinated shrimp. There is an increasing demand for value added shrimp products.
Shrimp cooking methods include water cooking, conventional steam cooking, and lower temperature steam cooking. The cooking method has a major influence on product color and yield. Steam cookers are used extensively in all parts of the world for a variety of warm water shrimp products. Conventional steam cooking can over cook the product generally resulting in a lower yield than low temperature steam cooking.

The food service industries and retail ready to cook shrimp products are driving the breading and battering process. A typical process is to pre-dust the shrimp with some type of flour to create a surface more conducive to batter adhesion. After the batter is applied, the shrimp is pre-fried which sets the batter and gives the product a crust characteristic of fried foods. There are dozens of variations in flavors and textures of breading and coatings. Fortunately, there is a variety of breading and battering machines available which make producing these products efficient and reliable.

Labeling of breaded shrimp for the U.S. market must meet certain standards. “Lightly breaded shrimp” must contain at least 65% shrimp. “Breaded shrimp” must contain at least 50 percent shrimp. Breaded shrimp containing less than 50 percent shrimp must be labeled “Imitation breaded shrimp.”

Freezing is the last processing step for most shrimp products. Typically IQF freezing is done in a Co2 or nitrogen freezer tunnel. Spiral IQF freezers are also used. Many shrimp products, especially head-off shell-on warm water shrimp are frozen in blocks, either 5lb or 2 kilogram. Breaded shrimp and cooked shrimp are most often frozen IQF and then bagged.

A major product form for warm water shrimp is green, headless shell-on product. This product is sold either IQF or frozen in blocks. IQF product is glazed as part of the freezing process. Frozen shrimp are dipped in water then refrozen. This glaze, or coating of ice, protects the shrimp from drying out during frozen storage. Block packed product is packed in a carton lined with a poly bag. The bag is filled with water so the when frozen the shrimp is encased in ice. Many forms of IQF shrimp will be glazed as part of the process. But the weight of the glaze is not included in the package net weight. Almost all shrimp products are distributed frozen then either thawed and sold “fresh,” or cooked and served.

In addition to glazing, all types of shrimp are very frequently treated with sodium tripolyphosphate (STP), which inhibits moisture loss when frozen shrimp is thawed. The treatment usually involves soaking the product in a solution containing STP and is primarily used on peeled shrimp to give it a protective coating for moisture retention. Although STP is GRAS (Generally Regarded As Safe) by the U.S. FDA, its use to treat shrimp has been controversial, especially when applied to shell-on shrimp. The shell acts as a natural moisture retention barrier so soaking in STP only serves the purpose of adding water and therefore weight to the product. Also, soaking shrimp in excessively high concentrations of STP will add extra water to the product. Companies are supposed to use Good Manufacturing Practices when applying STP, but there have been cases of abuse.
**Processing Cold Water Shrimp**

Processing of small cold water shrimp is mostly automated, especially cooking and peeling. Cold water shrimp is generally small and the grades limited to six or fewer. For example, raw northern cold water shrimp is sometimes graded as large if they count 200 to 300 per pound. Small cold water shrimp are graded at 300 to 450 per pound. Cooked grades include 120/150, 125/175, 250/350, 300/500, 500/up.

Cold water shrimp are generally cooked prior to peeling. Steam cooking is the most common cooking method for cold water shrimp. Typically, cold water shrimp are processed through individual combination machines that first cook then peel the shrimp. A more recent approach centralizes the cooking operation. After cooking, the shrimp are chilled to an optimum temperature for peeling. Peeling is then done by dedicated peeling machines which can be fine tuned to optimize yield. This approach also has other benefits for sanitation, and food safety. Most small cold water shrimp are cooked, peeled and either frozen or canned. IQF cold water shrimp are sold bagged in various weights.

**Marketing Warm Water Shrimp**

The primary markets for third world farmed shrimp are the United States, Europe and Japan. The United States alone imports more than 2 billion dollars worth of shrimp each year. These markets emphasize different product forms. Japan tends to require green head-on shrimp products while the United States requires primarily green head-off and peeled shrimp. Markets for wild caught shrimp are global and compete with the imported farmed product. Cold water shrimp address different markets which include IQF and canned small salad shrimp.

<table>
<thead>
<tr>
<th>Product Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head-on/shell-on - whole shrimp</td>
</tr>
<tr>
<td>Head-off/shell-on</td>
</tr>
<tr>
<td>PUD: peeled un-deveined (tail-on/tail-off)</td>
</tr>
<tr>
<td>P&amp;D: peeled and deveined (tail-on/tail-off)</td>
</tr>
<tr>
<td>P&amp;D butterfly: peeled, deveined, and deep cut</td>
</tr>
<tr>
<td>P&amp;D western style: peeled, deveined and halves split apart but joined at the tail</td>
</tr>
<tr>
<td>EZ-peel: shell-on, deveined, (tail-on/tail-off)</td>
</tr>
</tbody>
</table>

*Figure 41*  
Primary Green (Raw) Shrimp Product Forms
Processors of warm water shrimp in many ways form a link between the markets and the producers. Processors, who also act as exporters and take the risk of price fluctuations during the time they buy the raw material and sell it to the market place. This relieves the farmers of market risk. Processors also must understand shrimp processing, pricing, and marketing of the various products they produce. Processors are essentially the marketing arm for shrimp farmers in many countries that export to Europe, North America and Japan. A similar role is played by processors of wild caught shrimp. Although these processors face a different set of constraints, they must have a good understanding of the resource and markets.

Warm water shrimp prices can fluctuate wildly. Prices are affected by feed costs, diseases, and natural disasters like tsunamis. Imports of warm water shrimp compete directly with wild caught warm water shrimp in the developed countries. In North America the price of wild caught shrimp has steadily declined as imports increased. One organization in the United States, the Southern Shrimp Alliance, indicates that 2009 will be the worst year for prices in recorded history. This trend is likely to continue.

Competing dynamics between wild caught and farmed shrimp will influence consumer’s preference. Consumers are becoming more aware of where their seafood comes from. This is an advantage for wild caught product. Reports of mangrove destruction and the use of banned antibiotics also reinforces consumer’s perception that farmed shrimp is inferior to wild caught product. On the other side, as the public learns of farmed shrimp certification schemes, farmed shrimp will increase in credibility. In addition, the consistent high quality and availability of farmed product will promote its popularity.

Other important marketing issues have emerged in recent years that may influence both wild caught and farmed shrimp. First is a growing requirement by major retailers that fisheries and aquaculture operations be certified. Certification in the case of wild caught shrimp means sustainability. The Marine Stewardship Council is the primary certification standard for wild caught shrimp. On the farmed shrimp side, the major certifier is the Aquaculture Certification Council which certifies hatcheries, farms and processing plants to the Best Aquaculture Practices (BAP) standards developed by the Global
Aquaculture Alliance. These standards include food safety, social accountability, environmental controls and monitoring the use of aquaculture drugs and chemicals. There are also other certification standards for both wild caught shrimp and farmed shrimp. These standards are competing for market relevance and may play an important role in future certification schemes.

The second emerging marketing issue applies only to farmed shrimp. This is the development of organically farmed shrimp. To be organic, shrimp must meet some organic standards for farming and processing. In the United States, there are no organic standards for seafood of any type. Therefore, seafood cannot carry the USDA organic label. However, organic standards do exist in the EU for seafood including shrimp. This means that organic shrimp from Equator and other countries can be marketed as organic because it is certified organic by European certifiers. While the USDA continues to work on organic standards for seafood, there are tons of shrimp and other seafood entering the United States which is certified organic by foreign certifiers.

**Marketing Cold Water Shrimp**

Most cold water shrimp is sold frozen, either in block form, raw or cooked, or IQF bagged and ready to thaw and eat. A significant amount is also canned in brine. Much of the Canadian catch is sold to the United States and to Europe, especially the UK. Some specific cold water shrimp fisheries in Canada and the United States have obtained MSC certification which is an advantage in marketing to Europe. The Gulf of St. Lawrence northern shrimp fishery, the northern prawn trawl fishery in Newfoundland, and the Oregon state pink shrimp fishery are MSC certified. Most northern shrimp sold into the U.S. market comes from Canada, the United States and Greenland. According to Wikipedia, there is also an industrial component to cold water shrimp: “Shrimp alkaline phosphatase (SAP), an enzyme used in molecular biology, is obtained from Pandalus borealis…and the carapace is a source of chitosan….”

![Major trends in the worldwide shrimp industry](image_url)

Figure 43  Major Trends in the Worldwide Shrimp Industry
Structure and Organization of the Shrimp Industry

The organizations representing the global shrimp industry are similar in structure to those representing the salmon industry. There is both a farmed and wild caught component of the fishery and the farmed side has come under significant pressure from NGO’s and consumer groups questioning their farming and environmental practices. Also, the wild caught and farmed products are direct competition in most major markets. Thus the promotional organizations must deal with a host of issues affecting their group.

The farmed shrimp industry is more vertically integrated than the wild capture industry. Thus, it is clearly market oriented. But, as noted above, marketing farmed product includes defending various industry practices. Vertically integrated operations are, in general, more able to pull together the information needed to defend their operations on marketing level, or manage a certification process. In addition, the farmed shrimp industry has had to defend itself against anti-dumping charges in some of its major markets. These kinds of activities tend to drive the industry toward legal and political representation in order to protect their membership. In addition, some organizations in the farmed shrimp industry also control production in order to manipulate supply and therefore pricing. The Thai Shrimp Association is an example of production/pricing control. Their members, the Shrimp Farmer Clubs, recently agreed on production cuts in order to stabilize prices and balance farmers’ incomes.

Interestingly, organizations in the wild caught shrimp industry are more market oriented than resource driven. This is different than most wild capture fisheries. The reason for this is that wild capture shrimp fisheries must also respond to pressures from both governmental and non-governmental organizations. The issues include preservation of sea turtles, sea bottom disruption, and non-target species by-catch. The capture industry has had to comply with a number of gear modifications as well as regulations to avoid sensitive habitat damage. Furthermore, the wild caught shrimp industry in many countries must compete directly with farmed product which pushes them more toward market representation than resource representation. In general, prices of wild caught product have fallen as a result from competition from farmed shrimp. This completion has also given rise to organizations that are dedicated to promoting wild shrimp over farmed shrimp.
Pelagic Industry

Pelagic Fish are fish that live in the pelagic zone of the ocean’s water column. The column has three basic zones: the benthic zone which is the floor of the sea and includes organisms imbedded into the bottom; the demersal zone is the near-bottom, and the pelagic zone which covers the rest of the water column. There are hundreds of different species that occupy this zone from the tiniest free floating plankton to the largest sharks. All technically are pelagic species. However, the definition of pelagic fish used in this report, and the one typically understood in the seafood industry, limits the description to a variety of small schooling forage fish such as anchovies, capelin, herring, mackerel, menhaden, pilchards and sardines.

The pelagic industry represents some of the most abundant species in the world with average annual harvest in excess of 25 million metric tons. The industry is global but unlike groundfish and the tuna industry, it is not globally organized. The fish are caught all over the world, and are commonly found in the economic zones of both the underdeveloped and developed nations. Since many of the underdeveloped nations do not have the research capability, vessels, capital, or know-how to fish the offshore stocks, larger developed fishing nations with distant water fleets have historically exploited the offshore stocks with little to no benefit to the underdeveloped country.

In addition to aquaculture, the pelagic fisheries offer some of the best opportunity for underdeveloped nations to develop profitable and viable fisheries within their economic zones. Pelagic type fish are very versatile and may be used in different ways in order to increase the value of the fishery well beyond its raw material value. This concept is further developed in this report.

Resources

Pelagics are harvested all around the globe; almost every nation with a continental shelf will have one or more types of pelagic fish available. Pelagics are not just a small salt-water fish; they can also be caught in lakes and rivers. Most pelagic fish are oily and very boney by nature. In certain markets the higher fat content can be a desirable trait but in most markets the high fat and bone has limited the value of the fish for human consumption. Historically, these types of fish have had little food value and had often been used for industrial purposes. The value of both fish meal and fish oil continues to increase, so demand is growing for these resources as an ingredient in feed for the aquaculture industry.

Management of the pelagic resource globally has been a very serious problem. There are many nations that do not have adequate research, or the ability to manage and enforce control over the stock. Often these nations do not have the experience or know-how to understand the value or health of their local fisheries. If managed properly, the pelagic resources can represent a much higher value and growth opportunity for underdeveloped nations than they currently receive. Pelagic fish are a highly migratory species that can create stock management problems due to their trans-boundary nature. These stocks, therefore, are often managed under multi-lateral treaties in many of the historic pelagic fishing grounds. Regional fishery commissions set harvest quotas, but these agreements are only as good as the science behind them and the desire of the ownership nations to control the fishing effort. The management
schemes are extremely varied because of the wide variations of national jurisdictions. Marketing efforts of many European pelagics in the last few years have included third party sustainability certifications to improve the market value of their products. Unfortunately, even under these schemes, problems can occur when the fish decide to show up in large volumes in areas they previously had not been seen.

The pelagic industry is one of the oldest fisheries in the world. For thousands of years pelagic fish have been fished off beaches and from small dories. Gill nets, weirs, traps and small purse seines were used to catch pelagic fish. In today’s modern fishing fleets large purse seine and freezer trawler vessels travel long distances and stay at sea for long periods of time to fish stocks around the world. Compared to most other species, pelagic fish tend to have a low landed value per ton. Fishing effort, therefore, must be efficient at harvesting high volumes in order to be profitable. Today, modern vessels are sophisticated fishing machines with the ability to freeze on board and stay out for extended periods to fish multiple species of pelagic fish in the same trip. These attributes make these vessels extremely efficient and profitable. Below is a graph showing the combined catch of all the fish in the pelagic industry from 1960.

Figure 44  Pelagic Landings 1960 – 2008 (FAO 2008) in Metric Tons

Although pelagic fisheries are still strong, some stocks have been put under considerable pressure and the ten year trend indicates a slight decline in catches around the world. Some of the drop is caused by more restrictive management and improved sustainable practices, but other factors not clearly identified at this time could be affecting the downturn as well. There may be reduced fishing efforts or reduction in the stocks, but in any case, compared to the other industries mentioned in this report, jurisdiction and regulations of these fisheries are the most problematic.
Processing

Processing many pelagic species is quite different than most food fish since much of the harvest is not processed for human consumption which means that the handling techniques can be quite different. Harvesting operations are very dependent on the type of gear employed. Trawlers will haul large bags up the stern ramp or in the case of smaller vessels, pull the bag over the side then dump the cod end on deck. Purse seine vessels will close the net and pump the live fish on to the deck. Once on board, the fish are sorted and stored in refrigerated sea water if it is being transported fresh to the plant. Alternatively, it will be graded and frozen in vertical plate freezers then stored in the freezer hole. Depending on the species and the intended market, the process will vary from just loading, storing and transporting to a plant, to sorting, grading and freezing on board. Due to the volume of fish typically caught in the pelagic fisheries, the fish is rarely processed at sea other than round freezing. Fresh fish brought ashore will either be directed to fishmeal operations, processed for the roe market, or processed for human consumption.

Pelagics are typically good for fish meal because of the high protein value of the meal and the extracted oils. The decision to use the fish for meal is often driven by the economics of the fisheries. For example, herring can vary in value based upon its size and oil content. Herring that meets the right market criteria for the Western European market or the Japanese roe market can have very high value and will be processed as a high quality food fish using the most sophisticated automated processing equipment. Herring that does not meet these high value market requirements may be better utilized in a reduction fishery where the meal and the oils will be used for aquaculture feed, thereby being converted to protein that has higher economic value. Other species may be frozen in the round and used for bait fish.

Often the processing result is not simply a case of food fish vs. industrial usage. Usually there is a combination using the best products to obtain the highest return. Fish directed to meal will enter modern, low temperature fishmeal plants where the protein will be processed to obtain the best possible value. Low temperature processing is extremely important in maintaining high quality digestible protein. Oil will be recovered using a number of techniques, but its value and ultimate use will depend on the number of process refinements employed. Fish oil can be sold in many markets for bio fuel, animal feed, or for human consumption. Initial quality, inherent characteristic and the refinement process will determine what the final products will be.

Fish that are intended for use in the food fishery will be brought ashore either fresh or frozen. Frozen product will be thawed and then follow the same process as fresh product. The fish will be graded and processed through the most technically advanced processing equipment used in the fishing industry. Modern herring and mackerel plants run extremely high volumes of fish through filleting machines with almost no labor in the plant. All processes can be fully automated and these plants are often referred to as “lights out” plants. Like most seafood industries, pelagic processing employs a separation between wet and further processing but not to the extent seen in the groundfish industry. A high percentage of the pelagic fish sold for human consumption is directed into a canned or frozen product. Canning is done at the wet processing plant, while marinated products are often barreled or frozen at the wet processor
and then shipped to further processing operations that will pickle or marinate the product for specific markets.

The pelagic wet processing plants like their cousin industries stay closely aligned with the resource sector. With the development of the large freezer trawlers, fish plants have become more consolidated. The investment needed to build automated, high volume processing plants necessitates a constant supply of raw material. Therefore, local resources are supplemented with an influx of high quality raw material from large trawler operations in order to operate a sustainable business model. Given the highly automated processing plants and the proximity to the resource, these processing operations will mostly not be affected by the trend to move production to low labor cost countries.

**Market Sector**
The market sector for pelagics is probably the most diverse in all of the global seafood industry. Markets are very regional in nature in the food fishery. Because so much of the volume of pelagics goes to industrial applications, it is important to understand this market in detail. Fishmeal and fish oil have always been used for industrial purposes ranging from basic animal feeds, to cosmetics, linoleums, glues, fuels and even for pharmaceutical needs or supplements. Today, the value of the feeds and oils is increasing as the market better utilizes these incredible creatures. In many ways, the parts are worth so much more than the whole.

Products produced in low temperature reduction plants can be used not only for their high protein and mineral values in animal feeds, but also for human consumption as protein or protein isolates, gelatins, collagens and a number of different vitamins. The oil contains rich volumes of omega 3 oils such as DHA and EPA, and given the increasing value of the parts it can be expected that this industry will continue to grow, if not in volume, definitely in value.

The market for food pelagics has been a staple for many diets in both developed and undeveloped countries for many years and demand will continue. But it is a very price sensitive market. Most pelagics are sold in a shelf stable form though some variation of the retail channel depending on the country. Distribution is world-wide and there tends to be a lot of brokers and importers involved in the trade which makes the supply chain rather long. For the underdeveloped world, pelagics represent some of the best opportunity for fisheries’ development in the wild captured sector since the fish can be used in a variety of markets both locally and internationally.

**Structure and Organization**
The pelagic industry is not as well organized internationally as many other species; particularly in the market sector where there are such diverse markets and uses for the product. There are many local and regional organizations that represent the harvesting and trade sectors interest in the industry. Most of these are in Europe and Japan where the products have a higher value in the market than in many other areas of the world. Most of the other resource organizations noted in this study tend to be local or regional, but in the case of pelagics, the organizations, particularly amongst the Scandinavian and
European countries, are national in scope. This organization probably results from the need to represent their countries fisheries interest in the trans-boundary stock discussions. Recently, there have been meetings that have brought together much of the developed world’s pelagic industry at the North Atlantic Seafood Forum (NASF). The focus of these meetings was on the developed fisheries around the world. Another organization involved in the pelagic industry is the International Fishmeal and Oil Association. Their primary focus is on processing technology and markets for non-food uses.

The pelagic industry is an important fishery in the global seafood industry and for this reason a better understanding of the industry is needed. The pelagic industry is important for both the wild capture industry and the future of aquaculture. In the last several years a number of pelagic stocks have obtained third party certification and this trend is expected to continue since Western European markets have been willing to pay a premium for sustainable product. In addition, the use of fishmeal made from pelagics in organic aquaculture practices requires sustainability certification. At some point, third party certification will become a requirement for the market, and if the developing world’s fisheries are not able to achieve certification because they lack the ability to prove sustainability then they will be excluded from the premium markets. This will make it more difficult to find partners with the capital and experience to develop the fishery.
V. DEFINING THE STRUCTURE AND ORGANIZATION OF FISHERIES

There is not a single organization that represents all the global seafood industry, or even the top 5 commercial seafood industries. With such a diverse base of interests, no one organization has been able to emerge that can effectively represent all the global seafood industries and their diverse requirements. There are, however, hundreds of organizations, associations and alliances throughout the world that represent both very specific fisheries and a broad range of fisheries issues facing the industry today.

Fisheries generally organize by needs that are closely related to their sector. The closer the organization is to the resource, the more local and specific are the issues. Fisheries also tend to form organizations around their structure and sometimes form multiple organizations to represent specific needs within a fishery. The fishing and farming sectors tend to be represented by many smaller organizations since their issues are more local in nature. Conversely, the processing and market sectors are typically represented by larger more regional organizations. Each fishery within the resource sector can have such a diverse interest within a local or regional area that they must form small groups to represent the very specific needs of their fishery. These interests include government, NGO’s, regulators, and competing uses of the space. Resource sectors will organize very specifically around species, gear type, farming method, jurisdiction, or local geography such as an individual river.

Resource sector organizations represent local and specific fisheries and are also often supported by the harvesting and wet processing sectors. The goal of organizations at this level is to keep the fishery open and accessible. The market sector, on the other hand, is often organized by region or national area and is focused on keeping markets open. Thus, each sector within a given fishery may have unique views and goals. The resource sector, for example, has little or no incentive to see more fisheries enter the industry since each new fishery is a potential competitor that either directly competes for the resource or affects the value of the fishery’s catches. The marketing sector, on the other hand, benefits when more fisheries enter the industry since this lowers the cost of a limited product base and provides new offerings for customers that drive sales growth. Companies from the marketing sector have an incentive to expand the number of fisheries in developing nations, including both marketing and vertically integrated businesses.

There are some national and even international organizations that have been formed in the resource sector to represent interests of some of the larger worldwide fisheries. A general rule of thumb appears to be that the more vertically the industry is structured, the more it tends to organize nationally or even internationally. In contrast, the less vertical integrated a fishery the more it is represented by smaller local or regional organizations. This may be because larger vertically integrated fisheries often look at the bigger picture and are more strategic in what they expect from their industry’s organizations. They are also more market than resource oriented. Resource based organizations are very specific and
defined in mission and are narrower in scope, not less important but certainly less global. This is particularly the case in the WCF resource sector where local pressures require a very detailed and focused organization that deal not only with the strategic issues but also with the day to day tactical issues of operating within a fishery. This is possibly why it has been difficult for national organizations to represent resource sectors effectively. Membership within a national group often share competing interests which makes it very difficult for a large national group to represent all the diverse interests within a fishery. When required, local fishing organizations come together on issues they have in common which can cross different fisheries. The groups will generally form coalitions or alliances to meet specific common needs, but will quickly return to their roots once the issue has been resolved.

The processing sector also has organizations that represent their interests. These tend to be regional, national or even international in scope but more often are focused on regulatory issues and general trade. The sector also supports organizations both in the resource and market areas depending upon their interests and needs. The harvesting and wet processors tend to stick in a line closely with the resource sector organizations while the further processor tends to join organizations that represent the market. The reason for the varied alignment has to do with protecting the company’s long term investment. Harvesting and wet processing are very local in nature and are specifically tied to a resource. They invest in very specific processing technology for a local species. On the other hand, the further processor is in a much different position in that the plant equipment is very general in nature and is not dependent on a specific species, geography or jurisdiction.

Let’s look at the example of the Namibian hake fishery to illustrate these points. This is an inshore trawl fishery that will deliver the catch to a shore based wet processing plant for processing into fillets for the European block market. The wet fish processing plant would have invested considerable money into processing equipment very specific to processing hake. Most likely the core processing equipment would include: Baader 417 heading and gutting machines, Baader 197 filleting machines and Trio SDF skinning machines.

The core equipment for processing Namibian hake is neither designed nor capable of running any other species caught in the area. The Baader machinery is designed for a small whitefish and cannot run any other type of finfish or shellfish such as tuna or shrimp. Without hake coming into the plant, investment in equipment will not have a return. Consequently, the processor will most likely be a member of the Namibian Hake Association to promote resource allocation.

On the other hand, the European further processor who would likely buy the fish block of hake from the Namibian wet fish processor has processing equipment that is not species specific but rather market form specific. The further processor’s equipment line would include cutters, formers, breading and battering machines, fryers and freezer tunnels. This equipment can be used on any type of product be it IQF or block and any species whether it be hake, Alaskan pollack, tuna or shrimp. What drives the actions of the further processor is not the resource that goes through the equipment but rather what the market demands. Therefore further processors connect more to the market than the resource and
given the company’s investment in equipment and brand most likely the further processor would belong to AIPCE-CEP organization that is focused on market issues.

The market sector is organized typically in the broadest fashion. It is the least connected to the resource and is organized to meet market needs and requirements. The types of organizations serving the market sector would include general food groups such as a fishery. It would also be organized by channel such as food service, retail or industrial. Certain organizations also represent jurisdiction or areas that would be important to importers or exporters or deal with trade issues. There are more specific organizations that would deal strictly with distributors or operators or brokers. To be effective, many of these groups will form alliances on an issue by issue basis between themselves or even with their international counterparts.

Figure 45  Seafood Organizations by Sector Drivers

The Wild Capture fisheries are by far the most complex since the combinations of fisheries are numerous. Each category can have multiple divisions that can create unique fisheries due to regulation and management schemes that dictate very different rules for different types of gear or vessel. Therefore a fisherman who fishes for a particular species using a particular type of gear on a certain size vessel may be under regulations completely different than another fisherman in the same area fishing the same species but using differ gear or a different vessel size. Thus, because of management
regulations, the two fishermen may see themselves competing for the resource and will organize into different groups to defend and represent their fishing division.

Although all fisheries organizations are competitive in nature, the wild capture fisheries compete for access to resource and tend to be much less concerned about markets than the aquaculture industry. Aquaculture organizations are more focused on standards and market access. This is probably due to the nature of the two industries; the WCF industries are generally capped so access to resource is a more important issue than market access. All products in the WCF will eventually be sold in the market. The only variable is price. The aquaculture industry is the opposite situation. The farms have the capacity to outpace market needs particularly in short term bursts, so the farms tend to grow rapidly and build over capacity and then eventually the market catches up to the capacity.

In the case of the wild capture fishery, there is no cost to leave fish in the water. If the markets are poor the decision could be to not catch. By contrast, in the aquaculture industry the fish must be fed if they are left in water and feed cost can make up 65% of the production cost. Also, if the product stays in the water, it will continue to grow and can fall out of its favorable market size. Therefore, aquaculture organizations must focus more attention to market access since they are more market driven than their WCF cousins that are primarily resource driven.

The industries are generally structured around the needs of each sector. The resource sector organizations are local in scope and focus on improving the fisheries’ productivity and profitability. The market sector organizations are generally larger and more national and focus on keeping the supply chain unencumbered and the markets open. It is also clear that most of the seafood industries do not have international organizations representing them in an advocacy role, with the exception of the tuna industry. Up to this point, the seafood industries have not seen a need for this type of organization.

The problem is that sometimes one seafood industry’s most immediate issue or threat could be coming from another fishery or seafood industry as opposed to an external threat. For example, the issues affecting wild captured fisheries and aquaculture are different, diverse and at times conflicting. In addition, issues that could affect the tuna industry may conflict with issues in the pelagic or groundfish industries. Some of the biggest issues impact a fishery’s ability to function and have the potential to conflict with other fisheries. These include by-catch issues, gear type conflicts, and access to productive fishing waters. With such a diverse base of interests, no one organization has been able to emerge that can effectively represent all the global seafood industries and their diverse requirements. There are, however, hundreds of organizations, associations and alliances throughout the world that represent both very specific fisheries and a broad range of fisheries issues facing the industry today.

This situation may be changing. Sustainability issues and evolving requirements for third party certification schemes, product traceability, chain of custody tracking, social responsibility, carbon footprint reduction and life cycle analysis are forcing businesses to deal with new issues about which
they have little knowledge. These changes will drive the industries to organize internationally and eventually cause them to join forces.

Below are examples of fishery organizations and connection to the global seafood industries. The diversity of the international fishery is reflected in the types of organizations that represent these industries. These organizations represent both wild catch and aquaculture operations. There is an organization to represent every possible group which has anything to do with the international seafood industry. From harvest to consumer, there is a group, association, commission or other organization that represents every step of the seafood chain. Here is a description and partial list of the types of organizations that represent in some way the world fisheries.

**Geographic Area**

Some organizations represent the fishery activities of a specific geographical area or body of water. These geographic areas can be as small as a lake, river or bay, or as large as one of the world’s major oceans. Examples include the Northwest Atlantic Fisheries Organization (NAFO), Lake Victoria Fisheries Organization, and Mekong River Commission (MRC).

**Gear Type**

Many organizations are organized around a specific type of fishing gear. Gear Type is dictated by several factors including the species to be fished, the geography of the fisheries, the jurisdiction and even the market. Irrespective of whatever limits or parameters that establish the type of gear to be used, the gear in many cases will define a given type of fishery. These organizations range from diving fisheries to gill nets to highly automated mid-water trawl operations. Gear type and configuration, in general, is subject to regulation and specification. The length, depth and mesh size of most fishing nets is regulated. The design and number of traps and pots which can be employed is also controlled. The number of lines and hooks that can be deployed is often regulated in the troll and longline fisheries. And, fishing gear is also subject to required modifications to minimize by-catch or exclude non-commercial species such as sea turtles and dolphins. Organizations that represent specific gear types are often involved with engaging the regulatory agencies in defining gear restrictions. Examples of gear type organizations include: Washington Trollers Association which focuses on hook and line caught salmon and albacore, World Tuna Purse Seine Organization whose primary purpose is to actually limit the number of purse seine vessels operating in the tuna fisheries, and the North Pacific Longliners Association which represents large high seas longline vessels.

**Species Representation**

Many of the world’s aquatic species have organizations which are dedicated to their harvest, utilization, and preservation. Many seafood organizations target specific products. One of the most important characteristics of a fishery is the species that will be fished or cultivated. Today, more and more fisheries are based on target fishing and therefore the fisheries are organized and recognized by species. The Northern cod fisheries, the Gulf of Mexico shrimp fisheries and the South African hake fisheries are
examples of targeted fisheries. Organizations are often formed around the species. The Catfish Farmers of America is an example of an organization that focuses on single species. However, Salmon of the Americas is an organization of salmon producing companies which promotes several species of salmon.

**Vessel Type Organizations**

The industries of the wild fisheries have many types of vessels which are used to harvest the resource. Some of these vessel owners have formed organizations to represent their specific design or function. Clearly the vessel type is integrally related to gear and species. But often vessel type stands alone as a category even if they engage several different resources. The American Factory Trawlers Association, for example, represents a special type of combination vessel which functions as both a fishing vessel and a processing vessel. Another vessel organization, the Pelagic Freezer-Trawler Association, represents several European companies that operate pelagic freezer vessels internationally.

**Wild Seafood Organizations**

In an effort to differentiate themselves from farmed seafood, some organizations have the specific function to promote the wild product. Many of these organizations are marketing oriented and often tout the advantages of wild v. farmed product of the same species. “Wild” is often promoted as synonymous with “Natural”. Some wild seafood proponents are anti-aquaculture, especially where the farmed product competes directly with the wild harvest or the farming methods are perceived as detrimental to the environment.

The battle between farmed and wild salmon illustrates some of these issues. There is a clear effort by some anti-farmed salmon groups to educate the public about the environmental and health problems they claim are associated with farmed salmon. The Rainforest Alliance and SalmonNation, for example, have specific agendas to discredit salmon farming.

Another front on the battle between wild and farmed seafood is found in shrimp marketing. As with salmon, farmed shrimp compete directly with wild shrimp and the farming methods are perceived by some as harmful to local populations and the environment. Wild American Shrimp is an organization that promotes wild caught shrimp. Their web site features a video which focuses on the economic hardship suffered by the American shrimp industry as a result of lower priced imports. They also make a culinary argument in favor of wild caught product.

**Farmed Seafood Organizations**

Several organizations exist to promote the advantages of farmed or aquacultured product. Indeed, there seems to be many advantages of farmed seafood. Consistent supply, stable pricing, selective sizing, quality control and controllable production are some of these advantages. Organizations that support farmed seafood include Salmon of the Americas, Salmonchili, Catfish farmers of America, and the BC Shellfish Growers Association. The farmed seafood organizations do not generally try to discredit
their wild counterparts, but they do present a positive image of aquaculture and emphasize the marketing advantages noted above.

Processing Organizations

The seafood processing sector is well represented by numerous organizations. Every stage of seafood processing is represented in various degrees by these organizations. Processing organizations are often geographically based, but there are also organizations that are process or technology oriented. The Uganda Fish Processors and Exporters Association, for example, functions as an umbrella group to represent the country’s fish processing industry. The West Coast Seafood Processors Association exists to serve the needs of shore-based processors on the west coast of the U.S. The At-Sea Processors Association represents about 60 companies that process on-board in the north pacific.

Product Marketing Organizations

There are also a number of seafood organizations that have been formed for specific marketing and research purposes. These types of organizations are often partnerships between government and private industry and work regionally or nationally. They include NGO’s, and private industry or universities depending on the mission for the research and development work. The organizations can be very broad in scope but very specific in nature. An example of such an organization would be the Alaska Fishery Development Foundation. Marketing organizations are often closely aligned with species, gear type or geographic area organizations. Other marketing organizations function in a broader capacity and promote many types of product. The Alaska Seafood Marketing Association, for example, promotes all Alaska seafood regardless of gear type, species or area within Alaska. Marketing organizations can be state funded, industry funded or a combination of both state and industry contributions. Two common methods of supporting funding for marketing organizations from private industry are fees assessed for unit of product sold, and membership dues based on total company sales. Some marketing organizations can control production in order to influence market pricing. The Thai Shrimp Association is an example of such an organization. Due to global recession, this organization has cut national shrimp production in order to stabilize prices and harmonize farmers’ incomes.

Seafood Worker Organizations

These groups represent vessel crew members and seafood plant workers. Vessel worker organizations are often concerned with safety and training of crew members. Seafood plant worker organizations are concerned with working conditions, ergonomic issues, and automation of processing operations. The extent of influence of these organizations is highly variable among countries and industries. One international non-governmental organization is the International Collection in Support of Fishworkers deals with issues that concern fish workers worldwide.
Supplier Organizations

Commercial fishing suppliers and fish farm suppliers also have organizations to promote their goods and services to these industries. Supplier organizations to the capture fisheries offer vessels, fishing gear, refrigeration equipment and marine electronics. The International Ship Suppliers Association represents 1800 ship suppliers in 81 countries and publishes a catalog listing more than 38,000 ship related items. Supplier organizations in the aquaculture industry such as the Aquaculture Suppliers Association have members that offer equipment, feeds, fingerlings, and consulting services.

National Trade Organizations

National trade organizations attempt to represent all seafood interests in their respective countries. As documented in this report, national seafood groups are often in competition. This makes the task of general seafood industry representation very difficult. The National Fisheries Institute in the U.S. is an example of organizations whose members include fishermen, processors, aquaculturists, restaurants, retailers, suppliers, consultants and marketing companies.

Regional Fishery Management Organizations

Many fishery resources are migratory in nature and can move from one jurisdiction to another. Without treaties it would be impossible to manage these stocks. Regional Fishery Management Organizations (RFMO) are quasi-governmental organizations assembled for the purpose of managing trans-boundary fisheries. In other cases, regional nations that have an interest in a particular stock have organized to manage trans-boundary stocks such as herring. But these efforts are only at a very high level of jurisdiction. Within each nation and within each type of fishery, a myriad of regulations exist that dictate how the fishery is managed. Examples include the International Pacific Halibut Commission, Indian Ocean Fishery Commission, and the North East Atlantic Fisheries Commission. There are more than twenty regional fisheries management organizations. Exclusive Economic Zones under the jurisdiction of coastal countries only covers about 40% of the world’s oceans. Most of the remaining 60% is managed by the Regional Fishery Management Organizations. This management mandate includes the conservation of non-target species and seabirds and is founded in the 1995 United Nations Straddling Fish Stock Agreement.

Tribal and Aboriginal Organizations

Many legal issues have arisen with respect to access to fishery resources by native groups. Tribal groups in the U.S. and much of the British Commonwealth have formed organizations to represent their traditional and historical fishing activities. The Northwest Indian Fisheries Commission represents treaty tribes in Western Washington State. Other groups include The Great Lakes Indian Fish & Wildlife Commission, The Aboriginal Aquaculture Association in British Columbia, Canada, and the Columbia River Inter-Tribal Fish Commission in Washington State.
Research, Data Collection and Informational Organizations

There are also a number of seafood organizations that have been formed for specific marketing and research purposes. These types of organizations are often partnerships between government and private industry and work regionally or nationally. They include NGO’s, and private industry or universities depending on the mission for the research and development work. The organizations can be very broad in scope but very specific in nature. An example of such an organization would be the Alaska Fishery Development Foundation.

Some organizations related to the global seafood industries are non-advocacy and are dedicated to research into specific areas. Research organizations exist for many species, gear types, and geographical areas. The International Council for the Exploration of the Sea (ICES) is one of the oldest such organizations. ICES, based in Denmark, is a network of scientists and institutes from 20 member countries bordering the North Atlantic. They issue non-political scientific management advice to governments and fishery management bodies. The World Aquaculture Society is an international non-profit organization formed to facilitate the exchange of information among the global aquaculture community. The Gulf and Caribbean Fisheries Institute is also a non-profit organization that facilitates information exchange on the management of marine resources in the Gulf of Mexico and the Caribbean Sea. The WorldFish Center focuses on developing countries and conducts global research on management and conservation issues of aquatic resources.

Habitat Preservation and Restoration Organizations

Many non-regulatory organizations exist to conserve and restore marine and aquatic habitats. Examples include Conservation International, National coalition for Marine Conservation, and National Fish Habitat Initiative.

Non-Governmental Organizations (NGO’s)

There are dozens of NGO’s related to the seafood industry. Many are represented in the other categories described in this report. Some of these organizations are focused on environmental issues related to fishery resources, fishing methods, and the impact of aquaculture operations on local populations and the environment. Perhaps the most well known in this category include Greenpeace, PETA (People for the Ethical Treatment of Animals), The Environmental Defense Fund, The Monterey Bay Aquarium, and the Food and Water Watch. Most of these organizations have mandates broader than just seafood, and some employ dramatic public displays to gain recognition of their causes. Another characteristic of the environmentally oriented seafood NGO’s is the publication of seafood rating systems. These rating systems usually include some means of indicating which seafood species are OK to consume on a continuum to those which should be avoided.

While the environmentally oriented seafood NGO’s are the most well known, there are hundreds of NGO’s dedicated to enhancing the various sectors of the seafood industry. NGO’s exist to promote resources, processing, marketing, and cultivation of marine resources. The International Coalition of
Fishery Associations (ICFA), for example, is made up of national fishery trade groups of several major fishing nations of the world. Their goal is to maintain the world’s oceans as a major source of food fish.

**Governmental Organizations**

There are literally thousands of governmental and quasi-governmental organizations that represent the world fisheries. These organizations operate at every level of government in every country that has any type of fishery resource. These governmental organizations perform a wide variety of functions including regulatory functions, enforcement, research, training, and technology transfers. Like most government agencies, commissions, and organizations, their function is dependent on the level of funding they receive and the political environment. For this reason, government programs often have shifting priorities and changing mandates.

**Standards Organizations**

Another type of organization that has been forming in the fisheries over the past ten years is standards organizations and third party certifiers. Although these organizations do not qualify as industry organizations, they are somewhat of an alliance to the fisheries bridging the environmental, labor and food safety issues that are need to be verified for certain markets. Certification schemes exist for both the wild capture fisheries and aquaculture species and are primarily driven by the retail seafood sector. Retailers, especially in Europe and North America, are increasingly insisting that the seafood they purchase comes from sustainable sources, is produced in an environmentally friendly manner, and complies with various social accountability factors such as good working conditions, minimum wage laws and child labor laws.

The certification systems consist of two primary components: The Standards and the Certifiers. The standards are written by various organizations and the certifications are carried out by organizations independent of the organizations that create the standards. This dichotomy of functions is inherent in avoiding conflict of interest issues and in some cases adhering to international (ISO) standards. For example, the World Wildlife Fund and industry formed the Marine Stewardship Council and using a science base approach developed standards for capture fisheries and these standards are applied by independent certification bodies to individual fisheries that desire certification. The program is administered by the Marine Stewardship Council who licenses the eco-label associated with certification. A similar situation exists for the aquaculture industry. Standards written by the Global Aquaculture Alliance are applied by independent certification bodies and the program and logo licensing is administered by the Aquaculture Certification Council. Another organization, the International Fishmeal and Fish Oil Organization (IFFO) has also developed standards which are evaluated by third party certifiers.
VI. FISHERY DEVELOPMENT PATHWAYS

The seafood industry is complex. Every day on this planet hundreds of aquatic species are harvested and processed for human consumption. Wild caught and farmed species are processed into thousands of product forms, each with its unique market position. Often small variations in a product’s characteristic will define the form or grade, and consequently determine its value in the market place. Typical of these product characteristics are size, color, shape, texture, taste and smell. Control and monitoring of these variables can be a challenge when sourcing and processing seafood products in developing countries.

In addition to the intrinsic product factors, there are process factors that need to be controlled. Weights, glaze, cooking, freezing, candling, deboning, foreign object exclusion, packaging, additives, and pathogen control are all examples of processes that somehow must be monitored. Perhaps because of its complexity, the seafood industry has been known to invite devious practices. Some examples include mislabeling species, soaking products to increase weights, over-glazing, including glaze in net weights, and underweight packaging. Processors and packers in developing countries have been known to do some of these unethical practices which complicate sourcing and processing in under-developed countries.

Other than selling the service of processing, creating wealth means selling a seafood product. There are several scenarios to create wealth from wild seafood resources. Each has advantages and disadvantages depending on the type of resource. First is to sell the rights to harvest national fisheries resources to foreign fishing fleets. Revenue is generated by charging rent for the privilege of harvesting. But the resource once harvested belongs to the country vessel of harvest. The second scenario is a joint venture where foreign fleets harvest the resource and deliver to processing plants in country. A third concept is for the owning country to grant harvest rights to nationals through some management scheme. The harvesters sell the resource to third party countries for processing. A fourth possibility is for nationals to harvest the resource and deliver to in country processing plants for primary processing. A final concept is for in country processors to develop and market further processed products. All of these schemes have been tried for various wild caught fisheries with mixed results.

Creating wealth through aquaculture operations takes on many forms. In its classic form industrial aquaculture has been promoted by international development groups and financial institutions in coastal poor countries as a way to obtain foreign exchange earnings, and promote development. In general, it is assumed that export-oriented aquaculture facilitates economic growth, which in turn is associated with poverty reduction. However, some believe that export oriented aquaculture, as opposed to production directed to feed the local population, has had detrimental effects for the livelihoods of local population and the environment.

Notwithstanding the industrial farming controversy, many aquaculture systems still engage small farmers who deliver product to processing plants. Eventually this model will evolve into a similar scenario practiced by the poultry industry in the USA. The US poultry industry controls and contracts
with individual farmers to produce chickens for their processing plants. The processing plant dictates how and what the animals will be fed, how many animals are needed, the conditions under which they are raised, and the size and timing at which they will be harvested. In addition, the processing plant dictates which genetic strain the farms will produce. Thus the farmers will become an integral part of the production and processing chain.

The underlying base element to developing wealth from fisheries, wild or farmed, is to have a marketable product. It makes no sense to farm a species or pull fish from the sea, however abundant, that does not have an established market. In fact, the market must be expanding to allow for the lag time in getting a developing fishery off the ground. Many aquaculture projects have failed because demand had to be created for the product. Creating a market for an unknown species is not a good business model. It takes one to three years just to get product to a marketable size so significant capital is tied-up in just growing the product. In order to expand operations to reach critical economic mass, an income stream needs to be generated as quickly as possible. The success of tilapia and pangasius are good examples. Ten years ago tilapia was not well known in the industrialized markets, but there was a well-established market for white fish (aka groundfish). Tilapia fit perfectly in this category. The same applies to pangasius which is still evolving into the white fish markets. Farmed species that have declining wild counterparts are also good candidates if pricing is competitive and they meet other criteria. Farmed salmon is an example where existing wild fish markets were supplemented by farmed product. Shrimp is another example of farmed product plugging into existing markets and driving down prices of wild product resulting in increased consumption.

In addition to marketability, there are some other desirable characteristics in the choice of a species to harvest or farm. The specie should give a good processing yield into its marketable form, and the by-products should be convertible into other industrial products. This facilitates maximum sustainable utilization of the resource. Farmed species should exhibit a good feed conversion ratio. Wild caught species should lend themselves to efficient, environmentally friendly, harvesting methods. The specie should also be adaptable to mechanized processing since labor will become an important economic issue, even in developing countries.

Another key element to the development of fisheries is a stable government. Political stability is an important element in developing fisheries or aquaculture operations in underdeveloped countries. No matter how well organized aquaculture and fishery sectors are, political events can change the dynamics. Political instability affects investor confidence which can stifle existing production and lead to trade sanctions. Many countries have political and economic systems that are not conducive to rewarding good performance so motivation is lacking among the work force. Without political stability it is difficult, if not impossible, to implement and enforce fishery and aquaculture policies that will enhance industry development. A lack of governance can lead to corruption and over-exploitation of a resource. National fishery and aquaculture policies are also needed to prevent environmental damage and address the issues facing small-scale wild fishers and traditional subsistence harvesters. In addition to formulating and implementing policies, the government must be willing to dedicate the necessary resources to enforce those policies. Just monitoring and managing the capture fisheries can require
significant resources spread over huge water areas. Finally, many fishery issues, IUU (Illegal Unreported and Underreported) for example, require international cooperation which is not always possible with a dysfunctional government.

Science is the key for developing countries to manage their wild stocks and to advance aquaculture operations. Technical expertise is an important variable for efficient harvesting, grow-out and processing operations. Unfortunately, many countries lack the technical resources needed to perform these functions. In many countries weak data bases of natural fishery resources inhibit the accurate assessment of stocks. Without accurate stock assessments management plans cannot control the utilization of the resource. Other more detailed science issues that are deficient include expertise in breeding, seasonal migrations, and life histories of major commercial species. In addition, poor working conditions in many developing countries make it difficult to attract fishery professionals and scientists. This leads to poor fishery research and a lack of extension services to assist local farmers and processors.

Without a sustainable resource or sustainable aquaculture methods, a fishery cannot be successful in the long run. Short term gains can be made, but serious investors will not commit to funding unsustainable resources or farming methods. Sustainability implies control of the wild resource or management of aquaculture systems. These issues are complex and often require international cooperation. Clearly though, sustainability is more than just managing harvest levels or following good aquaculture practices. Environmental stewardship is a key element which can contribute or detract from developing countries’ ability to create wealth from aquaculture operations and capture fisheries, and in maintaining sustainability. Run off from deforestation and uncontrolled use of agriculture chemicals, for example, can change the ecology of rivers, lakes and coastal areas. An increase in toxic algae blooms in coastal areas is a symptom of this activity. Water quality can also be seriously degraded by discharging untreated domestic sewage and industrial effluents into the waterways. The development of hydro-power and irrigation projects alters natural river flows which can affect marine habitats. Biodiversity can be seriously diminished or changed by the introduction of non-native species. Many of these environment-altering activities can be noted in developing countries.

A trend in consuming markets is to require seafood producers to adhere to various standards for sustainability, quality, food safety, manufacturing practices, and social accountability. This is primarily being driven by major retailers in the consuming countries. Many developing countries lack national standards which address these issues so the markets are requiring third party certification. There are numerous third party certification schemes. Some address specific issues and others are broader in scope. The Marine Stewardship Council, for example, only addresses the issue of wild fish sustainability. The Global Aquaculture Alliance’s Best Aquaculture Practices, on the other hand, has a strong food safety component as well as feed mill, hatchery, farm, and processing plant standards. Included in the standards is a social accountability component. Social accountability generally includes standards for employee facilities, adherence to national labor laws, and employee safety and training. This trend toward third party certifications is likely to continue and will encompass more and more aspects of the seafood supply chain from harvest to consumer.
A final brick in the path to fishery development and creating wealth is infrastructure. For a fishery to be competitive in the world markets it must have the infrastructure to support its activities. If wild fish operations are not contained offshore then infrastructure plays an important role in fishery development. Aquaculture development also requires good infrastructure to move product efficiently from farm to processing and from processing to market. This issue is of particular concern in developing countries. In many countries there is geographical isolation between the harvesting sector and the markets. Transportation of product from farm or dock to trans-shipment points can be an impediment to development. If the market is local, then there needs to be good connections to the major population centers. In many countries there is a lack of ice plants and cold storage facilities in fishing villages and in proximity to prime aquaculture sites. Trained labor for processing operations is also a concern in many areas. Many capture fisheries are seasonal so there are gluts of fish that need to be processed in a short time frame. Modern fish processing plants which can handle the gluts of fish are lacking in many countries.

Two other infrastructure issues have been noted in the literature which could affect aquaculture operations in developing countries. The first is the availability and affordability of crop insurance. Small farmers often do not have the production records and other data required to qualify for crop insurance. The second is the lack of availability to information technology systems. This deficiency makes it difficult for farms and processors to respond to market requirements.

Fishery Development Foundation and Prerequisites

The following pages of this report summarize case studies in fishery development. Two cases are aquaculture related and two represent wild fisheries, one from fresh water and one from the high seas. These case studies represent successful ventures, failures, and projects that are to date unresolved. The success or failure illustrated by these cases can be directly related to the issues previously discussed regarding the basic foundation and prerequisites needed to successfully develop a fishery.

Summary: Honduras Tilapia Fisheries Case Study

The example of the tilapia industry in the mountainous regions of Honduras illustrates how an underdeveloped nation has used its natural and human resources to create a successful fishery. The example is that of a private company named Aquafinca, a subsidiary of Regal Springs. Regal Springs had already been successful in establishing a viable business model in Central Java, Indonesia in the early 1990’s and understood not only the economics of how to raise a good quality tilapia, but also how to work in an underdeveloped nation’s environment. The company also had learned from their previous experience that to be successful in underdeveloped countries, one must have the support of the local people.

Although Honduras has a track record of developing a successful shrimp farming industry in its coastal regions, there had not been any introduction of new industries in the inland waterways found in the
mountain regions. The mountain regions are home to populations that suffer from poverty and who would greatly benefit from industry that would bring jobs and opportunity to the local residents.

Commercial production of tilapia requires a much different environment than shrimp farming. The ideal conditions for raising tilapia would include fresh-water that is warm and fast moving. The inland mountain regions of Honduras are very well suited for tilapia production because there is an abundance of warm fresh-water that runs down the mountains as it flows in and out of lakes and down rivers.

In addition to having this desirable geography, there are other factors that must be in place in order to have a successful tilapia farming venture. The following are five important elements required to make a sustainable business work in commercially raising tilapia:

1. There must be a willing private investor who brings together the knowledge and expertise of tilapia aquaculture.
2. There must be a willing government prepared to help the investor build a sustainable business by providing well-conceived science based regulations, adequate infrastructure, and property rights provisions.
3. There must be the appropriate natural resources and environment to support the needs of the tilapia industry.
4. There must be a local population that is supportive and motivated to have the industry in the region.
5. The business must produce a quality product that is desired by the market.

As previously mentioned, Regal Springs had already been successfully involved in commercial tilapia production in Indonesia. Its success had been so great that it needed to expand its production capacity. Rather than expanding operations in Indonesia, the company decided it would be more secure for the business to have a new location outside of Indonesia for setting up a second operation. This new location would provide a safety net in case problems developed in the original location. In underdeveloped nations, there is always a risk that political or socio-economic issues could arise that would have a negative impact on the business.

After searching the equatorial zone for the types of waterways and environments necessary to sustain the quality of the tilapia and the growth of operations needed, Regal Springs decided to approach the Honduran government to propose building an operation in central Honduras. As part of its proposal, the company emphasized that it would bring the requisite “know-how”, access to the markets, and capital needed to implement and complete the project.

The Honduran government’s response to the proposal was very positive. Since they had seen the success of the farmed shrimp industry in the coastal regions of Honduras, they also saw great potential benefit to building additional aquaculture industry in other parts of the country where the local economies were in need of stimulation. The government saw expansion of their aquaculture industry as a means of economic growth, and was therefore, very receptive to the company’s proposal.
However, the government had also learned about the problems that could occur in an aquaculture business. The rapid growth of the farmed shrimp industry in Honduras had led to the development of diseases within the shrimp stocks and eventually led to an economic collapse of this industry. Fortunately, with time many in the industry recovered, but the government had learned the hard way that in order to maintain a successful aquaculture environment, the industry would have to be regulated to prevent runaway growth and promote sustainability of the resource. The government implemented very conservative license controls and other management schemes that limited the allowable production methods and controlled the production volume, all in the interest of creating a healthy industry.

In the case of Honduras and Aquafinca, these management controls in combination with a responsible commercial partner have created sustainable and successful fisheries that export a considerable amount of product to western markets, while providing good long-term jobs and building the local economies. Regal Springs had learned in Indonesia that the support of the local population was critical, and it undertook an exceptional commitment to the local people that exceeded the norm found in modern business practices. Some examples of community programs that are supported by Aquafinca in the Honduran region where they operate are as follows:

- Aquafinca has entered into partnership with two of the Honduran municipalities in which they operate to finance a wide range of specific projects to benefit the region. Such projects include building schools and road infrastructure, and purchasing necessary equipment.

- Lack of education is a major handicap for many Hondurans. The average education level in Honduras is estimated to be the equivalent of fourth grade of elementary school. Aquafinca has joined a coalition with several other business entities to help improve the level of education of the local population. One of the programs is called Educatodos, which is an adult education program targeted at both Aquafinca’s employees and also non-employees who are willing to pursue a diploma. Aquafinca’s role is to build classrooms, and to contribute the funds for paying some of the teacher’s salaries.

- Aquafinca considers one of their most successful programs established in 1999 to be Fish for Trees, which is a program that allows the local communities to be involved in the raising and selling of fish to the local markets. The profits generated by selling this fish are used to invest in projects that support and protect the region’s watershed. Aquafinca has donated production assets such as fish cages and fingerlings, and has also provided technical support required for growing tilapia in these cages. The profits earned by the participating communities are managed by a committee made up of a representative of the communities, the local electric company responsible for managing the watershed, and a representative of Aquafinca. Several successful projects have already been developed through the use of these funds including reforestation and drinking water purification projects.
The concept of larger companies supporting the growth of small local fisheries is not new. If one examined the past history of many of the remote fisheries that developed in the early to mid-twentieth century one would find this to be a common pattern. It was typically done all over the industrialized world, not only with the fish industry, but also in any industry where a natural resource was being exploited. This system was very useful in integrating the local populations and gaining their support. In the early stages of development of a natural resource industry, it was also quite common, and in many cases absolutely necessary, for the large companies to not only aid the set-up of small local businesses but also to establish the infrastructure necessary for the businesses to be able to operate. These small natural resource businesses eventually grew and were referred to as “company towns.” Many of the so called “company towns” eventually transitioned into small local independent governments as the industries grew and the towns expanded their businesses.

In order for a private investor to take on the risk of establishing a tilapia aquaculture enterprise in an under-developed nation, they must have a very long-term view along with the necessary capital be able to finance this type of long-term plan. The investor needs to have assurances that there is a solid and favorable opportunity to make a profit and that there is a stable local and national government in place that will assist in protecting their long-term investment.

In this case, Aquafinca was set up by Regal Springs as the operating company, and was able to bring in outside experienced management who could teach the technology and know-how to the local indigenous population. Operations began small and the financing was provided by Regal Springs. There were also some financial incentives offered by the national government.

The government stayed closely involved, but did not create an overly burdensome bureaucratic system. The government was interested in being able to have oversight of the growth but was sensitive to not creating requirements that might hamper the company’s development.

Year after year Aquafinca’s operations grew and the local economy grew alongside it, since the company’s continued growth was a boost to the other local businesses that provided goods and services to Aquafinca. The local population benefited economically through both direct employment, support services provided, and through the education and training offered by the company. As Aquafinca added more employees, it also required different levels of management. These management jobs were filled by the local people who had performed well in their jobs and were in a position to move up the ladder. Of course, higher level jobs provided higher wages.

Wages paid have remained competitive with the industry although they have increased over time. Fortunately, the value of the product has also increased and as Aquafinca gains improvements in efficiency through a more experienced and trained workforce, cost reductions are realized. Overall, the operations have been able to stay profitable.

Today, Regal Springs employs over 5,000 employees world-wide producing in Northwest Honduras, Indonesia and Mexico. Aquafinca, their Honduran tilapia enterprise, is no longer a startup operation,
but is now a highly developed tilapia farming venture. The factors that have made it a success are quite clear:

1. The product was very desired by the market and the company was able to maintain a high quality product.
2. The private investor, Regal Springs, was a partner who had the tilapia farm know-how, the knowledge of the markets, and the financial resources to withstand waiting the long-term period required for growth.
3. The government was cooperative and stable, and regulated the fishery using scientific management principles.
4. The local population was cooperative and supported the growth.
5. There was competitive cost structure in place that allowed Aquafinca to invest in the training of its personnel and to set up some of the smaller aquaculture organizations.

This company, Regal Springs, had the experience and capacity to make sure that all the levels of required business development were in place. Where the government was lacking, the company filled in the blanks. Ultimately, the company developed a sustainable and economically viable project. Their success can be attributed in a large part to their experience in developing tilapia operations in other developing countries. Investors take note. The experience and track record the company pursuing the development is a critical factor in determining the outcome of the project.

**Summary: Tanzania Fisheries Case Study**

The second case study is also an aquaculture project that was approved by the government but ultimately rejected by the local population. The project proposed was a massive shrimp farm in an environmentally sensitive area of the Rufiji Delta in Tanzania. After a number of studies on the economic and environmental impact of the project, the general conclusion was that the project was flawed and should not be approved. In spite of this the project was approved by the Tanzanian cabinet. Ultimately opposition by local villagers and environmentalists killed the project. In this case there was a somewhat stable government but it was corrupt. In addition, the project did not have the support of the local population.

The case of the Rufiji Delta in Tanzania provides an example of the wrong way to attempt development of an industrial shrimp farming business in an under-developed nation. Although the project was ill-conceived and was met with a mixture of tremendous opposition and over-zealous greed, the example is illustrative of the problems faced by under-developed countries in trying to establish new aquaculture industry in environmentally sensitive areas where the local population is also dependent on the land desired for development. The information in this summary is based on a study by the “Lawyers’ Environmental Action Team” (LEAT), produced in 2010.
The story begins in 1996 when Reginald John Nolan, owner of the African Fishing Company (AFC), applied for the rights to around 10,000 hectares in the Rufiji River Delta for the development of an industrial shrimp farming operation.

The Rufiji River Delta is located in Southern Tanzania, about 150 km south of Dar es Salaam. The Delta contains one of the largest mangrove forests in East Africa, and produces over 80% of all wild-shrimp landings in the country. The Delta’s population is over 40,000 and the residents are small farmers and fishermen who depend on the fertile grounds of the Delta for their livelihood.

Many under-developed countries have economically benefited from building a shrimp farming industry due to the great export market available and high dollar value of the product. Tanzania was eager to participate in this industry and welcomed the opportunity to work with AFC.

AFC had done an Environmental Impact Assessment (EIA) of their proposed project, which claimed they had procured adequate financing for the project through the European Investment Bank (EIB) and European Development Fund (EDF). The EIA report also included various projections regarding the social and economic benefits that would result from the project and also raised the negative environmental issues that would result such as clearing of mangrove areas, pollution from wastewater run-off, and contamination of fresh water and agricultural land from infiltration of seawater, etc. However, the EIA also outlined the measures that would be taken to mitigate the negative effects of the project to the environment.

The EIA report was criticized as being misleading and inaccurate by AFC’s own consultants, which sparked great controversy within government circles. Therefore, the government assigned the National Environment Management Council (NEMC) to bring in a team of experts to review the details of the EIA report and to submit recommendations to the government.

The NEMC reported back that the EIA report was fraught with misrepresentations and disputed the conclusions drawn by AFC representatives. The NEMC discovered among other things that the AFC did not have approved funding in place for the project as they had claimed. The NEMC also found that the EIA report’s research methods were insufficient, and that the projections were highly inaccurate.

In July of 1997 the NEMC recommended that the project be rejected as it would be devastating to the environment and the Delta population, and that it would work contrary to existing laws set out for proper conservation of the land and marine areas. There was a long list of other reasons provided by the NEMC for rejection of the project along with recommendations to the government of what actions should be taken before undertaking any commercial shrimp farming operations. Some of those recommendations were as follows:

- Commercial shrimp farming should not be permitted until the Fisheries Department sets out regulations for the industry.
- Shrimp farming activities should not take place in ecologically sensitive areas.
• Before any project for commercial shrimp farming should be approved, the laws and policies in place must be harmonized with the objectives of the project. If any legislative amendments are required to accomplish that task, these amendments should be made before allowing any project to proceed.

In spite of the NEMC’s recommendations and the objections of many other Tanzanian agencies such as the Ministry of Agriculture, the Tanzanian Cabinet approved the project in November of 1997. This decision, once made public, was met with disbelief and amazement. Why would the government choose to ignore the findings of the NEMC?

Part of the answer to that question seems to be that there was a past history between Mr. Nolan and the Tanzanian government. Since the 1980’s, Nolan had been involved in a series of failed projects; as a supplier of military equipment to the Ministry of Defense, then later in the 1990’s in a deal to build a thermal power plant, and also in a different deal to sell military radar equipment to the Ministry of Defense. The deal to build a shrimp farm operation was just another in a long list of money raising schemes he entered into with the Tanzanian government. The mutually self-serving relationship Mr. Nolan had with the government paved the way for acceptance of this project by high ranking officials, even in spite of strong advice to the government to do the contrary from the government’s own experts.

The controversy continued after the government’s decision to go forward. Tanzanian environmentalists and Rufiji Delta villagers led the charge. The villagers petitioned the Tanzanian High Court to challenge the government’s approval of the AFC project. All of this resistance to the shrimp farm project was damaging and costly to AFC. Apparently, AFC had accumulated such high debt as a result of delays and resistance to implementation of the project, that it was forced into liquidation by August of 2001. Due to this turn of events, the project was halted.

**Summary: Namibia Fisheries Case Study**

The third case study represents how a country can take control of an over-exploited fishery resource and develop a domestic industry. The country is Namibia and the resource is hake. This is basically an economic study but it also illustrates how a country can rebuild a depleted resource. The government in this case provided the foundation and prerequisites necessary to create a sustainable fishery. However, the results of the case indicate that the industry may not have the resources to expand and improve due to excessive high rents imposed by the government. The title of this 2003 cast study is: “Rent Capture in the Namibian Fisheries: The Case of Hake.” This study was done by Andreas P. Ithindi of the Ministry of Fisheries and Marine Resources of Namibia.

This study covers the twelve year period from 1990 to 2002. The background of this study is that prior to Namibian independence in March of 1990, there was no attempt to manage the nation’s fisheries. There were no restrictions on who could fish and where to fish and the fisheries were as a result grossly over-exploited. The hake fishery was the subject of this study, because it is the most important
commercial fishery in Namibia. Hake landings, according to the Ministry of Fisheries and Marine Resources (MFMR) data for 2002, comprised more than 50% of the value of all fish products landed.

After 1990, the new government of Namibia recognized the need to implement a management system to restore and grow their marine resources. They enforced the Exclusive Economic Zone (EEZ) under the United Nations Law of the Sea of 1982, which allowed them to reduce the number of foreign vessels fishing within the 200 mile from shore limit. Other management techniques employed included: license fees paid by active fishing vessels, observer fees paid by active fishing vessels, by-catch fees charged to quota and license holders, marine resources fund levies on quota and license holders, and quota fees paid by those who held quota rights.

The purpose of these fees was to cover the costs of fisheries management, and to help promote the policies of the Namibian government in regard to fisheries development. Specific policies of the government were to have more Namibians participate in the fishing industry as owner operators and to create more employment opportunities for Namibians. For example, Namibian nationals in general paid lower fees than foreign parties and fish that went to on-shore wet processing operations paid lower fees than fish that was frozen-at-sea since wet processing operations produced additional jobs on land.

A key question addressed by the study was whether or not the Namibian hake fishery was able to sustain positive “economic rents” within this new managed fishery environment and if the concept of “rent capture” allowed the individual hake companies to experience positive economic results from their operations.

To use the terminology of the study, the “economic rent” is defined as Total Revenue (TR) less Total Cost (TC), where cost includes a normal profit that each hake fishery company would be entitled to earn. Total Cost also includes all of the fees paid for fisheries management. Such excess “rent” could either be available as additional profit to the hake companies, or it could be “captured” in whole or in part by the government in exchange for the use of the fishing grounds. The rational for the so called “capture” is that according to rights under the EEZ, the fishery grounds are considered to be owned by the coastal nation, who in turn may give certain property rights to the fishermen to allow them to harvest the fish. This portion of excess “rent” taken by the government is what the study’s author refers to as “rent capture.” Basically the Namibian government sees the “rent capture” as a fee paid in exchange for property rights granted.

Namibia adopted a method of “rent capture” using a formula based upon the landed value of the fish times the individual’s quota allocation. There is also a factor added related to vessel category (Namibian or foreign based/flagged). These factors are applied to values of fish landed with no consideration given to the fisherman’s actual cost or true profitability.

The information in this study indicated that fisheries management techniques were successful in restoring health to the hake fishery and achieving government policies:

- Total hake landings increased over the study period from 58,000 tons to 171,000 tons and were just below the TACs established.
• Namibian vessels actively fishing increased significantly while foreign fishing vessels dropped.

The economic results were more mixed. The economic data was limited to data from 2002, because prior to that time, fishing and processing operational data was not separated. Also, there are many inconsistencies in the numbers due to different record keeping methods used by differently sized companies and vertically integrated companies. However, in spite of the many inconsistencies and difficulties with the numbers, the study was able to conclude that overall, it would appear that the fishery management techniques employed have resulted in improved economic performance for the hake fishery, before taking into consideration the results of the “rent capture.”

The problem with the economic results that can be seen by analyzing the available data is that after deducting the “rent capture,” the fishery had negative financial results. It would appear that the “rent capture” was a larger burden than the fishery could handle. In fact, many operators in Namibia are unable to stay current with the “rent capture” payments according to the study.

The study seems to conclude that any system of fees and levies that isn’t based on a sound understanding of the other costs the company must incur may result in overburdening the company and may actually erode the profits the company is entitled to retain. It would seem that in the case of the Namibian hake fishery, the government might want to do more economic analysis and may want to base the property rights fees on some sort of net profit method.

Also the study notes that the “rent” earned by any given company is normally the amount they are able to reinvest in the fishery or invest in other types of capital projects and expansions. If all of these excess funds are taken by “rent capture”, the companies may not be able to prosper and grow.

Summary: Lake Victoria Perch Fisheries Case Study

The final case study is concerning a fishery that has many elements and represents the complexities of managing a multinational resource. This case is a study of the Lake Victoria perch fishery. Essentially the development of this fishery is an economic success but an environmental disaster. Unfortunately, the sustainability of the resource is now in question. The elements of this case include government instability, unsustainable harvesting practices, destruction of biodiversity, and proximate agriculture operations polluting the lake. While the Lake Victoria perch harvest has increased greatly over the years, recent reductions in catches have resulted in closing many processing plants. It remains to be seen if the building blocks to a successful fishery can be restored.

There are many aspects to the situation in Lake Victoria, so in order to present a succinct summary; the focus will be on three major inter-related areas: the historical and current status of the Nile perch fishery of Lake Victoria, the ecological environment of Lake Victoria, and the social impact of these issues on the local populations. The information for this summary is based on three different studies; A Lake Victoria fishery study written in 1996 by Marcela Rabi, “Rents and rents Drain in the Lake Victoria Nile Perch Fishery” written by Simon Wahome Warui with the Ministry of Livestock and Fisheries

Geographically, Lake Victoria shares coastline with the African countries of Uganda, Kenya, and Tanzania. Based on surface area, it is the largest freshwater body in the tropics and the second largest in the world.

The three lake countries share the resources of Lake Victoria based on an allocation of surface area; Kenya 6%, Uganda 43%, and Tanzania 51%. The population of the Lake Victoria region is currently over 30 million, and experiences a population growth of about 2.3% per year. A large part of the local population depends on Lake Victoria for their livelihood.

The history of Lake Victoria was greatly influenced by British colonialism. By the turn of the twentieth century, British explorers had already discovered Lake Victoria, broadcast word back to England of their important discovery, and had built a railroad from Mombasa to the Lake. In discovering a region of great commercial potential, the Europeans infiltrated the region and planted crops of tea, coffee, sugar, tobacco and cotton. They also found an abundant biomass of native tilapia in Lake Victoria, many of which were from the cichlid species. In addition to expanding the agricultural crops of the region, they began to build a commercial fishery from the resources of the Lake. These commercial endeavors marked the beginning of a period of rapid population growth as the promise of prosperity drew people to the area.

The British colonials didn’t consider the small tilapia of Lake Victoria to be a commercially viable species, although they were very important to the local populations who fished the tilapia resource for trade and their own food supply. There were fishery managers who wanted to stock the Lake with Nile perch since it was a large fleshy fish that could be filleted, and would make a more fertile commercial fishery than the small bony native species of the lake. There are various stories of exactly how the Nile perch came to Lake Victoria, but suffice it to say that by the early 1950’s, the Nile perch began to appear in Lake Victoria. By the early 1960’s officials were actively stocking the Lake with the perch and by 1980 the Nile perch had become of major commercial significance to the region and continues to be very important today.

To give a picture of the tremendous growth of the total Nile perch fishery in the region of Kenya, Uganda and Tanzania (not Lake Victoria alone), see the following graph of annual landings of Nile perch in metric tons compiled from data from the FAO (2008):
As the Nile perch exploded in growth in Lake Victoria, they preyed on the smaller native species of the Lake. The bio-diversity of Lake Victoria was lost as the Nile perch became more and more dominant, and an entire species of native fish vanished from the Lake. Of greatest concern to biologists concerned with biodiversity was the disappearance of the cichlid species.

Although the introduction of the Nile perch to Lake Victoria has been a disaster to the biodiversity of the Lake, it has also had great commercial success. However, recent years show a strain on the resource. In 2005 and 2006 landings of Nile perch as a percentage of the total fish landed from Lake Victoria were 32% and 24% respectively. The total USD$ value of the Nile perch landings for 2005 and 2006 as a percentage of total value of all Lake fish landed were 71% and 66% respectively. This evidence seems to indicate that there is at state of declining stocks.

Management techniques of the Lake Victoria fishery have focused on growing the commercial value of the fishery to gain export dollars. Management has included protection of spawning stocks and young fish, preservation of some of the more fragile habitats, allowance of selective fishing gear, closing
nursery areas, implementation of fishing seasons and attempts to mitigate degradation of waters and pollution. All of these efforts seek to preserve maximum landings in order to have continued growth of the fishery.

The complexity of the management rules that have been put in place make them difficult to enforce, particularly where the fishermen look for every way to circumvent the rules since they are confusing and at times expensive to implement. Since the Nile perch stocks seem to be declining, it would seem that these management approaches are not achieving the desired results.

The Warui study examined the profitability of the Nile perch fishery in Lake Victoria, and determined that although the fishery was still profitable in 2006, it was greatly under-performing based on its economic potential. Warui concluded that this underperformance was due to the poor management of the fishery resulting in lower harvests due to over-fishing and higher costs due the high number of boats going after declining stocks. He recommends the implementation of a “rights based” management approach using a quota system and establishing proper TAC’s, with fees levied that will fund fisheries management work that needs to be done.

While the fishery growth has been exploding over the years, so has the growth of agriculture and industry surrounding Lake Victoria. There has been degradation of the water due to agricultural runoff, industrial waste and untreated sewage. The Lake was also affected by the Rwandan war casualties consisting of the remains of human bodies that floated down the Kagera River. These polluting factors also contributed to the disappearance of many of the species of fish from Lake Victoria, so the Nile perch perhaps shouldn’t bear all the blame for damage to the biodiversity of the Lake.

The three Lake Victoria nations put together a management plan in 2001 that included a focus on managing the ecosystem of the Lake. Improvements in the water quality of the Lake will not come overnight, and in the meantime, the Nile perch landings are declining. The impression from those who have studied the Lake is that the environment and the stability of the Nile perch are still very much in jeopardy.

The transformation of the Lake Victoria fishery caused by the Nile perch had great impact on the local populations. Prior to the growth of the Nile perch commercial fisheries, the locals harvested the native fish species and used it for trading and for their own food source. With the growth of the commercial fishery and the dominance of the Nile perch over the smaller native species, life changed a great deal for local residents. They couldn’t pursue the same lifestyle of fishing and trading, and in many cases were not able to find a new means of self-support. Although the Nile perch fishery brought prosperity for some, it has failed in having that prosperity trickle down to all of the lake region populations. Today for example, the unemployment rate in Kenya for its lake region is 46%, the highest in the country as of 2006.

The Nile perch gold rush displaced local fisherman by the loss of the native fisheries that they had traditionally depended upon. However, the locals were also blocked from sharing in the Nile perch fishery due to the capital investments needed for fishing gear required for successful harvesting of the
Nile perch. Only the wealthiest entrepreneurs could afford to invest, and the small artisanal fishermen had to sit on the side-lines.

Also, the growth and expansion of capital intensive commercial processing of Nile perch, and the shift from local marketing of the product to instead marketing product to higher wealth urban and export markets has severely damaged the small local fish distributors who were mostly woman. This marketing approach has also driven the price of fish to levels not affordable by many local residents of the Lake Victoria region as a regular diet staple. Also, the availability of Nile perch to the local residents is scarcer since such a large portion is exported.

Some additional reasons for the lack of prosperity sharing from the Nile perch fishery throughout the community are mentioned: a.) local's attitudes towards saving, b.) devastation in the communities by AIDS, c.) inability to raise capital to buy better fishing gear d.) exploitation of the small fishermen in the marketing chain, e.) lack of support from the government.

In summary, steps must be taken to implement better management of the Lake Victoria fishery, to impose strict measures to clean up the water quality of Lake Victoria, and to better integrate the social benefit to the community with the prosperity of the Nile perch fishery. These are all major endeavors to take on and need time for improvement. The state of Nile perch fishery is like a ticking time-bomb and the question is can it be diffused before it is too late?

The following figure illustrates the foundation and prerequisites needed to develop a fishery. If any of these building blocks are missing or incomplete then the success of the development project may be compromised. The success or failure of the previous cases discussed can be directly related to the foundation and prerequisite pyramid.
Figure 47  Foundation and Prerequisites Needed to Develop a Fishery
VII. Allfish

Allfish is a partnership between International Coalition of Fisheries Associations (ICFA), Global Environmental Facility (GEF), Food and Agriculture Organizations (FAO), and World Bank. The organization was formed as a partnership in 2009 with a combined three year funding grant of 1.2 million dollars provided by the World Bank. ICFA was designated the operating partner and charged with the responsibility to implement the group’s vision. The National Fisheries Institute in Washington, DC was delegated as the operating partner for ICFA, and appointed Stetson Tinkham as the Executive Director.

The Allfish Vision, Goals, and Mission

Allfish Vision: To bring seafood industry organizations and government policymakers from developed countries, along with their counterparts in developing countries, together to share knowledge and best practices on fisheries management, developing benchmarks, sharing concerns, and speaking as a voice for the seafood industry in the developed countries global policy debate. Its further vision is to help improve fisheries management in developing countries and create sustainable economic development through sustainable resources.

Allfish Goal: To get seafood industry organizations to work together with policymakers to promote responsible fisheries, particularly in developing countries. Allfish will provide a means for stakeholders to collaborate on issues of common interest. These include good fisheries governance, sustainable fishing practices, effective aquaculture methods, ecosystem preservation, responsible marketplace action, and engagement in the global policy debates that impact their operations.

Allfish Mission: To promote sustainable seafood and create a profitable industry that works toward good environmental practices and has concern for workers and consumers. This is to be achieved based on better collaboration between governments, civil society, and the seafood industry in the developed and underdeveloped world.

Building the Organization

In 2009, Allfish was established and developed with its partners the goals and mission of the organization, and built a work plan around three primary Axis:

Axis I: Establishing a Sustainable Partnership

Axis II: Developing Country Activities

Axis III: Building National and International Consensus and Codes
In 2009, Allfish funded one Axis I project that involved a stock-take of all the potential world organizations that could possibly bring assets to help achieve the Allfish mission. It also began work in 2009 on a Global Communication Plan. An Axis II project in 2009 began work on the Blue Swimming Crab project. No Axis III projects were initiated in 2009.

In 2010 Allfish Axis I projects included: completing works on the GCP by developing a logo, a brochure, and building a new website. Issuing and supporting the Strategy for Long Term Industry Engagement, and a project to determine how Allfish might operate in the long term after World Bank funding stops. Axis II projects included continuation of the blue swimming crab project and starting the Lesser Sunda Sustainable Fisheries Initiative. Axis III projects during 2010 included beginning work on the Industry Wide Code of Conduct Project and beginning work on the Benchmarking project to standardize fishery certification schemes.

Achievements

In the short period of time Allfish has existed, the organization has accomplished a lot of work with a minimum of staff and resources. A note of importance is the two Axis II projects that really strike at the core of the Allfish mission. Both of these projects, while still in the operational and development stages, have shown what the power of market influence can have in encouraging sustainable practices.

In the case of the Blue Swimming Crab fisheries project, Allfish provided seed funding of $50,000 and an industry led coalition of buyers of the product matched the Allfish grant with an additional $400,000. This funding was to help establish processor associations near the fisheries in the Philippines and Indonesia and to implement recommendation from the scientific community to stop fishing juvenile and undersized crab. Although this is not an example of direct funding for the Allfish program, it does demonstrate a role that Allfish can play in accomplishing its mission with partners from an established industry market sector.

Axis I projects build the framework for future work of the organization. Allfish has successfully developed and implemented a communication strategy that is informative and effective. This project, which was undertaken to help identify a future funding model for Allfish, has led to discussion of a somewhat expanded mission that attempts to engage the Global Seafood Industries directly and encourages them to form and fund a Global Seafood Organization managed by Allfish.

Axis III are projects are just getting underway and it will be several more months before any results will be learned.

Issues

Alignment of Allfish goals with that of the industry or funders is a key issue that must be addressed if those parties must eventually fund Allfish. The current plan outlined in the Allfish vision and goals is to build the global seafood organization using current organization such as ICFA members. Most of the current organizations are not structured to represent industries like shrimp or salmon on an international level. They are organized to represent their national fisheries like shrimp or salmon along with a
host of other fisheries. The issues facing the GSI are industry issues and not fishery issues, and new organizations will be needed to advance the industry to the global agendas. These new organizations will need direct industry participation; clearly an organization of organizations will not be able to react fast enough to the dynamics of the global agenda. Furthermore, if the intent is to have industry be the funder of this GSO then its direct participation is required and desired.
VIII. CONCLUSION

Since its inception in 2009 Allfish has successfully managed to advance its mission in both the developed seafood business and the developing world fisheries. In its short life Allfish has managed to stimulate discussions amongst the global seafood industry leaders to organize their industry with a more global perspective and scope. Allfish has also done some very successful work utilizing partnerships with the industry to advance its mission of helping the developing world build sustainable business practices. These works have left an impact and shown the merit of the Allfish concept; they have also demonstrated the power market influence can have on sustainable behavior. However, to leave a lasting impression on the GSI and the developing world it will take a lot more time and money than the three year window of life it has been given.

The Allfish vision and goals are admirable and lofty, and the practical implementation although not impossible to overcome is none the less a daunting task. It will take time, money, and a lot of energy to accomplish the objectives set in the mission and unless more funding is had, the program will end before a lasting achievement can be obtained. The original three year start up funding commitment will not get Allfish to a self-funded model; it takes a minimum of six years for an organization of this type to have any remote chance of being in a self-funded position without founders’ funding. Building a new organization that will be effective on a global scale takes time and money. As an example, it has taken Marine Stewardship Council eight years to get any serious industry and market traction. It took ten years for MSC to reach a point where industry was funding 60% of its budgeted expense and that has only taken place in the last two years. To keep MSC alive the founders and several long term foundations have had to heavily subsidize the operation for many years and still supplement it today. Although the MSC mission is different than that of Allfish the organizational undertaking and space are somewhat similar. Industry will be slow to come forward and pick up the cost of another organization that it has not initiated.

MSC was an NGO driven organization with very limited industry support or interest at its start. It took many years to gather enough support and considerable market force for it to have a real impact. Organizations that are industry driven generally are issue driven and their mission very focused and thus can normally come up to speed quickly. An example is International Seafood Sustainability Foundation (ISSF), an offshoot organization of the International Seafood Sustainability Association (ISSA). ISSA is the vehicle created by the Tuna industry to represent and advocate the Tuna industry on a global basis. This global group was able to organize and be functional very quickly but unlike MSC or Allfish it was started and funded by industry that gave a long term financial commitment. The organization was also kept very narrow in its mission at the inception and was focused on a very small segment of the Global Seafood Industry.

For Allfish to reach its mission it must focus energy on advancing the two key drivers that will build support from industry and other funders. To have any chance for success in reaching even a modified goal Allfish must find additional funding to keep it operational beyond 2011 or risk losing all the work
that has already been undertaken to date. Ideally World Bank would step forward and continue funding the project for another three years at current levels. It will take at least a minimum of three more years before Allfish can have any hope of fulfilling its goal and creating a lasting organization.

Absent World Bank or one of the other partners coming forward it is difficult to see any single entity that would fund the broad mission of Allfish on its own. However, it is possible that a combination of funders including World Bank could divide up funding based upon the specific interests of each of the potential funders in the Allfish mission.

The Allfish goal is really a combination of two very different tasks within one mission. Simply put there is one mission focused on the developed seafood industry and one mission focused on the developing world. Although the two missions have a dependency on each other from the Allfish perspective, the potential funders may see it very differently. These two tasks not only draw different types of funders but also require different skills and partners to accomplish the mission. If the founders want to keep Allfish alive then they must immediately begin to identify partners and initiate a full court press to get them on board. The likely candidates for future funding are industry, investors, suppliers, government, and foundations, but each will have a different strategic need and interest when considering funding. Both the resource based and market based seafood business and organizations are the most likely funders to support building an organization focused on the GSI, while foundations, governments, suppliers, and market based private seafood business may have interest in the developing of world fisheries and funding those types of projects. Structuring Allfish to meet funder’s expectations before funding runs out will mean focusing resources on the specific task necessary to be successful.

If the immediate issue of funding is resolved, then the organization can turn its focus on the fundamentals of accomplishing its vision. The question of the mission and how to move to the next step operationally needs to be addressed. There are two underlying problems Allfish must address to advance its goal; first, it must organize the GSI into a single global organization and, secondly, it must qualify the developing world fisheries to determine the scope of the problem. Tackling the second problem without regard to building the GSI will eventually lead to a failure of the latter.

**Organizing the GSI**

To organize the GSI, the various individual industries must first organize their fisheries into some form of global organization to speak for the needs of their sector. Of all the seafood industries, currently only the Tuna industry is organized to project needs on a global base. None of the other major industries are currently organized to advocate their fishery’s needs on a global level. Before they can reach that level leadership must first recognize the need to organize their sectors. Since most of the industries are not moving to organize their own industry’s fisheries into a global voice, someone must come forward to demonstrate the need; this of course begs the question, does the industry really want to organize and if so why has it not done so already?
In speaking to industry leaders about the Allfish concept of forming a GSO, the general reaction was less than enthusiastic; most clearly stated they saw value in the current industry organizations and expect to keep supporting and funding them based on their current missions. However, some of the leaders expressed concern that a global seafood organization would be too diverse to properly represent the specific needs of each industry and would therefore have to compromise to the point of rendering the organization ineffective. Although there may be some truth to that statement and each industry would still have to actively advocate its needs to the changing world, conditions will most likely impose the need for the various global seafood industries to find common ground or face problems getting access to resources and markets they will depend on in the future. The various seafood industries are no longer as isolated or insulated from each other as they once were and must recognize the shifting environment or risk losing control of the agenda. In most cases seafood industry leaders acknowledge issues affecting one fishery or industry can have negative effects on other industries and therefore recognize that a need exists to have some method of working together. Some leaders did mention after probing that they could see value in having a forum where dialogue between industries could take place. They saw value in such areas as having rapid access to other leaders on controversial issues, and understanding other industries’ problems and how those problems may affect their own industry. They also envisioned the possibility of creating a database through co-operation with other leaders that aggregated information on research or policy issues that affect the industry. Although no industry leader jumped forward to commit funding to such a program, the underlying interest could potentially be an opening for the Allfish program. Such a venue could be the forum where the industry could engage the debate and organize the GSI into a single voice addressing other issues such as global ocean policy. An organization of this nature could eventually be funded directly by industry once they see value but will require other funding to get it organized and started. Current Allfish funders may have concerns about committing funds to what is considered the developed industry, but to fulfill the mission of helping the developing fisheries grow sustainable fisheries the overall policy of the GSI is important and fundamental to accomplishing that mission. It is not a case of either helping the developed industry or the developing fisheries; it’s about keeping the industry alive and functioning.

Why the industry has not organized yet is quite simple. To date there has not been a need to organize any of the seafood industries into a global organization; each industry has operated independently with little to no concern with the other. When a regional or local fishery from one industry has had problems with farming, fishing, or harvesting issues and practices from another seafood industry fishery, those issues have typically been settled at the local, regional, or national authority level. However, in today’s world of globalized trade and activist global stakeholders, including NGOs as well as other resource based industries competing for access to the waters and oceans of the world, a more global threat is presented to the industry as a whole. The risk to the fishing industry is global pressure, regulations, or even laws that could exclude vast fishing or farming areas that cross international zones through such vehicles as Marine Protection Zones and sanctuaries or banning types of fishing practices such as bottom trawling. These threats that have never existed before on a global level are real and only through proactive engagement can they be successfully countered. Without a unified global voice, the fisheries and the various seafood industries will find themselves at a great disadvantage in the global arena unable to protect the long term interest of both the developed and undeveloped fisheries.
Qualifying Fisheries for Further Development

Understanding the developing world fisheries is difficult because there is not good information or understanding of many of the fisheries that are part of the developing world. Many of the developing world fisheries are or have been part of the GSI and may have been for years. Currently there are a number of fisheries from the developing world that make up major parts of the developed world fisheries such as tuna, shrimp, catfish, and tilapia. Some of the ventures have been very productive to all partners while others have lacked benefit to either some or all of the partners. To be effective, Allfish needs to bring something new to the table that adds value to the equation and attracts partnerships that have a long term interest in the fishery. Prejudices of past experiences often are a major hurdle that must be overcome. Distrust by developing world countries that feel isolated from the world markets are complex issues based often on perception but in some cases are based on facts. The established seafood businesses are skeptical of the developing world fishery and often see them as unprepared to enter the global seafood market. The developing nations have had issues with acquiring data on the condition of the resource. Often governments do not have a science and regulatory structure in place to credibly manage fisheries in a manner that will assure comfort to a partner who operates in a business world where western markets often require some type of third party certification. There are concerns that many of these fisheries are not economically viable because of issues with the fishery stocks, property ownership, government controls, corruption, laws, or culture. Before the developing world fisheries can move forward, someone must sort out the facts from fiction, needs from the wants, and the practical from the impractical. This must be done fishery by fishery auditing them objectively and classifying them into a scale that will indicate how close each is to being economically and environmentally sustainable (EES). Using a modified FPI to initially sort fisheries into the various categories will allow Allfish to develop a strategy for each fishery. Once a fishery is classified the Allfish goal is to develop a strategy that helps it identify the right partners to advance the fishery to EES status. This may in some cases be a foundation that can help the fishery gather better data and science on its stock or help develop models to determine MSY and ABC of the stock or even help that fishery get a third party certification. Allfish may also use its industry connection from the GSI organization to find good commercial partners for a fishery.

For fisheries that need industry partners who can bring expertise, capital, or market access it will be necessary for Allfish to select the right partner. The resource sector business and organizations that are made up of farmers, fisherman, harvesters, and wet processors with money heavily invested in fixed assets that are very specific to a species and a geographical area will have little incentive to develop a fishery that could potentially be a competitor either directly for the resource or affecting the value of their fishery catches. On the other hand marketing sector organizations and their member companies like the vertically integrated companies, further processors, brokers, importers, marketing, and distribution companies have a high degree of motivation to add supply and new species to the mix. However, before western companies will invest time or money into undeveloped fisheries they need assurances that the new fisheries can meet western standards for food safety, sustainability, social issues, and also can have a credible, stable government and legal system. This is not to say that western markets are the only path to a successful fishery development. Regardless of the market, without a
sustainable resource there cannot be a sustainable fishery business model. Without proven management schemes and a path to property rights with science backed programs, any investment made will not be sustainable. This will eventually lead to over exploitation with an eventual collapse of both the fisheries and the business.

With many of the developing world fisheries lacking basic data to determine the health of their fishery, Allfish must first find a partner that will help build the scientific data and knowledge necessary to determine the environmental sustainability of the stock before any viable investments can be recommended or promoted. Qualifying the potential fisheries in the developing world that would fit the right partner or opportunity is a large undertaking that would take time and money. The Allfish role must be to lead that task and find partners who can fund the research necessary to evaluate the fisheries.

There are a variety of potential partners that have either economic or mission driven motives to help the developing world fisheries by providing funding to do scientific research and data collection necessary to manage a sustainable resource. There are foundations whose mission is to help improve the sustainability of the oceans, and there are bankers, suppliers, buyers, and other investment groups that have a vested interest in seeing a stable development of fisheries to provide expanding market opportunities. A third source of help or funding could also be governments or NGO’s that are committed to developing sustainable business models such as the Sustainable Fisheries Partnership. To develop these opportunities Allfish would need to focus considerable attention to cultivating relationships with those communities.
IX. RECOMMENDATIONS

Allfish has a role to play in the Global Seafood Industry but it needs to find funding to keep operating beyond December 2011. A short term plan needs to be in place that will entice funders to help the organizations. Therefore, Allfish must focus its 2011 budget on projects that will align with potential funder’s interests, needs, or missions. There are foundations whose mission is to help the developing world fisheries but who may have little interest in helping organize the Global Seafood Industry. On the other hand the Global Seafood Industries could be the funder for the GSO if they could be convinced Allfish is the vehicle that could gather data, conduct meetings for the GSI, and bring the GSI together with the right NGO partners who would support their position on global issues.

Allfish must continue to build relationships with the Global Seafood Industry’s leaders and must strive to create an organization that can speak on global issues. It should also continue efforts to find partners to help fund the qualification, evaluation, and classification of fisheries in the developing world.

Action: Building the GSI Organization

Even though a number of GSI leaders reject the idea of creating a global seafood organization, we do not believe it should be so quickly abandoned. The various seafood industries have not had a reason to organize beyond their current structure; historically, most of the fisheries’ issues have been local or regional in nature. However, today the issues expand far beyond the local arena; global NGO’s are active on issues that will affect the many if not all fisheries and industries. To keep the seafood business healthy and alive, the industry must present a united front to meet the global challenge and influence the future of the global waters and oceans use policies before someone does it for them. Fisheries are not the only users of the oceans and other resource based ocean industries and global NGO’s are already far ahead in framing the global ocean policy debate. Should the seafood industry follow current path and not unite to advocate their needs on ocean and water issues, they risk letting others determine the future. Allfish has an important role to play in helping organize the seafood industry into a coherent group that can project its needs and influence the outcome of the debate. To move forward Allfish must bring industry leaders together, providing the structure and foundation to form a global seafood organization. By being the voice and policy creator for the GSI, Allfish helps strengthen the world fisheries and can help influence sustainable practices in the developing world. It would also help Allfish build direct contact with industry leadership that would be needed to gain financial support for future funding.

Allfish’s current strategy is to build its alliance with the industry through the industry sponsored representative organizations; however, those organizations need the direct support of their membership to move ahead. Allfish’s current strategy does not have a mechanism to directly engage the industry, but by establishing the forum it would provide the direct contact with industry leadership to overcome that problem. We would recommend that Allfish, using its ICFA member’s connection,
undertake a series of individual meeting with leaders from each of the major seafood industries for the purpose of encouraging each to form a global organization within their ranks. Once each individual major seafood industry has organized into their respective industry group, it opens the way for Allfish to hold a seafood industry only forum. Initially Allfish should sponsor a forum consisting of the representatives of each major industry and ICFA leadership with a facilitator to control the meeting. The early agenda should be to try and build a frame work of how the organization could function and what should be its mission and goals. The first forum should be small and only meet to help set the agenda for the future course. A follow up meeting, if the first is successful, could be opened up to a bigger audience. Should the industry find the forums effective and believe there is value to such a program, they would then need to formalize an organization using Allfish as the executor and administrator. Once the new organization is formed it should be Allfish’s role to help the industry indentify partners such as foundations and NGO’s that can help the GSI in the global debate on water and ocean policy.

**Action: Help the Developing World Fisheries Achieve Economic and Environmental Sustainability (EES)**

The developing world controls a significant amount of WCF resource and also is and will continue to be the future of many new aquaculture opportunities. However, one of the developing world’s major impediments to being EES is the lack of verifiable data to determine the current or future condition of a farmed or fished resource. Before Allfish can help any developing country, it must access the condition of the resource. To determine the status of a fishery, a set of indicators must be developed that can benchmark a fishery to determine where it is on the road to economic and environmental sustainability (EES). It would be wonderful but not practical if all fisheries could be evaluated and classified, but currently we recommend a more focused approach. We believe it would be best for Allfish to focus on building a program that begins small and expands over a period of time. The program or project should be tasked with evaluating, cataloging, and then classifying fisheries in a way to determine their ability to even reach an EES status. To begin the program ten different fisheries should be evaluated, and they should be a combination of both WCF and Aquacultured fisheries from the developing world. The fisheries would be measured using very high level modified Fishery Performance Indicators (FPI), as developed by James L. Anderson and Chris Anderson at the University of Rhode Island, to classify each fishery for comparative purposes. The modified FPI’s must measure the indicators that determine the relative chances of obtaining an EES status considering time, effort, and return for a fishery to reach the goal. Once the indicators are in place, Allfish would fund a project to determine what ten fisheries should first be evaluated and classified. Then either under a separate or the same project those fisheries picked would be audited and classified. The top five fisheries scoring highest on the FPI’s audit would go on to a more detailed audit and evaluation until the top two scoring fisheries can be found. Allfish would, with its partners, build a strategy and a work plan to assist the top two fisheries in achieving an EES status. Using the strategy and the work plan as a guide, Allfish must then find partners who can help implement the strategy. The partners could range from a single business partner to a multitude of industries, foundations, governments, bankers, or suppliers. Each and every fishery most likely would have a different need and thus different partnerships would be formed.
For Allfish to carry out this part of its mission beyond 2011 it must build a business model that adds value to the process. Allfish’s role of evaluating, classifying, strategizing, and cataloging fisheries should add enough value for parties in need of finding resource or market access, looking for investments or funding, or advancing a sustainability mission. The clients for the services would also vary depending on the condition and strategy for advancement of the resource. Those that could be brought relatively easily into an EES status would generally fit a private business or an investment group. The resources that are in need of a lot of work would require partners that are mission driven such as a government or a foundation.

**Organizational Requirements**

Organizationally, Allfish should not need a big staff to accomplish the mission if it uses resources that currently exist amongst its founders. The organization should be located in a major city that has access to influential organizations and people, governments, and preferably in a city where one of the Allfish founders are located that could provide space to the operation. Ideally either an ICFA member or a current fishery organization could house the operations and provide back office support for the Allfish operation that should allow the organization to operate with a staff of three people.

**Executive Director**: responsible for establish priorities; managing staff, finances, projects, outsourcing and evaluations; lead staffer for the GSO.

**Administrative Assistant**: among other day to day tasks, would be responsible for communication and manage the maintenance of the data base on developing world fisheries.

**Developing World Program Director**: primary responsibility to bring partnerships together, develop and prioritize projects, secure payments for services from project partnerships, secure grant funding from foundations and governments

**Budgeted Expense:**

- Staff salary and benefits organizational
- Office expense
- Professional and Legal
- Insurances
- Travel expenses
- Marketing and communications
- Projects funding

The budget for all staff and expenses but excluding outside project funding to operate a full time professional organization that would outsource back office work is estimated to be approximately
US $500,000 per year. This annual budget is meant to be a rough estimate. A more detailed budget could be done once a country and city location has been determined.
X. LIST OF TABLES AND FIGURES

Figure Number

1. Overview of global seafood industry
2. World fishery landings – wild and aquaculture
3. GSI: Wild landings & farmed production
4. Global seafood sectors
5. Fishery resource model
6. British Columbia wild caught salmon combinations
7. The wild capture fishery sector
8. Geography of the aquatic environment
9. Common types of commercial fishing gear
10. Fishing vessel types
11. Major aquatic categories
12. Hybrid fisheries 1
13. Hybrid fishery 2-examples of hybrid species
14. Characteristics that define an aquaculture unit
15. Freshwater vs. saltwater geography
16. Aquaculture production densities
17. Fish farming methods
18. Aquaculture species
19. Processing sectors of the GSI
20. Harvesting steps that can take place on land or vessel
21. Wet fish processing steps
22. Further processing steps
23. Major global seafood industries
27. Top 5 groundfish species sold in U.S. in 2009
28. Groundfish market price influences
30. Tuna species by percent of landings
31. Regional management fishery organizations affecting tuna management
32. Wild vs. farmed salmon production
34. Salmon species
37. Wild & farmed shrimp production
40. Size designations of warm water shrimp products
41. Primary raw shrimp product forms
42. Cooked shrimp product forms
43. Major trends in the worldwide shrimp industry
44. Pelagic landings 1960 – 2008
45. Seafood organizations by sector drivers
47. Foundations and pre-requisites to develop a fishery.