

Making Sense of Sustainable Seafood Certifications

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Student's Name: Samantha Yoder
Faculty Sponsor: John Visich
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ABSTRACT

This project is aimed at tackling the issues regarding the varying seafood sustainability certifications currently in circulation. It aims to uncover the confusion, controversy, and differences that arise from the numerous governmental policies and organizations that issue seafood sustainability certifications. Furthermore, it will assess the primary motivations for each participant in the sustainable seafood supply chain, as the value derived from participation. Supply chain members considered include the fisheries that supply the seafood products, the various companies that issue the seafood certifications, the grocers that stock the numerous seafood products, the restaurants that serve sustainable seafood products, and the end consumer that ultimately purchases the certified sustainable product. In order to gain a better understanding of consumer knowledge, shopping locations, and consumption habits regarding sustainably certified seafood a survey method was used. The survey was distributed to Bryant University professors, administration, and staff. The survey aims to uncover consumer's perceptions of sustainable seafood and better understand if consumer opinion on sustainably certified seafood products are aligned with what is currently being labeled as sustainable.

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INTRODUCTION

Over the past few decades, seafood products have continued to be one of the largest traded food commodities globally. Additionally, global revenue within the seafood industry has more than doubled in the past 20 years. In 1998, global annual revenue totaled approximately \$51.5 billion, but as of 2014, global annual revenue has exceeded \$148 billion (FAO, 1995; FAO, 2014). This large jump in revenues throughout the years can be attributed to massive growth in consumer demand for seafood products. This demand is being driven by the rising standards of living around the world, and a growing interest in healthy eating habits. Between 1992 and 2002, the global consumption of seafood rose by 21%. This growth trend has continued throughout recent years, with the continual average sales growth of 3.2% per year since 2002. Although this may appear to be limited, growth in consumption is more than double the growth of the world population (FAO, 2012).

With increased demand for seafood products comes the necessity to generate a larger supply of seafood products to sell. This has been done through expansion of seafood capture offshore, into deeper waters, and through the proliferation of species harvested (Pauly et al., 2002). However, this multifaceted expansion has led to serious issues concerning the global supply of seafood. The harvesting and processing techniques that have been employed to help keep pace with demand has led to unsustainable manners of capture, which in turn has led to the devastation of numerous species of ocean life. As of 2014, it was deemed that 61% of the fisheries worldwide are fully exploited. Additionally, around 29% of the remaining fish stocks have surpassed sustainable limits, putting them in danger of reaching overexploitation status within the next ten years (FAO, 2016). Thus, as of 2014, only around 10% of the global fish stocks were considered to be under-exploited (FAO, 2016). Seeing the overall degradation of fish stocks led Worm et al. to conduct a research study to determine the future longevity of the remaining global fish stocks. The study, which is discussed in “Impacts of biodiversity loss on ocean ecosystem services”, concluded that if something is not changed, by the year 2048, the remaining stocks of fish will be completely depleted (Worm et al., 2006). Furthermore, it was concluded that in order to avoid major extinction, issues such as pollution, overfishing, and habitat loss must be addressed in the near future.

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Adding to the dire situation, there have been few legal or governmental actions taken to combat the unsustainable practices prevalent in the commercial fish industry. With little regulation, it has become increasingly difficult to define what exactly is caught in a sustainable manner. Sustainably harvested products can be loosely defined as products captured in a manner that do not impact the long term fish supply or the overall ocean environment. However, currently, the exact definition of sustainable seafood products is left to the discretion of the certifying organizations.

These certifying organizations are various groups that have formed to satisfy the growing consumer demand for sustainably harvested seafood products. They show consumers that seafood products are caught in a sustainable manner using ranking or classification systems. Organizations issue certifications for seafood products that they deem to be sustainably caught according to their standards. In doing so, the products are labeled with their logo, ensuring the customer that the products they are buying have been harvested in a sustainable manner. This would mean that they are aiming to certify the commercial fisheries that are enabling the stock of seafood to be preserved for the long term future. However, each group has different standards in regards to what they consider to be sustainable, which the unassuming consumer might not be aware of.

This research aims to analyze the varying organizations that issue sustainable seafood certifications in order to make better sense of what types of seafood harvesting practices are actually deemed to be sustainable. Thus, it is worth considering how each seafood certifying organization conducts their approval process for fisheries, what practices they deem to be sustainable, and how they enforce their standards once a certification has been granted. By comparing and contrasting the certification requirements of the various organizations, we can better understand the conflicts and benefits of these certification programs. When comparing the different sustainability criteria we expect to be able to develop a set of best sustainability practices for the seafood harvesting industry. In addition, we will identify practices that are touted as sustainable, but are actually questionable in preventing seafood stocks from being over exploited.

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This research will also investigate the sustainability requirements for each member of the supply chain. Each member within the supply chain plays a crucial role in providing certified products to the end customer, and thus are worth considering. It will investigate different grocers and restaurants that sell sustainable seafood products to see if the supplier's certifications are aligned with the grocer's expectations. Grocers such as Wal-Mart, Target, Costco, Stop & Shop, and Wholefoods will be investigated to see what seafood products they provide to their customers. Additionally, chain restaurants that have sustainable seafood options on their menu will be examined. These restaurants include: McDonald's, Red Lobster, Long John Silver's, and Pret-A-Manger. This research will then be related back to the consumer of the actual seafood products in order to see if the seafood that is being purchased aligns with the opinions of the customer on what they consider to be sustainable practices. The information gathered and distilled in this research will help consumers better understand sustainability certifications, which should facilitate better choices when they purchase seafood products.

SUSTIANABILITY CAMPAIGNS

In order to better understand this research, we first have to understand what sustainability campaigns are, and how they operate. Sustainability campaigns are social marketing tools that hinge on the promotion of sustainably harvested seafood products (Jaquet and Pauly, 2007). Through promotion, sustainability campaigns create branding for all members within the supply chain including fisheries, restaurants, and grocers to ensure the consumer that these products were caught in a manner that will contribute to the long term maintenance of the global fish supply (Brandy, 2003). Sustainability campaigns normally take the form of either certification programs or recommendation lists. Below we will examine the major differences between certification programs and recommendation lists. Refer to Appendix A, Table A.1: for a summarized comparison of certifications and recommendation lists.

Certification Programs

The main objectives of certifying organizations are to assess the sustainability practices, operations, and characteristics of fisheries. Additionally, they often aim to develop a chain of custody to ensure transparency and visibility throughout the supply chain. Currently, the

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largest issuer of sustainable seafood certifications is the Marine Stewardship Council (MSC), but other dominant players within the market include the Friend of the Sea, Aquaculture Stewardship Council, Alaska Seafood Marketing Institute, Iceland Responsible Fisheries, Seafood Trust, Safe Harbor, and Naturland Wildfisch. Refer to Appendix A, Table A.2, for a brief description of five dominant certifying organizations currently in operation.

In order to attain certification, fisheries are generally responsible for paying independent certifying organizations to evaluate and determine whether their operations are in compliance with the certifying organization's standards (Parkes et al, 2010). If the fishery meets the standards, an ecolabel, which is a logo or statement, is placed on the product to ensure consumers that the product was captured in a sustainable manner. However, sustainability campaigns can be confusing to the unassuming customer. Currently in the United States alone, there are 201 eco-label certifications in operation, and this number increases globally to 465 ecolabels (Ecolabel Index, 2015). Thus, it is important to consider how these certified products differ from one another.

Although certifying organizations generally share the same overarching objective, they often differ in terms of basic organizational structure. For example they can be owned and operated by various organizations such as governments, NGOs, or private industry members, as well as choose to operate on regional, national, or global levels. In addition to varying in terms of organizational structure, certifying organizations vary in their definition of sustainability. Definitions of sustainability are not the same across all certifying organizations because each organization is responsible for developing, implementing, and governing their own standards (WWF, 2010). Thus, each organization has differing requirements for fisheries to meet in terms of environmental, social, and economic standards to attain certification for their products.

Recommendation Lists

Recommendation lists are another type of sustainability campaign used to promote sustainable seafood, but they are slightly different than certifications. Normally, recommendation lists are operated by non-campaigning organizations such as environmental NGOs, aquariums, national governmental bodies, or some other type marine conservation organization. Unlike

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certifications, recommendation lists typically rank sustainability using a stop light system where each species type is labeled as red, yellow, or green based on the current state of their supply. These rankings are then compiled and listed in a guide to aid consumers. These guides are often available as pamphlets at grocery stores or displayed via a label near where the product is sold. Some guides have also developed apps available for consumer download. Additionally, unlike certifications, fisheries seek inclusion by recommendation lists. The organization that creates the recommendation list is given the task of choosing which type of fish or product they wish to include. Typically recommendation lists are broader and focus on regional or global supplies of specific fish stocks as part of a larger sustainability campaign. Some of the popular recommendation lists include the Vancouver Aquarium's Ocean Watch, the Monterey Bay Aquarium's Seafood Watch, and the recommendation list developed by Greenpeace. For example, grocers such as Whole Foods, Costco, Stop & Shop, and Target all utilize recommendation lists in addition to providing sustainably certified products

Confusion

Although both certifications and recommendation lists aim to aid the consumer in selection of sustainable products, they often times lead to further consumer confusion. This is because in some cases, a seafood product at the grocery store can have an eco-label indicating the product is certified as sustainable, but also have a sign deeming it is a yellow or red product according to a recommendation list. Thus, consumers generally do not know which of these messages to trust. In general, an eco-label on the product indicates that the actual product has been caught by a fishery that abides by the certifying organization's standards. However, it can be considered a yellow or red product on the recommendation list because the total supply of that particular fish species is overexploited globally, or in the region that the product was harvested. Thus, it is important for grocers that use recommendation lists to inform consumers of these subtle differences. Studies have found that if consumers are not properly informed of the differences between certified products and recommended products, grocers can actually lose revenues from consumer confusion. This phenomenon will be discussed further within the literature review.

SUSTAINABLE SEAFOOD SUPPLY CHAINS

In order to satisfy consumer desire for sustainably certified seafood products, there has to be a system in place that will coordinate the flow of seafood products from the fisheries to the customers at the end of the supply chain. However, this has become more difficult with the increasing presence of globalization in business operations. Globalization has lead supply chains to become longer and more complex when operated across national borders. This means that supply chain visibility, transparency, and traceability have also become more difficult. For sustainable seafood supply chains to succeed, transparency is crucial. This is because sustainable seafood supply chains are consumer driven, meaning the desire for the product begins with the customer at the end of the supply chain. All members within the supply chain must abide by these sustainable standards and provide the utmost visibility in order to fully satisfy the derived consumer demand. Major actors within the sustainable seafood supply chain include: Fisheries, Certifying Organizations, Grocers, Restaurants, and Consumers. Refer to Appendix B, Table B.1 for a visual representation of the actors within the sustainable seafood supply chain.

Each player within the supply chain identified above has a different motivating factor as to why they have chosen to participate and operate within the sustainable seafood market. These actors aim to satisfy the consumer demand, but in doing so, participants are also creating a value added advantage for themselves. The fisheries at the beginning of the sustainable seafood supply chain are motivated to participate in order to gain access to premium markets. In doing so, they are able to gain differentiation from competitors, as well as generate greater profits through higher prices for their superior product. Moving forward in the supply chain, the certifying organizations were born in aims to improve the governance and regulation of seafood capture, preserve the depleting fish supply, and alter unsustainable supply chain practices. These organizations are also motivated to cater to the newly formed niche market of consumers. Grocers and restaurants have also chosen to participate in order to meet the demands of their customers. Providing sustainable seafood products enables restaurants and grocers to create a positive brand identity for their company, which in turn can attribute to increased sales through increased offerings. Finally, the end consumer is able to benefit from the sustainable supply chain. When all member work together within the supply chain,

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consumers are able to purchase seafood products that are certified as sustainable by the certifying organization. In summary, participation in the sustainable seafood supply chain enables all members to add value to their operations. Refer to Appendix B, Table B.2 for a summary of value added for each player when electing to participate in a sustainable seafood supply chain is summarized in.

HISTORY OF THE SEAFOOD INDUSTRY

In order to better understand the rise of these seafood sustainability programs, it is important to understand the historical development of the seafood industry. This section will examine the creation of the seafood industry, as well as explore the motivating factors for the sustainable seafood movement.

The Creation of the Seafood Industry

Fishing dates back to ancient times, and was generally used to provide necessary food for one's family. People typically only captured what they needed for themselves and used either nets or rods to capture fish. This remained the case up until the early 20th century. However, the process and purpose of fishing was forever altered by English fishers (Chushings, 1987). In the early 20th century, English fishers used large steam trawlers to harvest fish on a commercial scale for the first time. This led to the rapid growth of fishers, and by the mid-20th century, the Food and Agriculture Organization (FAO) of the United Nations (UN) was formed to begin collecting global data from fisheries. In the 1950s and the 1960s, commercial fishing spread, producing a massive upward climb of both population growth and the capture of fish among the developing world in the Northern Hemisphere (Pauly et al., 2002). Governments and businessmen from around the globe recognized the potential for growth within the seafood market, and this has led to the massive rates of growth within the seafood production and consumption industry through present day. To illustrate this, refer to Appendix C, Graph C.1, to view the growth of global production of seafood from approximately 20 million tonnes captured in 1950 to more than 140 million tonnes as of 2014. It should be noted that today's capture is approximately 90 million tonnes wild capture, while approximately 70 million tonnes are from aquaculture production.

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Although production has grown significantly throughout the decades, the consumption of seafood products has outpaced population growth by an average of 3.2% per year since the 1960s. Refer to Appendix C, Graph C.2 to view global seafood production patterns from 1950 through 2014. The figure shows the growth in global consumer consumption of seafood products in tonnes, as well the growth in consumption per capita. Additionally, this growth in actual consumption is compared to how the consumption of seafood would have grown if it retained the same growth rate as the population. It can be seen that if seafood consumption would have remained relative to population growth, the necessary increase in supply of seafood products would have only increased from approximately 20 million tonnes in 1950 to around 50 million tonnes by 2014. This means that the consumption per person would have remained at relatively 7kg/capita, which would be in congruence with the population growth. Rather, seafood consumption has grown immensely. In actuality, the seafood supply has grown from 40 million tonnes in 1950 to over 140 million tonnes as of 2014. Moreover, the consumption rate has grown to approximately 21 kg/capita.

EMERGENCE OF THE SUSTAINABLE SEAFOOD MOVEMENT

The emergence of the sustainably certified seafood can be attributed to the combination of two factors. These two factors include increased consumer awareness or demand for seafood products, coupled with the void of a strong regulatory environment. These two motivating factors are discussed below.

Rise of Consumer Demand for Sustainably Certified Products

The Green Movement started in the U.S. in the 1970s, and has steadily gained traction among consumers that are willing to pay a higher amount for products that promote a social cause (Howe, 2008). In conjunction with the green movement, the first incident that showed the world that fish supplies were in danger was the case of the Peruvian anchovy in 1971 (Pauly et al., 2002). It was ultimately decided that the steep decline of the Peruvian anchovy was attributed to environmental factors, not overfishing. However, this was a landmark event that brought some attention to the potential issue of a depleted fish supply. By the 1980s, it became apparent that overfishing was going to be an issue in modern day society. In 1986, it was discovered that there was a massive decline in the yearly tonnage catch of cod fish both

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in Canada and along the New England coast. This led to a massive overhaul of the total available catch allowed in the area, and informed the rest of the world that the fish supply could be in danger (Pauly et al., 2002).

The first ever ecolabel placed on seafood products appeared in the early 1990s with the eco-labelling of dolphin-safe tuna (Baird & Quastel, 2011). The labeling scheme was led by the Earth Island Institute and began in response to both consumer demand and the new tuna labeling standards enacted by the United States Department of Commerce. This initiative was started to prevent the bycatch of dolphin when harvesting tuna. Eco-labels were placed on tuna products to ensure that the tuna being sold was not caught using by-catching methods that trap dolphins along with the tuna (Cooper et al., 2012).

Additionally, in 1992, the sustainable seafood movement garnered strength following the announcement of the collapse of the cod fishing industry off the Nova Scotia coast (Zwerdling & Williams, 2013). This study showed that between Scandinavia and the United Kingdom there were less than 100 cod that were older than 13 years of age (BBC, 2012). Thus, it was identified that something needed to be done in order to promote the sustainable catch of seafood products.

As it can be seen the sustainable seafood movement was able to gain traction when adequate attention was finally drawn to the depletion of various fish stocks. This was done through the presentation of case after case of fish supplies in danger, as previously discussed. One instance of a marine stock in peril was not enough to garner strength, but rather each case was a stepping stone towards public acknowledgment of the underlying problem. The media presented the facts of the current situation to the public, which then led to the beginning of consumer awareness of global fish stock degradation. Unsustainable harvesting techniques were discussed, and thus a desire for sustainable seafood was born.

Regulatory Environment

It was apparent that there was a niche market forming that demanded sustainably harvested seafood products, but yet there was very little government regulation in place to actually meet this consumer desire until the 1990s. Although governments understand and are aware of the

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fact that there is an issue surrounding commercial fishing, it has become extremely difficult for them to navigate the construction of a harmonized regulatory environment. In 1982, the United Nation Conventions on the Law of the Sea decided that the regulation of coastal waters should be at the discretion of each nation state with coastal waters (FAO, 1995). Thus, they enacted exclusive economic zones (EEZs), which gave each country the ability to regulate the catches up to 200 miles off the coast of their nation. This was an attempt to gain greater control over the global capture of fish; however, enforcement is still a pressing issue. This is in large part due to the fact that most of the ocean space where seafood products are harvested are considered “high seas”, which are international waters that are not under the jurisdiction of any nation (National Geographic, 2015). Thus, the creation of EEZs was an attempt at regulation, but much of the capture still must be regulated by an international code of law.

The small area of coastal water that was provisioned to be regulated by individual government can fall under national law for each country. For example, the United States has both state and federal regulations governing the capture of seafood products. In the U.S., NOAA Fisheries is tasked with the management and enforcement of regulations that apply to all fisheries and capture activities conducted within the U.S. EEZ, but beyond the 200 mile limit, the open oceans are not regulated by any national or global laws (National Geographic, 2015). Seeing as each country is tasked with regulation, each government gets to choose what they feel should be considered sustainable. Common strategies employed by nations to control and manage fisheries within EEZs include catch quotas, gear restrictions, seasonal restrictions, monitoring requirements, and vessel licensing procedures (Markowski, 2009). Even though these are common approaches, each country sets different quotas, restrictions, and monitoring requirements, as well as has different levels of enforcement for violations.

The 1995 agreement previously discussed also allows for the formation of Regional Fisheries Management Organizations (RFMOs) through international treaties that are binding once signed (European Commission, 2017). RFMOs can be established between nations that share a common concern for conserving fish stocks within the region, and can be applied to the high seas. These agreements enable ships from member states to fish outside of their nation’s

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designated EEZ and within the regional bounds stated (Rogers, 2011). As of 2012, there were 17 RFMOs established globally, each with specific capture limits based upon shared capture data from each member nation. This sounds like a positive steps towards international regulation, but enforcement remains difficult (Pew Trust, 2012). It is hard to manage all of the vessels and ports within the region, seeing as they are vast. Moreover, it becomes challenging to enforce these agreements because enforcement is delegated to each individual nation to manage the fishing vessels that are flagged from their respective nation. Additionally, RFMOs are only solutions for the particular fish stocks that are addressed in the agreement, not all species within the region are managed by an RFMO (FAO-RFMOs, 2017).

In summary, sustainable seafood campaigns were formed in order to satisfy the newly created niche market of customers that demanded sustainably harvested seafood products, and were able to flourish due to the lack of regulatory oversight. Seafood campaigns were able to add value to the customer, create a market to thrive, and create sustainable seafood supply chains to get their certified products to the consumer.

Ecolabelling Guidelines

In response to the lack of international regulations to define what exactly should constitute a sustainable seafood product, various organizations have produced guidelines or principles that they feel can be used universally to accurately define sustainably caught seafood. As discussed in the *Eco-Labeling of Wild-Caught Seafood Products* report by the Food and Agricultural Organization (FAO) of the United Nations launched the Code of Conduct for Responsible Fisheries in 1995 and then published a guide for eco-labeling in 2005. It is said that the FAO framework for eco-labeling aimed to promote effective management and harvest of seafood products, but the authors feel that the attempt to provide a benchmark for the industry may have been most effective in promoting sustainability to the government and politicians (Thrane et al, 2008).

Jacquet and Pauly attribute this minor impact due to the general and voluntary nature of the FAO guidelines in their work “The Rise of Seafood Awareness Campaigns in an Era of Collapsing Fisheries” (Jacquet and Pauly, 2007). Additionally, they highlight the mislabeling issue can be derived from the FAO guidelines. Due to the fact that an official label is not

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given for FAO compliance, it has led to many products claiming they have been harvested in accordance to the FAO code of conduct. Jacquet and Pauly argue that this often leads to misrepresentation and deceptive advertising. While Kangun et al. investigation of environmental advertising found that up to 58% of advertisements contain misleading features (Kangun et al., 1991).

LITERATURE REVIEW

Our literature review of sustainable seafood practices will focus on examining the key players within the seafood supply chain. First we will examine the fisheries supplying the sustainable products. Issues surrounding fisheries in developing countries will be discussed, as well as capture methods used by these fisheries. Next, we will discuss the positive and negative critiques of certifications. We will investigate criticisms that have been brought to the public's attention concerning the practices of the organizations that certify seafood products as sustainable. Then, we will review the sustainability standards that grocers and restaurant operators require of their suppliers. Finally, we will illustrate the sustainability expectations of consumers.

Fisheries and Capture Methods

According to the "State of World Fisheries and Aquaculture" report released by the FAO in 2016, approximately 56.6 million people were working within the fishery sector as of 2014. Additionally, there were approximately 4.6 million fishing vessels in use in 2014, and wild capture fisheries produced 93.4 million tonnes of fish product. Of this, 81.5 million tonnes were caught in marine waters and 11.9 million tonnes were generated from Inland waters. Furthermore, fisheries in China were responsible for the generation of 45.5 million tonnes of the total wild capture products as of 2014.

Developing countries account for massive amounts of the global seafood production. Sampson et al. discusses the importance of increasing the number of sustainable fisheries within the developing countries in "Secure Sustainable Seafood from developing Countries". The article states that fisheries in developing countries are responsible for 50% of the seafood products that are traded internationally, which is a staggering amount. These developing

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fisheries only account for 7% of the total seafood that the MSC certified as sustainable as of 2015 (Sampson et al., 2015).

Over time, researchers have mounted evidence showing that certain fishing methods are less impactful upon the environment than others. In the work of Talting and Norse in 1998, they found that there was evidence that supported major habitat damage could be attributed to the bycatch of various fisheries within the area. Shester and Micheli also agree with this finding. They discuss other studies that have been performed on some of the large-scale fisheries operating throughout the developing countries. In these studies, there have also been findings of overexploitation and degradation of habitats due to bycatch (Shester and Micheli, 2011). Bycatch is the incidental capture of organisms that are unwanted while trying to harvest a specific species (Dayton et al., 1995). These unwanted organisms are then thrown back into the water injured and left to die. Due to various findings that bycatch is a leading cause of habitat degradation, fisheries that use harvesting methods that result in large quantities of bycatch often times will not qualify to attain sustainability certifications.

Following the discoveries that many fisheries were causing the devolution of the fish supply, and recognizing that different methods of capture have varying overall impact on the environment, Chuenpagdee et al. conducted a study that aimed to determine the most sustainable and unsustainable methods of capture. Various harvesting techniques were examined such as pots and traps, bottom longlines, bottom gillnets, dredges, bottom trawls, hooks and lines, midwater gillnets, midwater trawls, pelagic longlines, and purse seines. After conducting the study, the findings were reported in the work, "Shifting Gears: Assessing Collateral Impacts of Fishing Methods in U.S. Waters". The study found that dredges and bottom trawls were highly damaging to habitats while both midwater (drift) and bottom (set) gillnets, bottom trawls, and pelagic longlines produced either high or very high numbers of bycatch (Chuenpagdee et al., 2003). Moreover, it was concluded that bottom trawls produced the highest total impact, while bottom gillnets, midwater gillnets and dredges were ranked the next most impactful to the overall environment. It was shown that all four of these harvesting techniques fell into the high impact category, and thus it was recommended that sustainability programs impose stringent policies that prohibit fisheries using these types of capture from

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attaining certification. However, it should be noted that the largest certifying organizations have very few gear restrictions. Refer to Appendix D, Table D.1, for a summary of fisheries that are currently certified by the MSC and Friend of the Sea that use the capture methods Chuengadee et al. concluded were the most impactful.

Although the MSC and Friend of the Sea do certify some fisheries that use impactful gear, the majority of the fisheries they certify use less impactful methods of capture. Hence, this can directly explain why most fisheries that attain certification are from developed countries that have access to less impactful capture methods than fisheries located in developing countries. “Conservation Challenges for Small-Scale Fisheries: Bycatch and Habitat Impacts of Traps and Gillnets” discusses that the limited number of certified fisheries in developing countries is in large part due to lack of access to greater resources such as monitoring and management systems, proper infrastructure, and high end technology for extraction (Shester and Micheli, 2011).

Shester and Micheli observed that the most common forms of capture for small scale fisheries within developing countries, which they found to include lobster traps, fish traps, midwater gillnets, and bottom gillnets. Similar to the study conducted by Chuenpagdee et al., Shester and Micheli looked at the bycatch rates in order to determine which manner of capture yielded the highest rate of bycatch. The findings of Chuenpagdee et al., were corroborated when Shester and Micheli also found that both midwater and bottom gillnets yielded the largest quantities of bycatch. Additionally, it was discovered that gillnets have relatively the same impact per unit of surface as one pass that is made by a large scale industrial bottom trawler. This means that the environmental impact caused by the most common form of capture for small scale fisheries within developing nations causes the same amount environmental impact as the trawlers that Chuenpagee et al. found to be the most damaging to the environment in his study. Moreover, the study conducted by Stobutzki showed that trawlers are the most common harvesting technique used by large scale fisheries in developing nations (Stobutzki, 2006). Thus, the small scale and large scale fisheries within developing countries have been found to be causing the same amount of environmental harm. This issue is amplified because the unsustainable methods of capture employed by small scale fisheries target the younger

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fish populations, while the trawlers used by large scale fisheries target the adult fish supply. Thus, over 50% of the global seafood trade for both young and adult fish supplies are being harvested in unsustainable manners.

In addition to utilizing forms of capture that are unsustainable due to lack of financial resources, fisheries in developing countries lack proper management systems. As discussed by Gewin, it becomes difficult for governments to enforce total catch restrictions because many citizens that operate small scale fisheries rely on their businesses to provide income, which is barely enough to support their families and day to day operations (Gewin, 2004). In order to emphasize this point, Gewin uses Indonesia as an example. Throughout the country there are over 1.3 million people that rely on the fishing industry to provide their income. It becomes hard for the government to regulate or shut down these fisheries that are operating unsustainably because it is responsible for the economic prosperity for such a large portion of the population. Moreover, Gewin emphasizes the fact that local scientists within developing countries often lack the necessary resources to give concrete, precise, and accurate data to the local governments or bodies responsible for regulating the fishing industry. Stobutzki et al., also asserts that fisheries in developing countries lack concrete data, and attributes this to scattered landing sites and complex variable market chains (Stobutzki et al., 2006).

Although it might not be outwardly perceived as an issue to exclude most fisheries located in the developing world, it is an underlying problem. The primary goal of a certification program is to provide consumers with sustainable options, while simultaneously promoting the adoption of sustainable practices for all members of the supply chain. However, issues arise when consumer demand for sustainable products outpaces the supply of products that are certified as sustainable. This issue is brought forth in Palmer's article, "Is the Demand for Sustainable Seafood Unsustainable". It highlights the fact that consumer demand for sustainable seafood has risen so drastically, that supply of sustainably labeled products can no longer meet the demand (Palmer, 2015). Certifying organizations are discovering that they now need to include fisheries in developing nations in order to satisfy consumer demand. However, certifying these organizations has become a challenge. As previously discussed, these fisheries face numerous barriers to achieving certification such as unsustainable capture

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methods and the lack of proper management practices. Although it is risky to certify fisheries in developing nations, some certifying companies are willing to take on the risk in order to expand their reach and satisfy retailers, restaurants, and customers. In doing so, this initiative has sparked controversy among many academics.

Sampson et al. discusses the concept of fisheries improvement projects (FIPs). This is a newly emerging trend that gives fisheries in developing nations access to sustainable markets on the provision that they will attempt to raise their sustainability standards over a period of the next five years (Sampson et al., 2015). Although this sounds like a program that will lead to the eventual certification of fisheries in developing countries, Sampson et al. discusses the issues surrounding the initiative. Often times these fisheries are already being labeled as sustainable in order to meet the consumer demand for wild caught sustainable seafood, even though they have yet to reach the standards of the certifying organization. In this case, the MSC is used as an example of fishery improvement projects being utilized. According to the World Wildlife Fund report, “Fishery Improvement Projects”, these FIPs have the potential to open up new market opportunities for fisheries in developing countries to convert their outdated, unsustainable capture techniques to modern sustainable practices (WWF, 2010). Additionally, they believe that FIPs promote partnership and the development of good governance within the areas. The World Wildlife Fund makes this idea sound appealing in theory, but Sampson et al. outright rejects this notion claiming that FIPs often times lack adequate transparency, and should not be given access to ecolabels if they are not meeting the standards of the certifying organization (Sampson et al., 2015).

Certifying Organizations

Sustainable seafood certifications are highly controversial among academics. Some feel that the introduction of eco-labeling into the seafood products market will jump start the process of restoration for the global fish supply over time. They are largely a consumer empowerment initiative in which success is achieved when consumers trust the message they are given (Peattie, 2010; Boström, 2006). Moreover, in order to achieve success certifying organizations must provide clear, explicit information for all of their products (Parkes et al., 2010). Some academics feel that these certifying organizations can be the catalyst for change,

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and drive commercial fishing companies towards a more sustainable method of harvest. On the other hand, some researchers view sustainable seafood certifications as not producing conclusive recovery results. This leads them to conclude that drastic action must be taken to help the ocean life recover from the damage that has been caused.

The article, “Examining the Role of Eco-Labels in Changing the Approach to Sustainability in the Commercial Fisheries”, stresses the importance of informing commercial fisheries of the dire situation of the global fish stock, and how to cope with the excessive resource consumption that has led to the current situation. Cooper et al. feels that it is a promising sign that there is increasing presence from eco-labels. They discuss that the shifting public opinion towards environmental conservatism will ultimately lead to decreased demand for seafood caught using unsustainable practices. They believe that the more fish products that are certified and purchased as sustainable, the greater the odds for the future harvest and preservation of the seafood market (Cooper et al., 2013).

Although Cooper et al., feels that sustainable seafood certifications are a good catalyst towards a sustainable seafood revolution, others find certification programs to be flawed. Critics feel that many certifying companies do not uphold standards once they are certified, which has sparked much of the debate. This controversy is exemplified with Canada’s longline swordfish, Chilean sea bass from South Georgia Island fishery, and Fraser River sockeye salmon. These examples are discussed by Kalfagianni and Pattberg in their review of the MSC. The authors discuss the issue of the MSC no longer aligning with the sustainability goals that they set out to accomplish at the organization’s inception. This opinion is supported by the argument that there are no specific government regulations that the MSC or any other certification scheme must follow when it comes to issuing their certifications. In fact, they have the ability to set, construct, implement, and enforce their prescribed standards as they see best (Kalfagianni and Pattberg, 2014).

Ellis also sees the lack of a proper regulatory environment as a major problem with nongovernmental certification programs as discussed in his work, the “Constitutionalization of Nongovernmental Certification Programs” (Ellis, 2013). Both Kalfagianni and Ellis feel that tasking the individual certifying organizations with enforcement and development of

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standards leads to a myriad of certifications that differ significantly from one another. However, they do understand that the confusion surrounding the definition of what is deemed as sustainable is derived from various influencing forces such as scientists, governments, the media, and members of society all of whom have their own opinions. Thus, it becomes hard for these various players to agree upon what they deem to be sustainable, and even harder for these enforcing bodies to decide what in fact upholds the specified ethical and political convictions of their constituents. Unlike other articles that have examined the legitimacy of nongovernmental certification programs, Ellis's aims to examine the authority, and decision making processes that are used, as well as the standards that are imposed.

The lack of regulation just discussed by academics has led to the emergence of various scandals. These situations have arisen in instances where the consumer feels that the certifying organization is not upholding the sustainable standards that they have promoted. Thus, researchers have tried to make it a point to discuss the various flaws that are accompanied with non-governmental groups issuing certifications. In the article "A Review of Formal Objections to Marine Stewardship Council Fisheries Certifications", it discusses the 19 formal objections that have been brought against MSC certifications as of 2012 (Christian et al, 2013). These fisheries receiving formal objections accounted for 12% of the certified fisheries that had data available on the MSC database as of 2012 (Christian et al., 2013). The researchers also discuss this issue being amplified. Even though these fisheries with discrepancies only accounted for 12% of all fisheries certified, they were actually responsible for the production of 35% of the 7 million tonnes of MSC certified sustainable seafood produced in 2012 (Christian et al., 2013). Moreover, even though these complaints were lodged, they are presented to an internal review board within the MSC. Only in one case was the certification taken away from a fishery. The 18 remaining complaints resulted in the certification being upheld for the fishery in question. After receiving a firestorm of bad media regarding failure to uphold and enforce their standards, the MSC has taken some steps towards improvement. Since this study was complete, according to the MSC Global Impact Report of 2016, 17 fisheries have been suspended due to failure to record target stock sizes or failure to improve management systems (MSC, 2016)

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The claims as to the ineffectiveness of the MSC are further supported by Ward in his article, “Barriers to Biodiversity Conservation in Marine Fishery Certification”. He too asserts that the MSC has devised poor environmental standards, which has led to the misinterpretation of sustainable products among multiple fisheries that have been certified by this company (Ward, 2008). Additionally, Ward discusses the issue of using third party certification companies. He brings to light the fact that the MSC does not directly certify the fisheries, but rather the fishery is responsible for hiring an outside company to carry out an audit, which can create a large conflict of interest. Hiring of outside companies can lead to misinterpretation of core principles necessary to achieve for certification. This then leads to fisheries certified and not held to the same rigor of standards due to different audit groups, which Ward sees as a huge dilemma. Additionally, it is argued that data provided to the certifying organization to monitor in the long term is provided by the manager of the fishery (Ward, 2008). This too can lead to a conflict of interest where the manager may convey false data to the certifying organization in order to reduce the risk of losing certification if the fishery is not upholding the standards.

Although researchers have been eager to focus on the flaws of the private labeling groups, they have also posed solutions for the organizations, and have presented ways for the certifying programs to become more transparent and trustworthy. In the article, “the ‘devils triangle’ of MSC certification”, it discusses the MSC and highlights the fact that once a fishery is certified by the MSC, they lose motivation to continue improving. However, after presenting this argument the authors advocate that the MSC should adopt a multi-tiered certification system that will motivate fisheries to engage in continuous improvement in order to achieve the highest level of certification (Bush and Toonen, 2013). This can be viewed as a positive recommendation that could help the MSC to move forward and become more reliable in their classification system.

Additionally, a study conducted by Michael Tlusty, found that sustainable seafood certifications are only a small part of the larger picture solution (Tlusty, 2011). His findings stated that a single certification program alone will have minimal impact if they are not actively engaged in consistent and continuous improvement. Similar to Bush and Toonen,

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Thluth advocates for the independent companies that certify seafood products to continue working towards a standardized process for implementation and enforcement. He also expands upon this notion and claims that singular certification programs are only the beginning of the sustainable seafood revolution. It is the author's opinion that in the future, there can be a larger benefit if the singular organizations come together in order to create a standardized certification program. This would consist of a combination of all resources in order to reach new heights in innovation, which would ultimately lead to a maximized improvement of the overall fish supply.

Moreover, the article entitled "Encourage Sustainability by Giving Credit for Marine Protected Areas in Seafood Certification", agrees with Thluth's claim that sustainable seafood certifications are only the tip of the iceberg. The article brings forth the argument that seafood certifications help those consumers that are environmentally minded to purchase products they know will be sustainable. However, Lester et al. feel that the current seafood certifications are flawed. The authors attribute their opinions to the relatively slow speed of improvement that certifications achieve. They feel that progress made will be limited, and that certifications will not be able to achieve true progress in the limited time left before complete supply devastation occurs. It is argued that this is due to a large lag time between when the reform is implemented, and when the fish stocks are actually starting to recover (Lester et al., 2013). As a result of this assertion, this study too provides a recommendation on how to help the movement gain momentum. Lester et al. recommends that there be credit bestowed to those commercial fisheries that help to establish marine protected areas (MPA). The authors argue that MPAs, protected areas where fishing is prohibited, produce the maximum environmental benefit. This attitude is purported by Halpern in his study of 89 MPAs. Through the study, it was discovered that on average each MPA saw a 60%-150% increase of the fish supply within the area (Halpern, 2003). Lester elaborates on the creation of MPAs to catalyze the revitalization of the fish supply, and discusses the possibility of certification agencies rewarding companies for establishing new MPAs (Lester et al., 2013). In doing so, it is believed that recalibration of the global fish supply could happen much quicker than they are now using certifications.

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Grocery and Restaurant Industry

Grocers and restaurants play an integral role in bridging the supply chain gap between fisheries that supply the sustainably caught seafood products, and the customer that demands the certified products. Thus, academics have also chosen to investigate the sustainable seafood product offerings at these grocers and restaurants. Although the purchase and provision of certified sustainable seafood products by grocers is largely seen as a response to satisfying consumer demand, some argue that this provision is all part of the grocers larger corporate social responsibility (CSR) efforts. As discussed by Gulbrandsen, consumer desire for a product is not a strong enough reason to encourage grocers to provide sustainable seafood products. Rather, they have ulterior motivations that come in the form of pressures from environmental groups. Gulbrandsen feels that although certified products can generate a new customer base for the grocer, they have a stronger motivation to provide sustainable products for the promotion of their image and enables them to form partnerships with large environmental groups (ENGOS) (Gulbrandsen, 2009). This is very important because criticism from ENGOS could largely damage the brand reputation of groceries. Additionally, grocers need to participate in these CSR initiatives to remain competitive within their industry. This argument is corroborated and expanded by Olsen et al. who feels that consumers, ENGOS, the media, competitors, and fisheries all play a part in the decision of a grocer to supply sustainable products (Olsen et al., 2013). Adding to the benefits of corporate social responsibility programs, Gupta and Benson discuss the transition away from traditional business models that view environmental sustainability as a cost, to the new models that view proper implementation of a sustainability program as a way to increase operational effectiveness (Gupta and Benson, 2011).

Even though the provision of certified sustainable products can give grocers access to a larger market and enhances the company's broader corporate social responsibility campaign, providing sustainable products does not come without a burden. As discussed by Palmer, it is a great responsibility to sell sustainable products. Once it is decided that a grocer or restaurant is going to sell sustainably certified products, it becomes their obligation to ensure that their offerings are truly coming from a sustainable source (Palmer, 2015). As Rogers states, grocers in essence function as the "gatekeepers" between the suppliers and the end users (Rogers,

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2011). Moreover, incorporation of sustainable products can come with barriers such as cost and shortage of consumer awareness (Freeman, 2011). If managed properly, grocers have the ability to steer the customers towards products that will improve the condition of the environment. Moreover, restaurants have the ability to create stronger relationships with their customers when engaging in sustainability initiatives (Freeman, 2011).

In order to properly manage sustainable products, grocers understand that in order to retain control, knowledge is crucial. They must be able to ensure traceability and know the risks associated with each product in order to minimize the possibility of negative consumer backlash (Dauvergne and Lister, 2012). To maximize control of the products, some grocers have decided to develop their own sustainability standards and have begun labeling products themselves. For example, the French retailer, Carrefour developed their own ecolabel in 2005, “Pêche Responsable” (Chen et al., 2014).

In order to increase consumer awareness, some grocers have chosen to provide consumers with recommendation list guides or signs near sustainable seafood products. These lists are often formulated by environmental groups, which are generally considered to be less biased than certifications, and have a larger consideration for the overall global environment (Mendleson and Polonsky, 1995). However, Grocers must be aware that if rankings from the recommendation list contradict the labeling on the product, it can create larger confusion and diminished sales (Gulbrandsen, 2009).

An example of a grocer introducing sustainably certified seafood is Wal-Mart. Wal-Mart announced a plan in 2006 to provide only wild caught fish certified by the MSC within the following five years (Jacquet and Pauly, 2007). In making this announcement, Walmart was able to form a partnership with the World Wildlife Fund that supports the MSC, and gain positive brand recognition. However, the responsibility was placed on Wal-Mart to provide accurate and responsible information to their customers regarding the sustainability of its product offerings. It should also be noted that even though Walmart aimed to have 100% of their seafood products certified as sustainable within five years, as of 2011, only 73% of their products met this criteria (Jacquet and Pauly, 2007).

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Additionally, the findings of Ziobro's article, "Restaurants Mobilize to Save Fisheries", elaborate upon the increased movements of grocer and restaurant participants to ensure their customers are able to purchase sustainable seafood products. For example, Ziobro presents the varying criteria for certification required by McDonald's. McDonald's was the first chain restaurant to become MSC certified, and transitioned away from using Eastern Baltic cod in their fish sandwiches in 2011. This new movement is due to the dramatic decline in the Eastern Baltic cod population over the past few years, and McDonald's is hoping that through this effort, they will both help the global fish supply and appeal to those customers that are demanding a sustainable product. They now only serve Alaskan Pollock offerings that have been certified sustainable for its fish sandwiches. Long John Silver's has also adopted this standard, and have started only serving Alaskan Pollock. In addition, other restaurants have made the transition to offering sustainable products including Red Lobster and Pret-A-Manger.

Seeing as restaurants and grocers have different standards, it is worth investigating various companies and seeing how their strategies for providing customers with sustainable options compare and contrast. To aid consumers in their decisions on where to buy seafood, Greenpeace has devised a list comparing grocers to inform consumers which grocers are the most sustainably oriented on grounds of examining their policies, initiatives, labeling and transparency, and inventory lists. Refer to Appendix D, Table D.2 for comparison of restaurants by Greenpeace. The study conducted by Greenpeace found that Whole Foods was the best in providing sustainable options; followed by Wegmans and Hy-Vee. Ranking in the middle are companies such as Target, Trader Joe's, and Stop & Shop. Finally, on the lower end of the spectrum, include companies such as Shaw's and Acme. Many researchers have used these rankings when conducting studies on the varying grocers, and thus it could be a good starting ground for investigation into the differing levels of sustainable products provided by differing grocers.

Consumers

Consumers are the driving force behind the rise of sustainable seafood certifications. According to Gutierrez and Thornton, consumers show their interest in supporting the

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movement through their purchases (Gutierrez and Thornton, 2014). As stated by Osbaldiston and Shelton, this rise can be seen in the slow transition towards an environmentally responsible purchasing behavior (Osbaldiston & Selton, 2003). Consumers are starting to move away from purchasing products that are wasteful or damaging to fish supplies, and towards purchasing sustainable products that encourage environmental conservation. This idea is supported by the increasing revenues generated each year from certified sustainable products shows. Gutierrez and Thornton support this by stating that increasing revenues is due to increased consumer awareness for buying sustainable, which in turn motivates the grocers to continue supplying these types of products (Gutierrez and Thornton, 2014). However, studies conducted throughout the European Union show that consumer knowledge of the depleting fish supply still remains relatively low. Peiniak et al. conducted a survey in 2008 that received over 3,000 respondents. The study found that more than 50% of the respondents were not able to answer two out of six knowledge based questions correctly (Peiniak, 2008). Moreover, Potts et al. surveyed more than 7,000 residents in Europe asking participants to rank various global issues in order of importance. The study concluded that the stability and health of the ocean fell close towards the bottom, ranking eighth out of the eleven issues presented (Potts et al., 2011). Even though these studies found relatively low consumer knowledge regarding the state of the ocean, this can potentially be seen as a positive sign for certifying organizations. It shows that even though they are experiencing a period of rapid growth, there is still huge growth potential for their products. For example, Uchida et al. conducted an experiment in which he provided consumers with basic information from the FAO detailing the exploitation of fish stock and the overall degradation of the global fish supply. It was found that after receiving basic information, consumers were more likely to purchase products with a certified sustainable eco-label (Uchida et al., 2014).

In regards to consumer opinions on buying sustainable seafood, there are various studies that have tried to analyze the importance of buying sustainable fish products. For example, one study analyzes whether customers are choosing to buy wild caught sustainably labeled seafood products for their social impact, or rather if they are simply trying to avoid the purchase of farmed fish (Verbeke, 2013). During the study, participants were presented with two scenarios. They were first asked to choose between sustainably labeled farmed fish and

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sustainably labeled wild caught fish. The majority opted for the wild caught fish. They were then asked to choose between sustainably labeled farmed fish or wild caught fish that was not labeled as sustainable. Some participants opted for the sustainably caught farmed fish, but the majority opted for the wild caught fish. When asked why, a large majority said that they were less concerned about the fish that were caught sustainably, but rather more concerned with the lower quality associated with farmed fish. However, those that did not opt for the sustainable version did comment that they would like more information about what is considered to be a “sustainably caught” seafood product.

Additionally, other studies have been conducted in varying countries to try and gauge if sustainably labeled seafood products impact the consumer buying decision. For example, a study was conducted by Uchida et al., where Japanese customers were polled and asked whether sustainably labelled seafood products impacted their buying decisions. It was found that only 20% of those polled stated they would have purchased the sustainably labeled salmon product if given the choice to purchase a higher priced, sustainably caught, salmon versus the cheaper priced unsustainably caught salmon (Uchida et al., 2014).

When NPR conducted a study involving 3,000 United States participants, it was found that 33.6% of those surveyed deemed sustainability certifications to be “extremely important”, 43.8% deemed the certification to be “important”, and only 22.6% deemed the classification to be “not important” (Zwerdling & Williams, 2013). This goes to show that consumer preference can vary by region in terms of their attitudes towards the purchase of sustainable seafood products.

In addition to trying to understand consumer knowledge and purchasing tendencies of sustainably certified products, there have been various studies conducted to try to discern the confusion surrounding sustainably certified products. Hallstein et al., studied consumer reaction to recommendation guides within supermarkets of San Francisco California. It was found that once the recommendation guide was implemented, sales of seafood decreased 15.3% from previous sales before the guides were provided. This decrease was attributed to the decline in purchases of seafood products receiving a yellow, “some concern”, labeling (Hallstain et al., 2013).

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RESEARCH METHODOLOGY

This study aims to compare each supply chain actor to enable the development of a set of best sustainability practices for the seafood harvesting industry, which will aid in the reduction of consumer confusion surrounding sustainably certified seafood products, and empower consumers during the purchase of seafood products. To accomplish this, the study reviewed key players within the sustainable seafood supply chain. We placed focus on the comparison of certifying organizations, grocers, and chain restaurants, and then related this to consumer opinion through the distribution of a survey.

Certifying organizations were compared to better understand how sustainable seafood certifications differ in their criteria and standards for those seeking certification. Comparison of grocer and restaurant offerings is also crucial to understand how consumers are gaining access to the sustainably certified products, and to gain an overall better understand of how the sustainable supply chain operates for each certifying organization. After comparing the offerings of grocers and restaurants, the final member of the supply chain was analyzed, the end consumer. A survey was distributed to consumers to discover consumer knowledge and opinion of sustainably certified seafood products.

Sustainability Practices of Certifying Organizations

This study will compare five certifying organizations. These five certifying organizations were selected from a list of 17 organizations identified by the World Wildlife Fund (WWF) as providing certification for sustainable seafood products. The report used is entitled, *Assessment of On-Pack, Wild-Capture Seafood Sustainability Certification Programmes and Seafood Ecolabels*. Of these 17 certifying organizations analyzed by the World Wild Life Fund, 5 certification programs were selected to be reviewed and analyzed in detail in this study. The final Selections are listed below:

Certification organizations selected:

1. Marine Stewardship Council
2. Friend of the Sea
3. Naturland
4. Alaska Seafood

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5. Iceland Responsible Fisheries

The selection of the five certification programs aimed to include initiatives from a range of geographic regions. Additionally, selection tried to incorporate both small and large scale certification organizations, a variety in scale of operation, as well as ownership structure. After completion of the selection process for certification organizations, desk-based research was conducted to find out more information on the organizations. This research was conducted using information publicly available on company websites, as well as reports published by environmental groups, academics, and governmental organizations.

In order to compare these certifying organizations, the comparison was broken into two parts. The first which focuses on basic organizational structure of each certification program, and the second that focuses on sustainability requirements/standards. These two comparisons were further broken down into categories and subcategories that were selected to highlight certification similarities and differences.

Comparison Framework for Certifying Organizations- Organizational Structures

For the comparison of basic organizational structure, four categories were selected. These include: Geographic Scope, Organization Type, Participation, and Product Types Certified. The categories of Organization Type and Participation were derived from the WWF study previously mentioned, *Assessment of On-Pack, Wild-Capture Seafood Sustainability Certification Programmes and Seafood Ecolabels*, from their comparison entitled “Types of Assessed Sustainability Programmes”. These categories were then merged with the categories of Geographic Scope, from the “Scope of Sustainability Programmes” section of the same WWF report, and Product Types Certified from the Food & Water Watch’s report, *De-Coding Seafood Eco-Labels*. These four categories are combined to form the organizational structure component of the certification program comparison for this study.

After dividing the comparison of certifying organizations between basic organizational structures and sustainability requirements/standards and determining the category for each, the subcategories were selected. Within the basic organizational structure comparison, the geographic scope category was separated into subcategories of global, regional, national, and

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sub-national to show that certifying organizations can operate in specific, concentrated areas, or have operations internationally. Next, organization type was divided into the type of ownership of each certifying organization. These included: Public/Government, private industry, and private environmental. These were selected after investigation of possible ownership structures of certifying organizations. Participation was divided into open and restricted access because it was discovered that some organizations are voluntary for any company that wishes to get certified, while others have restricted access based largely on geographic criteria. Finally, the product type certified was divided into the subcategories of wild-capture and aquaculture because certifying programs can certify only wild-caught products, only aquaculture products, or both.

Comparison Framework for Certifying Organizations- Sustainability Requirements

Following the compilation of a basic organizational comparison, the organizations were also compared based upon their sustainability requirements/standards. These standards and requirements were broken down into three categories: Environmental, Social, and Economic consideration. These three categories were used because these are the three pillars of sustainability, and we wanted to determine how each certifying organization sets requirements for each of the three pillars.

In the sustainability requirements/standards comparison, the categories of environmental, social, and economic considerations were also divided into subcategories. Each of the subcategories developed for all three categories was based on the compilation of standards and requirements discussed on each of the certifying organization's website. These standards were then assembled to form a comprehensive list that accounts for each of the sustainability initiatives discussed during the research. The subcategories for environmental considerations include: Carbon Footprint, Gear Restrictions, Habitat Preservation, Traceable Chain of Custody, Data Management System, and Increased Impact Awareness. The social considerations subcategories include: Small Scale Fishers, Human Rights, Labor Laws, Fair wages, Worker Health and Safety, Employment conditions, and Social Programs. Finally, the economic considerations category has subcategories of local economy support, fishing quotas, and price incentives.

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After developing both comparison frameworks, the comparisons were conducted using primarily the websites of each certifying organization. However, other reports constructed by environmental groups, academics, and governmental organizations were used to find information not directly discussed on company websites. These reports include:

- *De-Coding Seafood Eco-Labels: Why We Need Public Standards* by the Food & Water Watch
- *Assessment of On-Pack, Wild-Capture Seafood Sustainability Certification Programmes and Seafood Ecolabels* by the World Wildlife Fund
- *An Overview of Ecolabels and Sustainability Certifications in the Global Marketplace* by Vermeer et al.
- *Review of Fish Sustainability Information Schemes* by Parkes et al.
- *Eco-Labeling of Wild-Caught Seafood Products* by the FAO

Sustainable Product Offerings and Initiatives of Grocers

In order to compare sustainable product offerings and initiatives of grocers, a comparison framework was constructed similar to that of the certifying organizations previously discussed. Five grocers were selected for comparison, and these grocers were selected largely based upon store location relative to Bryant University due to the fact that the survey portion of the study was distributed to Bryant University professors, administrators, and staff. In order to gain an accurate reflection of consumer shopping patterns for sustainable seafood products, it was necessary to designate grocer options in the surrounding Rhode Island community that all participants would have close access to. All grocers selected are not farther than 30 miles away from Bryant University. It was found that there are 13 different grocers located within the 30 miles surrounding Bryant University. This number excludes counting repeat locations of grocers within the vicinity, and each grocer was only counted once no matter how many retail locations occupied within the target region.

In addition to selection based on location, grocer selection was based upon ranking by Greenpeace, an independent global campaigning organization that ranks grocers based upon their sustainable seafood practices. All grocers selected have been ranked by Greenpeace with

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varying degrees of sustainable seafood practices according to the organization. The Grocers selected for comparison are listed below.

Grocers Selected:

1. Whole Foods
2. Costco
3. Stop & Shop
4. Target
5. Walmart

In summary, Whole Foods was selected because it received the highest ranking from Greenpeace in provision of sustainable options. Stop & Shop, Target, and Walmart were all selected because they are some of the closest options to Bryant University and they all have at least two locations within ten miles of the university. The final selection was Costco. Although this location is a farther option, just under 30 miles away from Bryant, it was included due to its low score received from Greenpeace campaign. It was found that Greenpeace had launched a campaign against Costco leading up to 2011 due to Costco's lack of consideration for sustainably certified seafood products.

Sustainable Product Offerings and Initiatives of Chain Restaurants

In order to compare sustainable product offerings and initiatives of restaurants, another comparison framework was devised. Four chain restaurants were selected for comparison based largely on their publicity of their sustainable seafood offerings. All restaurants made it publicly available on their websites that they had sustainable offerings present on their menus. Additionally, these chain restaurants were selected in hopes that survey participants would have been able to try their menu offerings. The chain restaurants selected are listed below.

Chain Restaurants Selected:

1. McDonald's
2. Long John Silver
3. Red Lobster
4. Pret-A-Manger

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These restaurants were compared based upon five categories. First, they were compared between start of their sustainability initiatives to determine when each restaurant began their sustainability endeavors relative to one another. Additionally, the chain restaurants were compared based upon the types of certified products they offer, the types of products that they offer as sustainable, the percentage of their menu offerings that is certified sustainable, as well as the various sustainable projects they support.

Comparison Framework for Grocers- Sustainable Product Offerings and Initiatives

In order to determine how grocers differ in the sustainable seafood product offerings and their efforts to aid the consumer during the product selection process, each grocer selected has been analyzed based upon six categories. These categories include: Start of Sustainability Initiative, Sustainable Seafood in Stores, Consumer Awareness Initiatives, Future Initiatives, Number of Red List Fish Offered, and Greenpeace Sustainability Score. Each of these categories was constructed for this study based on initial investigation of the grocer websites and the Greenpeace website. Some grocers had very little detail of their sustainable seafood offerings for customers. Thus, the categories were constructed based on criteria that could be comparable between all grocers, given the available information.

The comparison framework devised for comparing grocers has some categories with subcategories, and some that lack subcategories. In this section, subcategory selection will be explained. If there is not a subcategory available, the category itself will be explained in further detail.

The start of the sustainability initiative is included to show when the grocer publicly adopted sustainability standards. It should be noted that some of the grocers may have had sustainable seafood offerings before the date listed, but the date used will be when each grocer publicly launched their sustainable seafood campaigns as described on their websites.

The Sustainable Seafood in Stores category was further divided into five subcategories for the study. These subcategories include: Single Certifying Organization, Multiple Certifying Organizations, Recommendation Lists Provided, Sustainable Standard Developed, and Seafood Offerings Certified as sustainable. These subcategories were constructed to gain a

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better understanding of which types of certified seafood will be offered at each grocery store. These will show whether a grocer sells products from a single certifying organization or whether the store has products certified by numerous organizations. Additionally it will investigate the utilization and provision of recommendation lists to aid consumers, as well as investigate which grocers have developed their own sustainability standards, and which types of seafood products are certified as sustainable for each grocer.

The websites of these grocers also discuss their awareness initiatives they have in place to educate consumers of their sustainable seafood offerings. The category consumer awareness initiatives was divided into common methods used by grocers to educate their customers. This list was devised compiling all initiatives mentioned on the grocer websites or by Greenpeace. These categories are: Employee Training Program, Website, Weekly Circulars, Blog, In-Store Recipe Cards, Signage, and Traceability Technologies.

The initiatives for the future category shows how grocers are planning for long term success in the sustainable seafood market. Subcategories include Long Term Supplier Developments and FIPs Utilized. The long term supplier development will show which grocers are working to develop their providers for their long term sustainable initiatives, and FIPs utilized will demonstrate whether or not the grocer is using products from fishery improvement projects. Although this category does aim to show that grocers are interested in the long term development of fisheries, it may also show that FIPs are being utilized for shortage in supply of sustainable offerings.

Sustainability Knowledge and Opinions of Consumers

This study aims to ultimately uncover consumer opinion and knowledge regarding sustainably certified seafood products. In order to better understand consumer knowledge and opinions, a survey was distributed to 80 members of the Bryant University community, which included professors, administrators, and members of the staff. This survey was distributed via email, and was completely anonymous. Additionally, it received internal review board approval from Bryant University. The survey can be broken down into demographic questions, knowledge and opinion questions regarding sustainably certified products, as well as

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questions regarding specific certifying organizations, grocers, and restaurants. Reference Appendix E for the complete survey distributed to consumers.

Demographics

For this study, three demographic questions were asked of participants. These demographic questions include gender, age, and level of education. These factors were included to whether gender, age, or level of education had any impact on consumer knowledge or opinion of sustainable seafood products. Refer to Appendix E, Questions 1, 2, and 3 for the specific demographic questions asked of participants.

Certifying Organizations

For the survey, seven certifying organizations were selected to poll consumer recognition of ecolabels. Of these organizations selected, the five that were previously compared were selected. Additionally, the dolphin-safe ecolabel of the AIDCP was selected because dolphin safe tuna was one of the first sustainable initiatives, and the Aquaculture Stewardship Council (ASC) was also included to determine whether consumers were more likely to recognize ecolabels placed on farmed fish rather than the ecolabels of wild-caught sustainable fish. Participants were asked to identify which ecolabels of the organizations listed below they could identify as having purchased in the past. The frequency of response was gauged in order to determine which ecolabel was most recognized by consumers. The certifying organizations with ecolabels that were presented to the consumer are listed below.

Certification organizations selected:

1. Marine Stewardship Council
2. Friend of the Sea
3. Naturland
4. Alaska Seafood
5. Iceland Responsible Fisheries
6. Dolphin Safe (AIDCP)
7. Aquaculture Stewardship Council

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Grocers

Grocer selection was largely based upon store location relative to Bryant University because the survey was distributed to Bryant University professors, administrators, and staff. The same grocers that were compared using the framework earlier are compared within the survey. As previously mentioned, these grocers are not farther than 30 miles away from Bryant University in hopes that survey participants would shop regularly at these locations.

Grocers Selected:

1. Whole Foods
2. Costco
3. Stop & Shop
4. Target
5. Walmart

This study aims to gain better insight into consumer shopping patterns, knowledge, and perception of sustainable offerings at various grocers. To accomplish this, the survey asks consumers which grocers they choose when shopping for seafood products, consumer knowledge of sustainable offerings at the selected grocers, and finally asks consumers to rank grocers in comparison to one another in terms of their perceived sustainable seafood offerings. Rankings were then determined based on a weighted scale. Refer to Appendix E, questions 15, 16, and 17 to see the exact questions consumers were asked in the survey.

Chain Restaurants

For the survey, the four restaurants that were previously discussed were also included. All restaurants selected were chain restaurants in hopes that at some point respondents would have had the opportunity to eat at the establishments. Additionally, these restaurants selected all promote their sustainability efforts on their websites in some detail. Restaurants selected are listed below.

Chain restaurants selected:

1. McDonald's
2. Long John Silver
3. Red Lobster
4. Pret-A-Manger

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The Survey aims to discover consumer purchase of seafood products at the chain restaurants, as well as the awareness of sustainable offerings on the restaurant menus. Additionally, the study aims to discover in general whether customers select restaurants based on sustainable offerings, and what percentage of each menu with seafood products should be sustainable. Reference Appendix E, questions 11, 12, 13, and 14 for the questions asked on the survey.

Sustainable Seafood Knowledge and Opinion

The bulk of this survey aims to uncover consumer knowledge and opinions of sustainable seafood products. In order to do this, survey participants were asked a series of questions, which can be seen in Appendix E, survey question 10. These questions used a Likert scale to ask participants their level of agreement with the statement regarding sustainably certified seafood products. The scale was a seven point scale ranging from one, where the participant strongly disagreed with the statement, to seven where the participant strongly agreed with the statement. After responses were received, the statements were compared using a paired t test in order to determine if there is a significant difference between the consumer levels of agreement with each statement. The hypothesis was that consumer level of agreement would be the same for all similar survey items, and to test this, the confidence interval was set to 95% with a difference equaling zero. The sample was not normally distributed, and was set to where the difference does not equal the hypothesized difference. Thus, significant differences in consumer level of agreement could be seen if the p-value was greater than .05.

Following the comparison of consumer agreement levels, these statements will be further analyzed to determine significant differences between responses of different genders, ages, and education levels. To do this, we will run a two sample t-test. First, gender was divided between male and female responses for each statement. In order to determine if we could pool the variances in our two-sample t-Test, we first conducted a variance test. Variances were pooled if Levene's p-value was greater than .05 at a 95% confidence interval for the sample that was not normally distributed. Next we ran a two-sample t-test at a 95% confidence interval that was not normally distributed to determine whether gender has a significant difference in level of consumer agreement with each statement. After running the variance test and the two-sample t-test for gender, the same was done for age and level of education.

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Age was divided between level of agreement for participants below the age of 55, and those that were 55 or older. Next, the same was done for level of education, where the respondents were segmented into those with less than or equal to a four year degree and those with greater than a four year degree.

ANALYSIS AND DISCUSSION OF FINDINGS

Commonalities and Differences among Certifying Organizations

The similarities and differences between certifying organizations are summarized in the tables below. Refer to Appendix F, Table F.1 for the commonalities and differences in organizational structure and Appendix F, Table F.2 for commonalities and differences in sustainability standards for each of the five selected organizations.

Data in Appendix F, Table F.1 indicates that these organizations operate on various geographic scopes. For example, the MSC, Friend of the Sea, and Naturland all operate on a global scale, are run by private environmental third party organizations, and have open access to all fisheries wishing to participate. On the other hand, the Alaska Seafood Marketing Institute is confined to sub-national operations, is owned and operated by both the government and private industry members, and has restricted access. Additionally, the Responsible Fisheries of Iceland also differs in that it operates on a national level and is operated solely by industry members. However, it is similar to Alaska Seafood Marketing Institute in the fact that it has restricted access to fisheries within its country borders. Moreover, each of the organizations varies in types of products that they certify. The MSC, Alaska Seafood Marketing Institute, and Responsible Fisheries of Iceland all only certify wild-capture seafood products, while the Friend of the Sea and Naturland certifying both wild capture-and aquaculture products.

As can be seen in Appendix F, Table F.2 Certifying organizations also vary in their sustainability standards. They all aim to increase impact awareness and ensure a traceable chain of custody; however their environmental, social, and economic standards vary by organization. The MSC is the largest organization, yet it has the most lenient standards out of all the organizations compared. The MSC is very much focused only on environmental

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considerations such as the fisheries must have a traceable chain of custody and proper data management system. However, others require a traceable chain of custody in addition to other sustainability requirements. The Friend of the Sea requires consideration of carbon footprint when shipping products, a standard that none of the other organizations consider. Naturland, the Alaska Seafood Marketing Institute, and the Responsible Fisheries of Iceland all have gear restrictions that fisheries must abide by as well as habitat preservation guidelines fisheries must follow. The MSC and Friend of the Sea, two of the largest certifying organizations lack consideration of gear restrictions as well as stringent guidelines for habitat preservation. Additionally, most certifying organizations lack social and economic considerations. Between the two largest organizations, Friend of the Sea has much higher standards both environmentally and socially than the MSC. Friend of the Sea has social considerations such as inclusion of small scale fisheries, and fisheries must abide by human rights laws, labor laws, wage laws, health and safety laws, as well as have social programs for employees. Naturland too has strong social considerations with all of the same considerations as Friend of the Sea except they require fisheries to meet standards for proper working conditions as well. In addition to this, Naturland is the most concerned with economic standards for fisheries to meet. These include supporting the local economy, imposing their own fishing quotas that that fisheries need to abide by, and providing price incentives for fisheries operating according to their standards.

It can be seen that certifying organizations vary greatly in their sustainability standards. Very few organizations consider all three pillars of sustainability in their certification requirements, this includes the two largest suppliers, the MSC and Friend of the Sea. Moreover, the MSC has the least sustainability requirements, while Naturland has an extensive list of requirements necessary for fisheries to receive certification.

Commonalities and Differences among Grocers

The commonalities and differences among grocer sustainable seafood products and initiatives are summarized in Appendix F, Table F.3. As it can be seen, grocers vary in terms of their sustainable product offerings. All five grocers seem to be committed to long term sustainable initiatives through supplier development and promotion of their efforts on their websites.

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However, this is where the similarities end. For example, Costco only offers products that are certified by the MSC, but all other grocers analyzed use products certified by multiple different certifying organizations. Whole Foods provides products certified by the MSC and Naturland, Target uses products from multiple different certifying organizations, and Walmart sells products certified as Best Aquaculture Practices or by the MSC. Additionally they vary in provision of recommendation lists to customers. Whole Foods uses the Monterey Bay Aquarium Seafood Watch in combination with products recommended by the Safina Center. Costco and Stop and Shop also use the Seafood Watch while Target uses FishWise and Walmart does not discuss the utilization of any type of recommendation list. Moreover grocers vary significantly in their consumer awareness initiatives. Whole Foods and Stop and Shop offer a wide array of initiatives aimed at increasing consumer awareness for sustainable products. These initiatives include: Employee training programs, weekly circulars, blog postings, in-store recipe cards, signs, and traceability technology. Due to the various offerings in products and consumer initiatives, when compared by Greenpeace, Whole Foods had the highest sustainability rating while Costco had the lowest of the five compared.

Commonalities and Differences among Chain Restaurants

The commonalities and differences between chain restaurants are summarized in Appendix F, Table F.4. It can be seen that the restaurants all describe themselves as providing a certain offering as 100% sustainable. However, Pret is the only restaurant to offer all seafood menu items that are certified as sustainable. McDonald's only has 100% of its white fish on their menu, while this statement ensuring 100% sustainable only applies to the fish products of Long John Silver's and Red Lobster. This may not include all seafood products. Additionally, the restaurants vary in the certified products they offer. McDonald's, Long John Silver's and Pret all offer products certified by the MSC. However, Long John Silver's also utilizes products from the Alaska Seafood Marketing Institute and Red Lobster offers products certified by the Global Aquaculture Alliance or according to Best Aquaculture Practices.

Consumer Opinion and Knowledge of Sustainable Seafood Products

After distribution, the survey received 49 total responses. However, two surveys were eliminated due to incomplete responses. Of the complete survey responses 19 were male

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respondents and 28 were female respondents. Additionally, 28 were between the ages of 18 and 55, and 19 were above the age of 55. The respondents also included 26 respondents that had less than or equal to a four year degree and 21 that held a higher education degree.

Of the respondents, 49% did not recognize ever purchasing a seafood product with any of the ecolabels presented. In addition, 22.5% of respondents had purchased products certified by Friend of the Sea or by the AIDCP. Moreover, 20.4% of respondents purchased MSC certified products, and 18.4% purchased ASC certified products. Only 14.3% of respondents recognized Responsible Fisheries of Iceland products, and 10% recognized both Naturland and Alaska Seafood Marketing Institute Products.

After analyzing the grocers based on a weighted ranking, it was determined that consumers deemed Whole Foods to be the Grocer with the best sustainable offerings. Whole Foods was followed next by Stop and Shop ranked second, Costco was ranked third, Target ranked fourth, and the last grocer was Walmart. This finding is interesting because Walmart is ranked third by Greenpeace, the company ranking sustainable offerings of grocers while Costco is ranked last by Greenpeace.

Finally, when asked about their knowledge of the four chain restaurants, the survey found that 76.60% of the survey participants were not aware that the restaurant even had sustainable seafood offerings on their menu. However, the restaurant with most consumer awareness was Red Lobster, with 19.15% of participants having awareness of their sustainable offerings. McDonald's only had 10.64% of participants aware of their sustainable campaigns while Long John Silver's and Pret only had 8.51% of participants aware of their sustainable seafood menu offerings.

The results of the paired t-tests are summarized in Appendix F, Table F.5. The statements were ranked based on average level of agreement with the statement. The top three statements in consumer level of agreement are that seafood products are meant to preserve the supply, are healthy, and are harvested in a manner that is economically beneficial to their surrounding area. Additionally, it can be seen that there are numerous significant differences that were found in level of consumer agreement with each statement, meaning that the p-value of the t-

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test was less than .05. For example, there is a difference in consumer level of agreement with the statement that sustainable seafood products are meant to preserve the supply compared to being economically beneficial to the area of harvest, traceable, regulated, applied to aquaculture products, and similar in standards. There are significant differences in consumer level of agreement between sustainable seafood products being traceable, regulated, applied to aquaculture products, and similar in standards. Additionally significant differences arise in level of agreement for sustainable seafood products being economically beneficial compared to regulated, applied to aquaculture products, and similar in standards. Finally, significant differences arise between level of agreement with products being traceable versus regulated, applied to farmed products, and similar.

After determining significant differences between consumer levels of agreement with each statement, the variance tests and two-sample t-Tests were run to search for significant differences in level of agreement for each statement based on gender. After comparing all statements to gender, a significant difference was found in level of agreement with that certifications are regulated. The finding is significant because the p-value is .048 in a 95% confidence interval. Thus it was found that males were more likely to believe that certifications are regulated by the government than females. Males had an average level of agreement of 5.42 while females only an average level of agreement of 4.61.

Additionally, variance tests and two-sample t-tests were run to compare level of agreement with the statement to education level. Although no results were significant at the 95% confidence interval, regulation was significant at the 90% confidence interval with a p-value of .092. Respondents with higher education degrees were more likely to believe certifications are regulated by the government than those with less than or equal to a four year degree. On average, those with higher education degrees had a level of agreement of 5.33, while those with less than or equal to a four year degree had an agreement level of 4.62.

Two-sample t-tests were also run to compare responses based on age, however, there were no significant differences found between levels of agreement for any of the statements based on age.

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CONCLUSIONS

Overall, this study found that consumers believe sustainable seafood products are meant to preserve the global fish supply, are healthy, and are beneficial to local economies. Although it is a positive sign that consumers understand sustainable products are meant to preserve the global supply, sustainable products are not meant to be healthy for consumers. This is a common misconception that still exists among consumers. In addition, as was discovered through comparison of the certifying organizations, most certifications are not actually beneficial to local economies. Many lack social and economic considerations. If consumers do wish to purchase products that are harvested in a manner that is beneficial to local economies, they can purchase Naturland certified products from Whole Foods. Moreover, grocers and restaurants need to find new ways to inform customers of sustainable offerings because many survey participants still lack knowledge of their product offerings.

Limitations

This study was limited largely by the small sample size of only 49 respondents. Thus, the sample was not normally distributed. Additionally, the survey was largely based on the willingness of participants to respond, and was confined geographically to participants in Rhode Island that work at Bryant University. Moreover, not all certifying organizations, grocers, and chain restaurants were analyzed in this study.

Future Research

This study opens up doors for future research. In future studies, a larger sample size is needed to gain a better reflection of consumer opinion. A larger sample size will enable normal distribution for the tests, as well as gain a larger geographic customer base. Additionally, future research should include more grocers, restaurants, and certifying organizations to get a better understanding of consumer knowledge and opinion regarding sustainable offerings. Moreover, more certifying organizations should be analyzed and these certifications should be analyzed through a quantitative analysis based on consumer survey response that uses an analytical hierarchy process

Importance of Research

This research is important because it helps uncover why sustainable seafood certifications can be confusing to the customer. It identifies how certifications differ, and how grocers and

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restaurants differ in their product offerings and consumer awareness initiatives. It identifies how certified products can be confusing when used in conjunction with recommendation lists, and highlights the gaps in the literature for future research. Currently there are not studies that follow each member of the sustainable supply chain to determine how differing standards of the certifying organizations impact all other members and their offerings of sustainable products. Moreover, studies do not ask consumer knowledge and opinion questions for certifying organization standards, which could be a future topic for research. In conclusion, sustainable seafood products are extremely confusing and more investigation must be done to uncover the similarities and differences between their offerings. Moreover, heightened awareness of these differences may work towards the eventual harmonization of certifying organizations, which would reduce consumer confusion while helping the global fish supplies to recover.

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APPENDICES

Appendix A-Sustainability Campaigns

Certifications	Recommendation Lists
<ul style="list-style-type: none"> • Fisheries participate voluntarily • Assess specific operations of fisheries or aquaculture operations • Often participants pay for independent certification • Mostly operated by 3rd party market participants • Major Players: <ul style="list-style-type: none"> • Marine Stewardship Council (MSC) • Friend of the Sea • Usually results in eco-label on product <ul style="list-style-type: none"> • Logo or recommendation on product 	<ul style="list-style-type: none"> • Creators choose products to include • Broader, less in depth • Assess fish species or retailers for sustainable/unsustainable practices • Normally operated by environmental NGOs, aquariums, awareness groups • Normally part of larger sustainability campaign • Major Players: <ul style="list-style-type: none"> • Monterey Bay Aquarium • Greenpeace • NOAA Fish Watch • Most often produce guides with ranking system <ul style="list-style-type: none"> • Can be distributed in pamphlets, via an app, website, or an ecolabel on product

Table A.1: Certifications vs. Recommendation Lists

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<u>Certifying Organization</u>	<u>Program Description</u>
Marine Stewardship Council	<p>The Marine Stewardship Council (MSC) is a global non-profit and was one of the first certification program created to label fish products as being sustainably caught. It was established in 1997 from a partnership between the Unilever Corporation and the World Wildlife Federation in response to the Canadian Grand Banks cod crisis in 1992 as previously discussed. Their mission was to use a market based approach to address the proliferating issue of unsustainable fishing in order to preserve the supply for future generations. Since its inception, the MSC has grown to be the largest agency certifying sustainably caught seafood. It labels over 10% of the global catch as of March, 2017 which accounts for approximately 9.5 million metric tonnes produced annually. This is approximately double the amount certified in 2010, which only accounted for 5% of the global catch. Their certified products come from 312 certified fisheries as well as 68 fisheries “under assessment” that are located throughout 30 countries. The MSC primarily focuses on the certification of white fish and small pelagic products (European Commission, 2016) and the organization certifies over 55 species of fish. Moreover, in attempts to reduce the occurrence of mislabeling and improve supply chain tractability, the MSC developed a Chain of Custody Standard in 2009. This chain has over 3,700 members that have been recognized as chain of custody certificate holders and the participants include suppliers, distributors, processors, and retailers.</p> <p>https://www.msc.org/</p>
Friend of the Sea	<p>Friend of the Sea (FOS) is a third party international non- profit that aims to conserve the marine habitat (Friend of the Sea Sustainable Seafood - Who we are, 2017). It was founded by Dr. Paolo Bray, who was the European Director of the Earth Island Institute’s Dolphin-Safe Project. The organization aims to follow the FAO guidelines when granting certification to both wild-caught and farmed seafood products. The organization makes a conscious effort to appeal to small scale fisheries, which represent over 50% of their certifications, through an affordable pricing model. Moreover, as of 2016, Friend of the Sea certified more than 500 companies from over 60 different countries, with 88 approved wild fisheries from 45 different countries. In addition, the organization is responsible for the certifying more than 2,000 products that are part of 150 different commercial species. The Friend of the Sea certification scheme operates in direct competition with the MSC and they too place heavy emphasis on chain of custody and traceability. The FOS continues to amass rapid yearly growth, totaling an annual growth of 15% in 2015. Main product certifications include fisheries focusing on supply to the fishmeal industry, but they also certify large quantities of tuna, shrimp, prawns, mussels, and salmon (European Commission, 2016).</p> <p>http://www.friendofthesea.org/</p>

Table A.2: Description of Certification Programs

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Naturland	<p>Naturland is an independent certifier that was founded in 1982 as part of a larger organic farmers association. The organization set standards for various agro products, and this includes setting standards for and certifying various wild caught and aquaculture seafood products on a global scale. The organization has operations in various European countries, as well as in Latin America, and Southeastern Asia. Unlike many other certification schemes, Naturland chooses to embrace a holistic approach to certification that focuses on all three dimensions of sustainability. In order for products to be certified, they must be environmentally, economically, and socially sustainable. Meaning they protect the future fish supply and environment, are economically beneficial to the area in which they are harvested, and the products are captured by fishing operations that abide by fair working conditions. The primary wild-caught products include fish, shrimp, and mussels.</p> <p>http://www.naturland.de/en/naturland/what-we-do/naturland-seafood.html</p>
Iceland Responsible Fisheries	<p>Iceland Responsible Fisheries logo is a non-profit organization that aims to promote stakeholder value for all participating members and to promote its Icelandic origin. The organization was created in response to the release of the Statement on Responsible Fisheries in Iceland of 2007. This statement ensured buyers of fisheries management operations within the nation’s jurisdiction. The statement also showed the government agreement to abide by international law agreements. The first logo appeared on seafood products in 2009, designating the product was harvested by a responsible fishery in Iceland. The program was originally operated by the Fisheries Association of Iceland, however, as of 2011, the brand is now owned and operated by the Iceland Responsible Fisheries Foundation. Each fishery wishing to certify their product must pay a fee to obtain third party certification.</p> <p>http://www.responsiblefisheries.is/</p>
Alaska Seafood Marketing Institute	<p>The Alaska seafood Marketing Institute (ASMI) is a partnership between the Alaskan state government and the Alaska seafood industry, forming a public-private entity. The marketing organization aims to maintain and improve economic development throughout the state, as well as maintain the supply of seafood products within the area, which have always been an integral part of life in Alaska. The organization promotes habitat preservation, resource management, and traceability to ensure the preservation of the local fish supply. Additionally, the organization imposes gear and vessel restrictions for the capture of seafood products, in which all fisheries wishing to bear the ASMI eco-label must abide by.</p> <p>http://www.alaskaseafood.org/</p>

Table A.2: Description of Certification

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Appendix B- Sustainable Seafood Supply Chain



Table B.1: Sustainable Seafood Supply Chain Participants

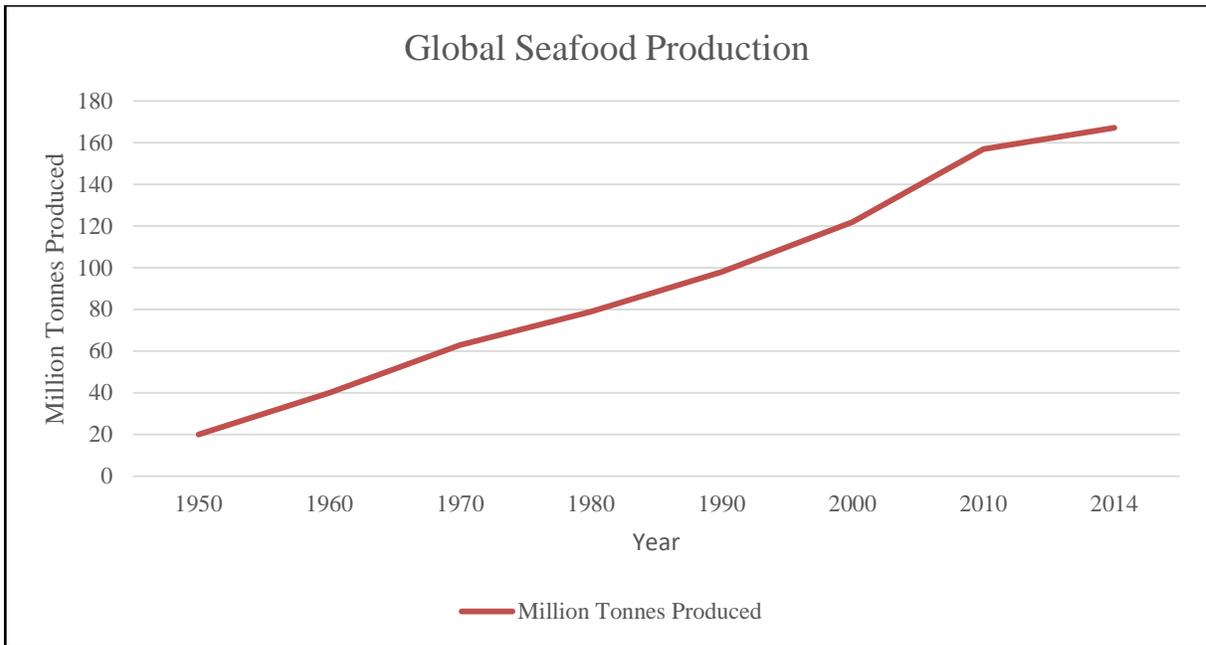
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VALUE ADDED	FISHERIES	CERTIFYING ORGANIZATIONS	GROCERS	RESTAURANTS	CONSUMERS
Price Premium	✓		✓	✓	
Long-Term relationships	✓	✓	✓	✓	✓
Improve Supply Chain Management		✓	✓	✓	
Preserve the Fish Supply		✓			
Improved Source Traceability		✓	✓	✓	✓
Gain Access to New Customer Base	✓	✓	✓	✓	
Differentiate from Competitors	✓	✓	✓	✓	
Create Brand Recognition/Identity		✓	✓	✓	✓

Table B.2: Value Added for Participation in Sustainable Seafood Supply Chain

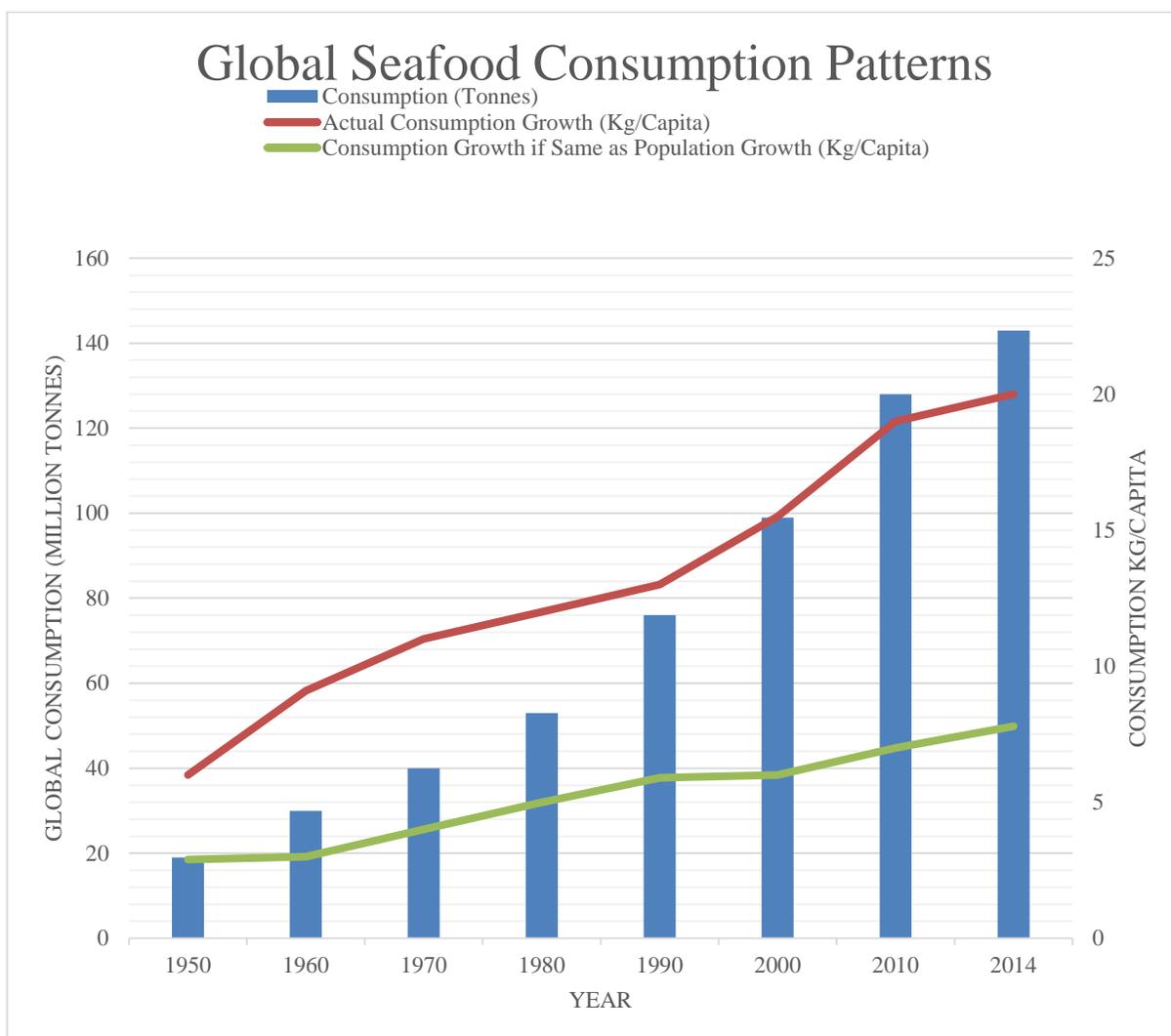
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Appendix C- History of Seafood Industry Graphs



Graph C.1: Global Seafood Production

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Graph C.2: Global Seafood Consumption Patterns

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Appendix D- Literature Review Tables

<i>Certifying Organization</i>	<i># Fisheries Certified</i>	<i># Fisheries using Bottom Trawls</i>	<i>Bottom Trawls % Total Fisheries</i>	<i># Fisheries using Dredges</i>	<i>Dredges as % Total Fisheries</i>	<i># Fisheries using Gillnets*</i>	<i>Gillnets* as % Total Fisheries</i>	<i>% Total High Impact Gear Used</i>
<i>Marine Stewardship Council</i>	312	45	14.42%	23	7.37%	26	8.33%	30.12%
<i>Friend of the Sea **</i>	88	8	9.09%	0	0%	7	7.95%	17.04%
<i>*Includes both midwater and bottom gillnets</i> <i>**Wild Capture Only</i>								

Table D.1: Fisheries Certified Using High Impact Capture Methods

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Greenpeace Grocer Sustainable Seafood Scores					
Policy	93%	66%	79%	69%	64%
Transparency	66%	29%	47%	59%	34%
Initiatives	83%	54%	74%	68%	54%
Red List	57%	66%	76%	59%	67%
Overall Sustainability	75%	53%	69%	64%	55%

Table D.2: Greenpeace Grocer Sustainability Ratings

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Appendix E- Survey

Appendix

Q1 What is your gender?

- Male
- Female
- Do not wish to disclose

Q2 What is your age?

- 18-24
- 25-34
- 35-44 45-54
- 55 or older

Q3 What is your highest level of education?

- Completed some high school
- High school graduate
- Completed some college
- Completed 2 or 4 year college degree
- Completed master's program
- Completed Ph.D.
- Completed medical degree
- Completed law degree
- Other level of higher education

Q4 How often do you eat seafood?

	Never	Less than once a month	1-3 Times per Month	Once a week	Several Times per Week	Every Day
I eat Seafood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5 Have you ever purchased seafood that is certified as sustainable?

- Yes
- No
- I do not know

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Q6 What is your knowledge of sustainable seafood certifications?

- I have never heard of sustainable seafood certifications
- I have heard of sustainable seafood certifications, but do not have any knowledge of them
- I have some knowledge of sustainable seafood certifications
- I am very knowledgeable of sustainable seafood certifications

Q7 I have purchased seafood products with the following labels (click all that apply).

<input type="checkbox"/> 	<input type="checkbox"/> 	<input type="checkbox"/> 	<input type="checkbox"/> 
<input type="checkbox"/> 	<input type="checkbox"/>  Certified from sustainable fisheries www.friendofthesea.org	<input type="checkbox"/> 	<input type="checkbox"/> I have never purchased a seafood product with any of these labels

Q8 What is your attitude towards purchasing sustainable seafood products?

	very unimportant	unimportant	somewhat important	very important	I only buy sustainable products
Purchasing sustainable seafood is	<input type="radio"/>				

Q9 How much more would you be willing to spend for sustainable seafood products?

- No more
- 1% to 5% more
- 6% to 10% more
- 11% to 15% more
- 16% to 20% more
- Over 20% more

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Q10 my opinion sustainably certified seafood products

	Strongly Disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Are healthy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are the same regardless of the organization certifying the products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are caught in a manner that preserves the future supply of fish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are regulated by government	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have a positive economic benefit for the country in which they are harvested	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are only applied to wild caught seafood products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can apply to farmed seafood products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can be traced to their point of origin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Q11 When eating seafood at a restaurant

- I only eat at restaurants that provide sustainable options
- I do not select the restaurant according to sustainable offerings, but I will eat sustainable seafood if it is offered
- I am not concerned with purchasing sustainable options when dining out

Q12 In your opinion, what percentage of the seafood menu offerings should be sustainable seafood products?

- 0%
- 25%
- 50%
- 75%
- 100%

Q13 I eat seafood at the following restaurants (please select all that apply)

- McDonalds
- Red Lobster
- Long John Silver
- Pret-A-Manger
- I do not eat at any of these restaurants

Q14 I am aware of the sustainable seafood products offered at (please select all that apply)

- McDonalds
- Red Lobster
- Long John Silver
- Pret-A-Manger
- I am not aware of the sustainable seafood products offered

Q15 When grocery shopping, I buy seafood products at (please select all that apply)

- Walmart
- Whole Foods
- Target
- Costco
- Stop and Shop
- I do not buy seafood products at any of these grocers

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Q16 I choose to shop for seafood products at the following grocers because I know they provide sustainable seafood options (please select all that apply).

- Walmart
- Whole Foods
- Target
- Costco
- Stop and Shop
- I do not shop for seafood products at any of these grocers

Q17 Please rank these grocers in order of their ability to provide the sustainable seafood product that you desire (With 1 being the best, and 5 being the worst).

- _____ Walmart
- _____ Whole Foods
- _____ Target
- _____ Costco
- _____ Stop and Shop

Q20 Thank you for your participation!

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Appendix F- Findings Tables

	Marine Stewardship Council	Friend of the Sea	Naturland	Alaska Seafood Marketing Institute	Responsible Fisheries of Iceland
GEOGRAPHIC SCOPE					
Global	X	X	X		
Regional					
National					X
Sub-National				X	
ORGANIZATION TYPE					
Public: Government				X	
Private: Industry				X	X
Private: Environmental	X	X	X		
PARTICIPATION					
Open	X	X	X		
Restricted				X	X
PRODUCT TYPE CERTIFIED					
Wild-Capture	X	X	X	X	X
Aquaculture		X	X		
ECO-LABEL					

Table F.1: Organizational Structure of Certification Organizations

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	Marine Stewardship Council	Friend of the Sea	Naturland	Alaska Seafood Marketing Institute	Iceland Responsible Fisheries
ENVIRONMENTAL CONSIDERATIONS					
Carbon Footprint		X			
Gear Restrictions			X	X	X
Habitat Preservation			x	X	X
Traceable Chain of Custody	X	X		X	X
Data Management System	X	X			
Increase Impact Awareness	X	X	X	X	X
SOCIAL CONSIDERATIONS					
Small Scale Fishers		X	X	X	
Human Rights		X	X		
Labor Laws		X	X		
Fair Wages		X	X		
Worker Health and Safety		X	X		
Employment Conditions			X		
Social Programs		X	X		
ECONOMIC CONSIDERATIONS					
Local Economy Support			X		X
Fishing Quotas			X	X	
Price Incentives			X		

Table F.2: Sustainability Criteria for Certifying Organizations

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	Whole Foods	Costco	Target	Stop & Shop	Walmart
Important Dates					
Sustainable Seafood Initiatives Begin	1999 (First)	2011	2011	Not Provided	2006
Sustainable Seafood in Stores					
Single Certifying Organization		MSC			
Multiple Certifying Organizations	MSC, Naturland		Sources certified with MBA yellow or green	MSC, ASC, BAP	MSC, BAP
Recommendation Lists Provided	MBA, Safina Center	MBA	FishWise	(MBA)	
Developed own Sustainable Standard	X		X	X (Sustainable Choice Program)	
Seafood Certified as sustainable	Fresh and Frozen MSC certified or green or yellow by Monterey Bay	Not Provided	97% products certified sustainable, all Target Brand	All Counter Items, Nature Promise, and Stop and Shop Brand	Fresh and Frozen 90% certified or from FIP
Consumer Awareness Initiatives					
Employee Training Program	X			X	
Website	X	X	X	X	X
Weekly Circulars				X	
Blog	X				
In-Store Recipe Cards	X			X	
Signage	X		X	X	
Traceability Technologies	X		X	X	X
Initiatives for the Future					
Long Term Supplier Development	X	X	X	X	X
FIPs Utilized		X			X
Number of Red List Fish Offered	14	9	7	12	9
Sustainability Score Greenpeace	75%	53%	69%	64%	55%

Table F.3: Grocer Sustainable Offerings

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	McDonald's	Long John Silver's	Red Lobster	Pret-A-Manger
Start of Sustainability Initiative	2001	1989	Not Provided	1986
Certifying Organization	MSC	Alaska Seafood Marketing Institute, MSC	Global Aquaculture Alliance, Best Aquaculture Practices	MSC
Types of Products Mentioned as Sustainable	Alaskan Pollock	Alaskan Pollock, Lobster	Maine Lobster, snow crab, shrimp, salmon, tilapia	Salmon, Tuna, Crayfish, Prawns, Crab
% Certified	100% white fish on menu	100% fish products	100% wild caught and farmed fish	100% Menu Offerings
Sustainable Projects	2001 Sustainable Fisheries Program, 2013 MSC products adopted	Aided American Fisheries Act 1998, harvesting efficiency projects, "Think Fish" campaign	FIP Fund, Atlantic Lobster Sustainability Foundation	Menu displays capture methods

Table F.4: Restaurant Sustainable Offerings

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$\alpha \leq 0.05$ $\alpha \leq 0.10$	Average	Standard Deviation	Differences
1. Supply Preservation	5.70	1.10	7,6,5,4,3
2. Healthy	5.51	1.23	7,6,5,4
3. Economic Considerations	5.34	1.13	7,6,5
4. Traceable	5.19	1.19	7,6,5
5. Regulated	4.94	1.45	-
6. Aquaculture Products	4.77	1.35	-
7. Similar	4.64	1.37	-

Table F.5: Significant Differences in Consumer Level of Agreement

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