

# **Who's Got the Power: An Examination of the Distribution of Power in the Commercial Fishing Industries**

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## **Abstract**

Over a quarter of the world fisheries are already considered to be overexploited (FAO, 2010). If such a trend as this continues for the next several decades, there will be very few naturally occurring fish stocks left in our oceans. This thesis will look back at the history of two fishing industries located in South America, the Ecuadorian tuna industry and the Chilean salmon industry, how these particular industries developed into top competitors in their respective international markets. In answering this question I examine Wallerstein's World Systems Theory (WST) to distinguish if this model works as a means for helping to understand the changing dynamics in these industries. What I found was that the development of these industries was due in large part to the influence of foreign powers. Ultimately, what I conclude is that the Ecuadorian tuna industry matched the WST more closely than the Chilean salmon industry and that of the two industries the Chilean salmon industry provides the best model for mitigating its environmental externalities.

## **Introduction**

In natural resource economics there is a popular economic principle that forms the foundation for assessing many of its top issues. This principle is the principle of maximum sustainable yield (MSY). In Laymans terms, it states that a non-excludable, non-rivalrous open resource has a set point at which it can be harvested year after year, without the total harvest declining in the following years. If you go beyond this point, without pulling back, at some point the natural resource will reach a point at which it cannot recover even if a moratorium is placed on its harvest.

If you google global fisheries, you come up with page after page of the world fisheries crisis, commonly referred to as over fishing. According to the WHO, global fishery catches reached their MSY in the 1970's (WHO, 2012). According to an article in Science from five years ago in 2007, it argues that a quarter of the percentage of global fisheries should be considered as being harvested beyond their maximum sustainable yield (Grafton et al., 2007). The FAO provides an even more detailed breakdown in their 2010 report on the State of World Fisheries and Aquaculture. This report places the percentage of world fisheries being over fished in 2008 at 32 percent. It also states that 53 percent of the world fisheries are being fully exploited, which according to the MSY principle, means that these fisheries cannot be exploited any further, or they will be fished beyond a sustained point (FAO, 2010).

The purpose of this thesis will be a cross-national examination of the current and historical processes that have been taken to supply our supermarkets with the fish we eat and why these processes have resulted in them being over fished. Our current level of over fishing is a product of a series of interrelated events. At its heart is an increase in not only the global human consumption of fish products, but also an increase in the proportion of fish we eat compared to meat products. Harvesters and producers of fish products have responded to this increase in harvest levels of commonly eaten fish, because our world's fisheries are located in the world's largest commons, the world's oceans. The access to this commons has remained unchecked until relatively recently with the implementation of protective measures, which has meant unchecked access to all of its fisheries.

The other important trend that has been occurring during this period of time is the change in the percentage of fish being imported by the developed countries commonly found in the western world. At current in the United States 86% of the seafood consumed is imported from another country (NOAA, FishWatch). In European Union this percentage is recorded at just over 60% in 2009, although individual countries may have a higher or lower percentage than this overall percentage (EU Fisheries Statistics, 2010).

This raises the interesting question of course of where do these imports come from, if they are no longer coming from the country where they are being consumed. The answer to some extent is that an increasingly large percentage of these imports are coming from developing countries. This can be seen from even just of a quick glance at the breakdown of countries the EU imports from.

Specifically I will be focusing on the tuna and salmon fishing industries, two of the top global commercial fisheries, as well as the developing countries in South America, which are among the top international exporters of these fisheries.

An integral part of my education in the field of environmental studies has been exploring differing models of explanation to account for subjects such as these. One of the prominent models we are introduced to is the World Systems Theory (WST), which attempts to do just what its name suggests, which is to explain the economic and political interconnectedness of the world (Rice, J., *Unequal Exchange*, pg. 46-47).

In consideration of the basic principals of the WST and the changing dynamics the world's fisheries, an argument can be made that the fishing industry was one of the industries that Wallerstein, the creator of the WST, was attempting to explain with it. Under this assumption it would suggest that the current structure of the global fisheries

allows for a larger share of the power within each fishing industry, where there is a developing country acting as a major exporter of the fish, to lie with the developed countries (Rice, J., *Unequal Exchange*, pg. 46-47).

Accordingly, my thesis examines the validity of this idea, examining the breakdown of power relations in the sphere of fisheries. How much power do the developed countries actually have? How much power do MNC's have, is that power more influential than that of developed countries?

Examining where the power lies will be answered by exploring the following questions. How have the economic and political climates of developed and developing countries lead to different patterns of, and strategies for the exploitation of the fishing industry and what implications does this have for the environmental impacts.

### **World-Systems Theory Justification**

In nineteen-seventy two Emmanuel Wallerstein spearheaded an alternative to the modernist theory of examining world dynamics, called the world-systems theory. At the core of this system is the basic principal that the whole world is connected, with three spheres of development, the core states, the semi-periphery states, and the periphery states. He used this theory to postulate that there was an inherent relationship between the core states and periphery states of exploitation. At the foundation of the relationship between these states is the assumption that, because the core states are more developed they will naturally take advantage of the periphery states in particular when it comes to the realm of natural resources, constituting a lopsided relationship where the core country received the majority of the benefits. (Rice, J., *Unequal Exchange*, pg. 45)

I will argue in my thesis that the world-systems theory provides a loose economic based mechanism that will provide the basis of my explanation for the transition from the first wave to the second described in more detail later. More importantly it will also provide a means for getting at the central question of where do the power relations in these fisheries actually lay.

### **Past 60 years**

Over fishing is not a new phenomenon, it is has been known to been occurring for at least a half century now. By the beginning of this decade, the proportion of fish species considered to be overexploited had already doubled in number compared to the 1970's. The proof for this comes from government reports published by the Food and Agriculture Organization every two years since 1994. In these reports titled "The State of the World's Fisheries" (SOFIA for short), the data used only dates back to the 1950's, but within those sixty years they already show a definitive increase in the global catch and production data as well as levels of the human consumption of fish. (FAO, SOFIA 2010)

In 2010 human consumption reached approximately 117 million tonnes of fish. This number has doubled in just under 20 years (FAO, SOFIA 2010). In the wake of this increase in global catch data, also has come an increase in the practice of aquaculture. Aquaculture is the process of farming a specific species of fish in a controlled environment. Beginning with the fish eggs, taken usually from the previous generation of fish, they are raised in fish pens that are located either in the open ocean, or in a lake. In some instances, such as the salmon that run in the Columbia River there are individuals that have been released into the river from the fish farm located adjacent to the

Bonneville Dam. The intention is that the fish will be harvested when they have matured and returned to the river. In other cases the individual fish are raised for their entire lives in the pens and harvested straight from them.

In the sixty years that the records show, this trend in aquaculture has increased globally from less than 1 million tonnes in 1950 to 52.8 million tonnes in 2008. Just over 90 percent of this production is currently located in the developing countries. Of these the largest producers in the developing world are located in Southeast Asia followed by South America. These figures however do include all aquaculture production not just fish species (FAO, SOFIA 2010).

### **The tragedy of the commons, fishery style (a.k.a. Downfall of 1<sup>st</sup> Wave)**

The earliest commercial fisheries were generally located in the developed countries, because of the resources available and existing international trade networks. As a useful simplification these first commercial fisheries comprise, what I defining in my thesis, as the first wave of global fisheries. This first wave has since experienced a downfall, no longer comprising the major source contributors globally for fishery products. To compensate for the continually growing demand for consumption, the focus was gradually shifted to new areas of fish stocks located in the developing countries. The evidence for this comes from the current trend that the developing countries located around the world are the top suppliers of aquaculture products as well as wild caught fish, also known as capture fisheries (FAO, SOFIA 2010). This gradual shift I have defined as the second wave of global fisheries.

The major fisheries located in the developed countries had already started to level off by the mid to late 1900's, or in certain cases dramatically decrease disappearing almost altogether. Take for example the 1995 FAO "The State of the World's Fisheries" report which shows that in 1973 Atlantic Cod was listed as the 2<sup>nd</sup> largest marine catch as a percentage of the world total of catch data. Twenty years later, the Atlantic Cod was listed as ninth (FAO, SOFIA 2005). Overall cod stocks are now among the lowest in the world and are one of the best-known cases of over fishing. Cases of over fishing such as this exist, because they represent an example of the tragedy of the commons. Without the presence of preventative policies in place, the oceans and lakes offer open access to any individual fisherman, company, or government that wishes to capitalize on the presence of a particular fish stock. In the wake of cases such as these, demand attention was placed on alternative fisheries not yet exploited and countries whose fisheries have not yet been exploited, which in the last few decades usually tend to be located in the developing countries.

#### Importance of world-systems theory

With the rise in the second wave it presents an opportunity to bring into this an important impact that Wallerstein postulated was a fundamental consequence of how the world-systems theory is structured. This consequence deals with environmental cost-shifting also known as creating a negative externality. This happens because the collapsing fisheries in the developed countries are no longer shouldering the majority of social and ecological costs, instead these costs are being transferred to the developing countries, which are not always as equipped to deal with recovering from them. The



specifics of the externalities for each case study will be examined more in-depth, later in the thesis (Rice, J., Unequal Exchange, pg. 46-47).

## **Methodology**

For my methodology I will be examining where the power lies in the tuna and salmon fisheries in Ecuador and Chile respectively. In order to do so I will compare the influence in each case study that the disappearance of fisheries off the coast of the western countries had with the following political reform policies, Import Substitution Industrialization (ISI) and Neo-Liberalism. This is important to study, because as is the case with many of the food industries in South America, their structures have become determined by the same political climates. Therefore it will make it easier to make comparisons between the two case studies to examine if there is a common trend among the creation of new commercial fisheries in the developing countries. As a supplement to this, I will also include a short qualitative as well as quantitative section on the environmental externalities, caused by the creation of these new commercial fisheries, which will again be compared between the two case studies.

Content wise I am using the world systems theory as an explanation to base my initial hypothesis, on why there was movement of the fisheries to the southern hemisphere in addition to the power structures and the environmental impacts that have resulted from it. As stated previously the world systems theory proposes a likely movement of industries to the periphery, because of the stronger abundance of the commodity, and fewer restrictions.

## Movement to the Periphery

The history of South America acts as a unique example of large-scale political trends. At its core is the issue of colonization. Given South America's status as an area of underdeveloped countries, it provided an easy target for colonization from the more developed countries. When these countries gained their freedom and independence it triggered three consecutive phases of economic and political growth, each one initiated in reaction to the previous phase. Because the fishing industries began in the mid twentieth century, it is the last two of these distinct phases that hold importance, and thus necessitate a further explanation for the circumstances behind their initiations.

The transition away from colonization occurred at end of the nineteenth century and the beginning of the twentieth century. When this transition occurred it forced the majority of these countries into the global economy in an effort to kick-start their growth and development, given that they no longer had a Western developed country to rely on for support. This period in their history is thus often referred to as export led economies. During this period of time, those industries that faired the best were based on the principle that the domestic processes required for the preparation of the commodity to export, should be integrated into the rest of the domestic economy, not separate everything else. In return the developing countries would be supplied with refined products that were supplied by the developed countries (Latin America's Economic and Political Development, ~pg. 20).

After the Second World War, it temporarily reduced the demand from developed countries for the commodities that South America had been structuring their economies around. In turn, with less income being received by the developing countries, it made it

more difficult for them to continue importing the array of refined products. In response the third transition was made toward an Import Substitution Industrialization (ISI) policy. This was characterized by an effort to reduce the dependence of each country on these outside countries. This period failed because of the large debts and inflation that many of the South American countries experienced as result of their policies during this period of time (Latin America's Economic and Political Development, ~pg. 20).

In its place a neo-liberal atmosphere was adopted in the late twentieth century. Ideologically this period was about trying to create policies of free trade and open markets. This was done in most cases through the privatization of their export economies that had been previously directly controlled by the government (Latin America's Economic and Political Development, ~pg. 20).

### **Tuna Case Study**

#### From Trash to Gold

Located off the Southwest corner of central park, sits one of the most expensive restaurants in the country, a high-end sushi bar. Meals can reach a thousand plus dollars. Approximately six thousand seven hundred miles away, a 593-pound tuna was sold in Tokyo, Japan, for 736,000 dollars, which comes out to 1,238 dollars per pound. Examples like this, of extremely high priced tuna expound around the world, providing proof that dollar for dollar, tuna has become one of the most valuable fish that is harvested in today's fisheries.

The Ecuadorian tuna fishing industry's narrative begins centuries ago, when local fishermen along Ecuador's coast relied upon this abundant natural resource as a food source. The commercialization of the industry however did not begin until the mid twentieth century. This new perspective on the tuna industry in Ecuador, sat initially at the center of two corner stones. The first was the popularization of tuna as a global commercial industry, helped along by the Japanese. The second is the movement of tuna production from western countries to Ecuador, in other words the introduction of foreign direct investment (FDI) in the Ecuadorian tuna industry (Bellinger, 2011). Later on chronologically of course there were a large range of other factors that will also be discussed at length following these two cornerstones.

#### The Start of a Global Industry

As a country completely surrounded by the ocean Japan has always relied on Tuna as source for food. Culturally in this era, one of the most popular fish products consumed by the Japanese people is sashimi. However if you were to come across sashimi before the early twentieth century you would have found it to be prepared with a different fish completely. This is because until the twentieth century, tuna was considered to be a trash fish, something that only the poor would deign to consume. When the various fish used prior to this era began to be depleted, they looked to other sources to supplement their sashimi products. It was at this point that a transition can be clearly seen, towards the usage of tuna instead, given its abundance in the coastal waters off of Japan. About a half a century later tuna and sashimi have become interchangeably linked, without any thought as to the usage of a higher-grade fish instead (Haward et al., 2001).

The Japanese tuna market since being adopted on a large scale has run into many issues, at the forefront of which is the noticeable trend in catch data from Japanese tuna fishing fleets. This data indicates the peak in tuna landings was in the 80's and since then their tuna landings have decreased noticeably. The conclusion can be derived from this and other supplemental indicators, is that their fishing practices have gone beyond what would be considered the maximum sustainable yield for the tuna population off their coasts (Haward et al., 2001).

As a result Japan has had to rely more heavily in the recent decades on the importation of tuna (about 80% of their tuna consumed is imported), because although their tuna catch may have decreased, the consumerist interest in sashimi, has not. Interest in sashimi has become so high that the sashimi market represents a large portion of the market for what tuna is used for worldwide. The countries that the Japanese have relied upon most heavily as it happens are for the most part, developing countries, given that at the time, their tuna stocks have not yet been utilized for the global tuna industry.

#### Outside of Japan

This trend is not localized to Japan however. Countries such as the United States in the late twentieth century also turned their attention to importing tuna from these same developing countries as well. In the case of the United States their largest persuading factor to import a larger amount of the tuna consumed domestically, was the rising industry costs that the three of the largest international tuna producing companies

(Bumble Bee, Starkist, and Chicken of the Sea) faced in San Diego, the location for the predominant domestic supply of tuna production (Cely et al., 2006).

These rising industry costs came from a similar situation of first and foremost a dwindling tuna stock, which in turn jacked up the operating costs for the fishers and producers. In addition the tuna producers were at this time also facing rising labor costs at their canneries. Eventually these increased costs meant that the companies located in San Diego were not operating at enough of a profit their continued usage. The last cannery in San Diego closed in 1984 (Cely et al., 2006).

#### Rise in Ecuador's Tuna Industry

When the developed countries looked elsewhere for new sources of tuna their gazes fell on given its large previously untapped tuna population. This abundance is a result of the geological conditions found off of its coast, specifically the continental shelf, two hundred miles from the shore. This shelf allows for the convergence of several large currents, the end result of which is the creation of large areas of upwelling, bringing nutrient rich, colder water at the bottom of the ocean up to its surface. This is important because, these conditions have resulted in a large population of phytoplankton in these waters. The presence of phytoplankton in turn, means that it's predators, will also be present en mass, which in turn attracts the attention and presence of tuna fish. The three species of tuna that can be found off of Ecuador's coasts are the yellowfin, bigeye, and skipjack tuna (Anda-Montanez et al., 2004).

The presence of this tuna population off of Ecuador's coast, has meant that it has been used as a local staple for food since the presence of humans in this geographic

region. However the abandonment of the domestic fisheries described above in favor of relying on the exports of Ecuador's tuna, for an international market, did not happen until the late 50's early 60's for Japan and even later in the century for the United States.

Equally important to mention during this early period in the history of the Ecuadorian tuna industry, is that there was strong support from the government for allowing the foreign powers to come in and oversee most of the industry. The government even went as far to draft laws to protect the rights of the foreign powers, to ensure their continued interest in Ecuador as a place to set up shop. Among these laws was the creation of duty free access to the United States and the E.U., the largest importers of Ecuadorian tuna. The help tuna could provide to the economy as an export industry was what motivated this interest (Bellinger, 2011).

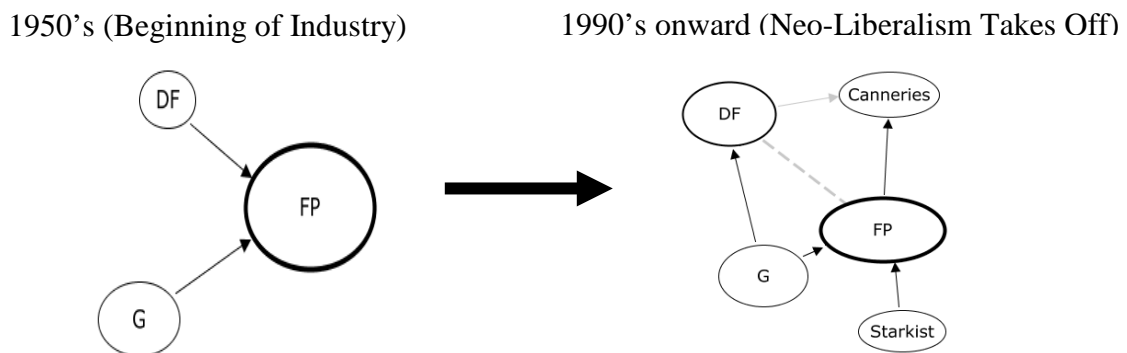


Figure 1  
The generalized evolution of power in the tuna industry in Ecuador

Figure 1 shows the very generalized progression of power in this industry. As can be seen the foreign power have continued to take a dominant role in this industry due to the convergence of the previously mentioned factors. Within this role dominant role however there have been a few changes that can also be seen in figure 1, specifically the

diversity with which foreign powers have become involved. There is not only involvement from nationally owned fishing fleets from countries such as Japan and Spain, but during this time we also see the presence of multinational corporations as well (beginning in the 70's). Among these MNC's, the one that has maintained the strongest presence is arguably Starkist, which is still an American based company (Bellinger, 2011).

Despite this strong control that they the foreign powers have maintained, it bears mentioning that the government served in two other very important capacities in the creation and flourishing of the industry. The first was that the government was responsible for implementing the initial infrastructure for the commercialized tuna industry, starting in the late 1950's, early 1960's, Without this support the foreign powers would have found it very difficult to help establish a profitable tuna industry in Ecuador. Initially the creation of this infrastructure occurred only in Manta, at what was and still is the epicenter of tuna production in Ecuador (Bellinger, 2011).

The second was that they instituted strong ISI reforms in the country from the 1930's-1980's, which meant that the creation of infrastructure such as this, country wide, was already a priority that the government was looking into, before the formalization of the commercial tuna industry. In addition it led to the strong interest in the creation of an economy dependent on exports, which meant that there was a consideration for everything available to them to export (Bellinger, 2011). Later in the twentieth century, the government however followed the trend of many other South American countries and reversed their stance on their support for ISI policies, and instead through their weight behind Neo-Liberal reforms. These reforms are what explain the duty free exports that



Ecuador has ensured for the foreign powers.

The expansion of the tuna industry and influence therefore that these national policies have had on it, means that although the government should not be considered as having the most power in this industry, they none the less still act as a significant factor in deciding its future.

### **Outside Influence**

Outside of Ecuador's national regulations on the processing of the tuna industry there is also one other significant source of influence worth mentioning. This influence is from the Regional Fisheries Management Organizations (RFMO's). World wide there are five RFMO's located in the tuna hot spots around the world (see figure two), the primary aim of which are to promote the creation of sustainable fishing practices for the tuna industry.

The intended means of achieving these practices is through international cooperation, given that the RFMO's are organizations that operate with the cooperation of the majority of the countries in the designated tuna hot spot. Their specific mission has been through to monitor and regulate fish catches per region and per country.

As is evident from Figure 1, The Inter-American Tropical Tuna Commission (in red) is responsible for the eastern half of the pacific, meaning that they are the regional management organization that would be responsible for Ecuador's fishing practices.

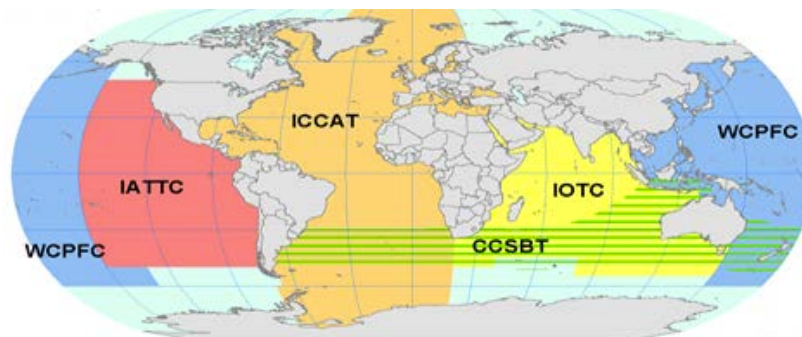


Figure 2: Visual of the geographical locations covered by the 5 RFMO's

Ecuador is also a cooperating non-member of the Western and Central Pacific Fisheries Commission (in blue).

However the realities of policing the catch of tuna populations globally has become a significant issue of concern. Until these efforts to police the industry become iron tight, it will be difficult to place the RFMO's under the category of one of the powerful actors in the Ecuadorian tuna market (Green Peace briefing on joint tuna RFMO meeting, 2007).

### Case Study Salmon

#### Invasive Fishery

“...the salmon and shrimp farming stories do not have a silver lining. The lack of a premium market has set in motion a cyclical race to the bottom. The industry's response to diminishing prices has been to increase production— further driving down prices and initiating another round of rationalization and cost offloading. Salmon and shrimp are becoming homogenous, low-value commodities—battery chickens of the sea.”

Volpe, J., Dollars without Sense

Within the order Salmonidae there are eight different species of fish, which are

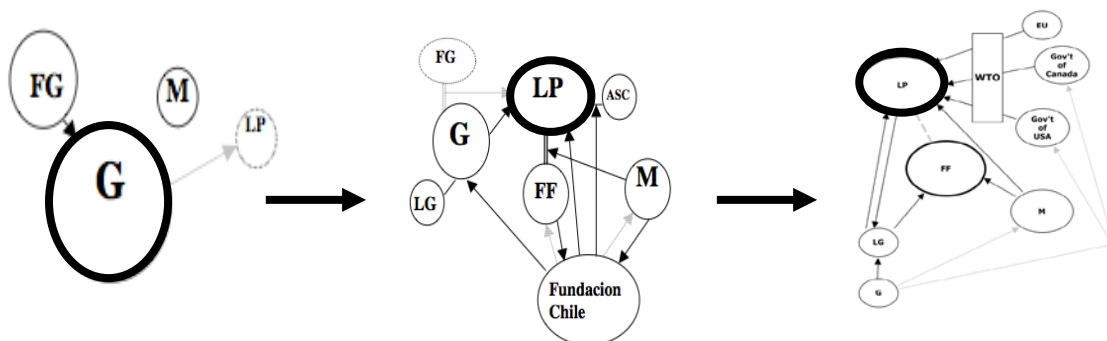


Figure 3  
The generalized evolution of power in the salmon industry in Chile

commonly referred to as salmon. These species of salmon are found in both the Pacific Ocean and the Atlantic Ocean. Only one of these eight species is native to the Atlantic Ocean, *Salmo Salar*, all of the other species are native to the Pacific Ocean. The native ranges of all eight species regardless of which ocean they reside in though, do not extend below the equator. The salmon fishery of Chile, now the second largest in the world is therefore not a naturally occurring fishery. It has been artificially created to provide an economic stimulus to the country. The three specific species of salmon that are now found in Chile are the Coho, the Atlantic, and the Chinook salmon.

Efforts to create salmon production in Chile have been occurring for over a century at this point. However it has only been within the last forty years that Chile has made the decision to turn these efforts into a full fledged industry, in addition to entering into the international market, as one of the top exporters of salmon products. The trajectory of their success can be traced to four specific factors, new advancements in aquaculture technology, high salmon prices in the 20<sup>th</sup> century (making it a high return industry despite its risks), Chile's ISI policies, and influence from foreign powers, all of significant importance. However given the scope of this thesis, the analysis will be limited to the last two factors.

During the second half the twentieth century, the Chilean government shifted its focus to being in favor of ISI policies and neo-liberal reforms. Despite the lack of uniformity in the creation and enactment of these ISI policies, they were still extensive enough to influence the course of events helping to shape the creation the salmon industry. ISI policies were first introduced after Gabriel Videla a member of the radical party of Chile was elected in the 1946 presidential election. Following Videla's reign,

these policies continued to grow under the subsequent president including Allende. These policies were in response to the colonial actions taken by foreign powers up until the twentieth century, in order to establish overbearing control over the entirety of the country. Incentive

At the forefront of these policies, the focus remained squarely on the nationalization of Chilean industries. In this context the progression of the development of this industry takes on a new context. Specifically it helps to show why the initiative for this industry began with the Chilean government sector in the early 1960's, rather than from private sector or even from the initiative of a foreign power, as Wallerstein predicts in his model. Under this scenario, it therefore gave the power to regulate and control the salmon industry to the government, taking this ability away from the foreign powers (included under which are also MNC's).

On the other hand, it should be made clear though that there has never been a complete lack of presence foreign powers either. Early on foreign powers still played a vital role in kick starting the industry. This was because the foreign powers had access to the previously mentioned advancements in technology and the know how of how to use it. This technology was crucial for salmon to produced in Chile since it is not a naturally occurring species in the southern hemisphere.

This initial influence was introduced into the country, with use of cooperation between the Chilean government and foreign governments, chief among which, was the United States. One the first collaborations of note, was the usage the Chilean government made of resources provided by the University of Washington, in order to introduce two salmon species into specific rivers in Chile's interior. This particular effort failed, as did

other projects, of a similar style. These failures are largely due to the lack of a connection the government sector had with the private or commercial sector. All of the knowledge gathered stayed mostly in the government and therefore there was of little incentive from the commercial sector to invest in this industry (Iizuka, 2004).

Although these efforts did not last, the sound infrastructure created by this technological capacity, did last. This infrastructure was used in the following years once it was picked up by the private sector. Also these early efforts were not the last examples of the international cooperation that can be seen in Chile in reference to this industry. Foreign powers continued in the following years to provide a source of technology overflow, the main difference being though that international cooperation shifted to cooperation with foreign firms (Iizuka, 2004).<sup>1</sup>

These failures marked the start of a transition period, where the salmon industry was picked up by the private sector. This shift came when the private sector gained enough faith in this industry to invest the time and money need to develop it beyond a pilot program, allowing it to become permanent part of Chile's economy. This began with the establishment of Nichiro Chile and Fundacion Chile two large corporations. Nichiro Chile no longer exists\*, however when it was in operation it was a Japanese based fishing company that was a subsidiary of Nichiro Gyogyo Kaisha Ltd. Fundacion Chile, a collaboration between ITT Corporation (an American based company) and the Chilean government, however still does exist and has continued over the decades to

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<sup>1</sup> <sup>1</sup>The one exception seen over and over again, in regards to the case of foreign powers operating in collaboration with Chile is the country of Japan. Any mention of Japan, including its foreign firms was followed by an explanation of how it operated to capitalize on the salmon industry independent of efforts with the Chilean government or domestic firms.

provide support for the salmon industry where needed. After these two corporations found their foothold in Chile, interest from other foreign powers was also developed helping the salmon industry to grow at a fast pace (Iizuka, 2004).

The most important aspect of the relationship these foreign powers had with its development however was that in the majority of cases the investment they provided in the industry, occurred in an indirect manner, through the funding and support of existing local domestic based firms. This gets back to the neoliberal government policy raised earlier that helped to create a stronger nationalization of Chilean industries.

The other crucial aspect of this era, was the limited influence that the government began to take. This was in reference to the growth of the technology of the industry, which they realized was progressing beyond their control. Therefore they changed their influence to creating regulations. A stance that Chile was taking on a larger scale, not just with the fisheries. Fundacion Chile stepped in the following years as a support structure for the subject of technology. It is crucial to mention here that part of this decision can be attributed to the strong *laissez faire* policies put into place in the 80's by General Pinochet (Iizuka, 2004).

The position of the domestic producers as the controlling factor at this stage was strengthened by several factors. The first was the massive growth of the number of domestic firms 56 by 1987, allowing them to help leave behind their 'trial phase'. The second factor was when the Chilean salmon exports reached over 1 million US dollars. Reaching this milestone meant that Chile was now considered to be a serious presence in the international market. The third was the creation of the APSTC, which created

collaboration between the largest of the domestic firms, although later it became the APSC (Iizuka, 2004).

The industry began to diversify in the early 90's. This was due to the price of Chilean salmon becoming too high, resulting in lower imports from Japan and the US, the two main importers at this time. The end result was that it helped save the Chilean market. The new markets that they found were countries in South America, Asia, and the EU. This diversification came as a result of further domestic collaboration, which created Salmocorp. This further demonstrates their strength in this industry.

The only area where Chile was truly dependent on the foreign powers for the continuation of their industry at this point was the import of salmon eggs. This final separation began in 1990, with the inclusion of salmon reproduction techniques in the overall farming process. From the late 90's on, foreign powers regained traction in this industry though. The domestic firms had been continuing to grow in size, creating what is often referred to in economic terms as an economy of scale. This galvanized action among the foreign firms to also get in on it. They're other interest in the Chilean salmon industry was the lower labor costs that they had. One of the other important factors was the political policies of the Pinochet presidency, which touted a stronger acceptance of international influence in Chilean market policies (Iizuka, 2004).

### Comparisons on Influence

From the outset two things have become clear about these industries in general. The first is that when looking at industries in developing countries it is very hard to get away from the influence of government policies. The second is that industries which have

been around for a long time, that have a well-established framework, that already have heavy investment made in them, are not as prone to change from the influence of government policies. This bears mentioning for the simple reason that commodities such as agriculture, timber, and other similar commodities have become well-established industries in Latin America since the 1800's.

On the other hand as mentioned earlier, the tuna and salmon industries did not become well-established industries until the mid to late twentieth century. The importance here is that when these fisheries became established in their respective countries, the government policies that existed at the time were different from those that had helped shape the previously established industries. Import substitution industrialization and Neo-Liberal policies became the pertinent guiding influences and because of this it has undeniably allowed for the distribution of power to rest very squarely in the seat of foreign powers.

However within this realm of influence there is yet a very wide scope as to what that influence entails exactly. But now that this information is known it must be asked once again, do these profiles provide evidence in favor of supporting Wallerstein's World Systems Theory, or do these industries strive from the path of development his theory predicts.

### Getting Back to the World Systems Theory

Wallerstein's WST is a complex theory that covers many age and issues. However as stated in the intro section the area of this theory that is of interest to me is based on the following thought process. Modern day society is built on a consumer-based



philosophy. This is particularly true for the core countries, because the existing levels of developed infrastructure we surround ourselves with, all of which requires updating, replacing, adding to etc. In order to maintain this level of the consumption of the natural resources however, Wallerstein posits that developed countries will given the first chance look outside of their borders, towards less developed countries, with a large number of the limited resources needed by the core countries. Just as important he reminds us, these less developed countries can be easily exploited due to the smaller degree of infrastructure, in the developing countries.

Based on this specific focus of the WST, it shows us that there is a definitive divide that can be drawn between the Ecuadorian tuna industry and the Chilean salmon industry in how they relate to the WST.

The tuna industry finds itself in a situation of developing the closest to the WST. It only has one main difference worth noting. As stated earlier the government in Ecuador has had an active role in recruiting and maintaining the strong presence of the international powers influencing its development. In other words it was not against the Ecuador's will, that these countries set up shop within their borders.

The number of similarities to the WST however is a lot longer. For instance the exploitation of Ecuador's tuna population as described earlier in the examples of the United States and Japan, was influenced by the depletion of the tuna stocks off of their own coastal waters. Also, despite the fact that their government has had a large hand in encouraging the involvement of foreign powers, the equally important part, is that the foreign powers are quite powerful in deciding the course of the development of the tuna industry at this beginning and now as well.

On the other hand the Chilean salmon industry differs from the WST more than it is similar to it. The largest difference that this industry has that sets it apart is that the initiative for this industry first came from the Chilean government and not foreign powers looking to Chile as a new source of salmon. Also the other crucial difference is that until the last couple of decades a significant, influence of the industry remained within the boundaries of Chile. Its path to development was not controlled by the foreign powers. This influence from the foreign powers has admittedly increased recently, in such a manner that has allowed them to take control of many of the domestic salmon production firms, through mergers and acquisitions. Therefore they can now control the direction and amount of production chosen each year.

### **Environmental Externalities**

There is one other area of analysis that can be made, with regards to the usage of the WST for the two industries. This additional area of analysis deals with the environmental impacts that Wallerstein includes as part of this theory. He states that because the core countries in his model are in control of the industries in the developing countries, it will result in unmitigated negative externalities that are a result of the exploitation of the given natural resource.

### **Tuna Case Study**

#### **Environmental impacts**

One of the clearest indicators of the environmental impacts of the tuna industry in Ecuador is its carbon footprint. A carbon footprint is an indicator of the total greenhouse

gases (GHG's) that a system or in this case a series of processes to deliver a tuna product, emits. For simplicity's sake though, many of the sources, which have calculated the footprint of the tuna production, deal just with carbon dioxide levels.

In 2009 Tan and Culaba from the Center for Engineering and Sustainable Development Research wrote a report detailing the carbon footprint of the Philippine Islands. Given the lack of reports found on direct numbers for Ecuador, this report will be used as surrogate means for assessing the environmental impacts of the tuna production process.

According to the report the authors developed a system for assessing this carbon footprint, based on an input-output analysis, which gives a comparison between a top-down versus a bottom up approach. This is based on a calculation of the footprint per kilogram of tuna brought in. The top-down analysis is believed to be an underestimation of the actual total carbon footprint though, even if it does show a profile of "essentially complete inter-industry linkages" (Tan et al., Carbon Footprint). Therefore the bottom-up analysis they suggest provides more accurate numbers to rely on.

What was made real clear from this report is that if you are looking at the carbon footprint for an individual tuna product from a supermarket, it will differ greatly, based on the manner in which it was caught and processed. It details four different methods for catching fish: purse seine fishing, long line fishing, small pump boat fishing, and large pump boat fishing. Of these, long line fishing has the highest footprint. Based on both of these methods, the high estimate for all parts of the process is 26.11 kg CO<sub>2</sub>/kg, while the low estimate is about 13.7 kg CO<sub>2</sub>/kg (Tan et al., Carbon Footprint).

Based on a system analysis of the Ecuadorian tuna production, these numbers will be much higher, given that they are the largest tuna producers in Latin America. According to a report by the Food and Agricultural Organization (FAO) “Recent developments in the tuna industry”, the United States in recent years has imported a lower percentage of tuna loins than it does canned tuna. In the European Union the percentage of canned tuna to tuna loins is even higher. What this shows is although the exports of tuna loins, do help to lower the carbon footprint of Ecuador, the higher amount of canning products overrides these benefits. On top of this, reform of the GHG emissions does not look like it is likely. Their air pollution controls, meaning how much GHG’s their factories are allowed to emit, are far less strict than the United States or European regulations. This only furthers the incentives for foreign powers to have their business located in Ecuador, because fewer regulations, generally means they can make a higher profit. Ecuador currently is and for the time being will remain one of the leading supplier of tuna world wide, and because of their size and the development that has been made to their operations, their carbon footprint will remain sizable for the foreseeable future.

### Biological Impacts

Outside of the environmental impacts that the tuna fishery has on the surrounding ecosystem, there are also extensive biological impacts as well. Therefore the largest biological impact is on the structure of the food web. The way any food web works either in the water or on land is that it is built on a hierarchical structure, where every species has its specific place in the ladder. The fragility of these structures depends on the size of

the food web and the nature of the species in the food web. When there is a ripple in its structure, however small it is, the term biologists use to describe the repercussions is that of a trophic cascade. More specifically it helps us to answer, which species increase as a result and which decrease as a result of the trophic cascade.

In relation to the topic of the over fishing of tuna, it disrupts marine food webs, through the removal of a top predator to the ecosystem. When it is removed or drastically diminishes through over fishing, the smaller fish, such as the mesopelagics and the large invertebrates (specifically squid) will increase. On the next rung down, the zooplankton and benthic invertebrates will decrease, because it is what consists of the diet of the small fish and large invertebrates. Below them are the phytoplankton, the prey of zooplankton, which should in turn increase. At the very bottom of the food web are the nitrates, which will decrease, with an increase in phytoplankton. With strong international influence in the tuna industry, these trophic cascades will not improve, without drastic measures taken to reduce the consumption of this item.

## Salmon Case Study

### Environmental Impacts

The carbon footprint also represents an important tool in assessing the externalities of the salmon industry. Unfortunately though, there is even less literature on the subject of GHG emissions for Chilean salmon producing companies, than there is for the Ecuadorian tuna producing companies. However what can be stated for sure is that because of the nature of the salmon industry in Chile, in that aquaculture techniques are

used exclusively to produce the salmon, its carbon footprint will look significantly different from the footprint of the Ecuadorian tuna production.

### Biological impacts

One of the largest biological impacts as with tuna over fishing is the resultant trophic cascade, given that salmon is a non-native species to Chile. Unlike the tuna over fishing however the trophic cascade for the Chilean salmon, deals with the introduction of an invasive species to Chilean rivers and coastal waters, rather than the reduction or removal of an organism. Although this introduction into the native waters is not intentional, it occurs in most cases because salmon can, on occasion, escape, usually from the destruction of the net holding it (a result of sea lions attacking the nets to get at the salmon or a storm that hits and destroys the nets).

An important note to make here is that despite the severity of these externalities, the Chilean government is actively involved in creating policy that mitigates the effects felt by the introduction of the aquaculture, with for example the passage of its Basic Environmental Law. While these policies are not perfect of course, they are at least a step in the right direction. In addition they also serve to show that theory of unmitigated environmental externalities, does not exist as such in Chile.

### **Conclusion**

When comparing these two different models of development for a large commercial industry, as well as the resulting environmental externalities it becomes apparent that the Chilean salmon industry offers not only the model of the lesser degree

of exploitation enacted by outside factors, it also offers the model of least similarity to the Wallerstein World Systems Theory. This shows that due to the circumstances behind its creation, the salmon industry represents its own unique model of development.

As a final thought though, it deserves mentioning that the Chilean salmon industry is far from perfect, given particular regard to the fact that this salmon industry is a completely man made industry and therefore there are certain ecological and environmental issues that have been passed over for the betterment of our own economic situation is concerned. Over fishing does not have a fix all solution that can be applied, it is an issue that will continue to plague us for decades, perhaps centuries to come.

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