Exploring the Mismatch between Supply of Fish and Consumer Demand

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Abstract

The goal of our project was to evaluate the factors that influence consumer fish buying habits and to better explain the reasons behind the disparity between the daily fish supply of local fishermen and consumer demand. In order to achieve this we conducted interviews with three professionals with many years of experience within the fishing industry, conducted sampling of specific questionnaires at the Red's Best kiosk in Boston Public Market, and conducted marketing experiments at two local seafood restaurants: The Sole Proprietor and Johnny's Luncheonette. From the data we collected and our analysis, we were able to provide information and recommendations to remedy the unsustainability of the current fishing industry. Our project aims to provide exploratory information that will assist fishermen and seafood distributors in remedying the disparity between the local supply of fish and consumer demand by exploring what variables factor in consumer's decision to purchase fish, allowing for a more sustainable fishing industry.

Executive Summary

The available supply of fish in New England's Oceans is currently depleting. After years of overfishing and high demand for select species of fish, the population of consumer preferred fish are steadily declining. New England fishermen are having difficulty producing large amounts of these preferred fish, but are steadily catching other underutilized fish. There is an abundant populous of these underutilized species of fish but they lack a sustainable consumer demand.

New England's fishing industry has become increasingly unsustainable due to several issues including: Warming Waters, specific consumer demand, lacking fishing regulations, and fish imports. Due to the temperature levels of New England's waters increasing, which causes oxidation levels in the water to decrease, fish have begun migrating north making them less available in local New England waters. The current consumer demand focuses strictly on popular fish species that have become harder to land due to strict environmental regulation and low population levels. In response to these popular fish species having a limited available local supply, a large magnitude of imports of popular fish are taking place. These fish travel an average of 5,000 food miles and are typically sourced from polluted and unregulated waters. Since there is a current available supply of fresh local fish in New England's waters, and no demand for them, our group decided to conduct an exploratory research project on the issue.

Our project goal was to evaluate the factors that determine consumer fish buying habits and better explain the reasons behind the disparity between the daily fish supply of local

fishermen and consumer demand. Our objectives that allowed us to achieve our goals are outlined below.

1. Examining the similarities and differences between the available supply of preferred and underutilized fish.
2. Identifying the variables that influence consumer fish buying habits.
3. Determining the level of influence that restaurants, fish marketplaces and fisheries have on the local fishing industry.

Through interviews with local fishing community figures, we were able to categorize local fish species as underutilized, or consumer preferred. Our group was able to confirm these suspicions through statistical analysis of New England fish landings provided by the National Oceanic and Atmospheric Associations.

After statistical analysis of New England's fish landings, our group was able to identify variables that influence consumer fish buying habits. Our group then contacted three different community figures involved with the local fishing industry. We selected these individuals through the referral of our advisors. We conducted semi-structured interviews each of these figures to compile a list of variables that are thought to influence a consumer when he or she purchases raw fish, or fish at a restaurant. Each individual provided different variables which were taken into account when the team formulated questionnaires used later in the project.

Our interviews revealed that fish consumers ranked influential variables subjectively – different consumers rank variables differently. In order to identify if this is true and determine which variables most affect consumer decision to buy fish, our group decided to sample

consumers and analyze the information we received from our interviews in order to complete our second objective.

The team interviewed fish consumers at Red's Best Kiosk in the Boston Public Market using a questionnaire in order to determine the magnitude of variables that influenced their decision to purchase raw fish. This questionnaire began by asking the recipient to provide their age, zip code, gender, and frequency of fish purchase. Our group sampled consumers who purchased raw fish, or were looking to purchase raw fish. Recipients were then asked to rank variables that may have affected their decision to buy fish. Finally, the recipients were asked about three different underutilized fish, and the variable that deterred them from purchasing them.

In order to test the magnitudes of the variables we compiled for restaurant prepared fish consumers, we collaborated with two restaurants: Johnny's Luncheonette and The Sole Proprietor. Both restaurants agreed to apply a new style of marketing that tested the magnitude of advertisement using menus and specials. Johnny's Luncheonette added menu inserts to their menu of advertising an underutilized fish for a week, then advertised their specials exclusively through conversation with customers.

The Sole Proprietor featured a questionnaire that asked customers what fish they would buy out of a provided list. The list included three underutilized fish, and three consumer preferred fish. The questionnaire then asked the recipient to rank a set of variables that may have influenced their decision to buy a fish. It ended by asking the recipient to cite a variable that deterred them purchasing an underutilized fish in the first section of the questionnaire. In addition, The Sole Proprietor advertised the underutilized fish as "Stuffed Gulf of Maine

Pollock" for two weeks. After this experiment, they renamed the dish as "Blue Cod" and added a lengthy description of the profile of the fish.

The team recorded one hundred different responses from the sampling done at the Red's Best Kiosk. There were ten people who declined to answer. From asking the recipients to gauge how influential the listed variables were on their purchase, we found that consumers at the kiosk valued taste and appearance the most on their purchase as those were the two highest ranking variables through a mean distribution.

Unfortunately, based upon the actual execution of the experiment at the Johnny's Luncheonette, we were unable make any findings. The experiment was shortened and only allowed for one week per advertisement phase. In addition, there were discrepancies in whether or not the waiters and waitresses mentioning the special dish to consumers upon their arrival. At the Sole, we found that implementing the name change and providing a description of the fish was successful. The Pollock dish warranted 94 purchases during the two weeks it was featured on the menu. When the dish was renamed to "Blue Cod," the dish was purchased 241 times, during the following two week period. The team attributed this success to the fact that renaming the dish to include a famous fish name like cod, the consumer assumes that "Blue Cod" is a similar species.

To conclude our project we created a list of recommendations in order to remedy the mismatch between consumer demand and the available supply of local fish. After analysis of our findings, our team developed six recommendations for fish markets and restaurants that sell fish. Our recommendations will assist in remedying the mismatch by increasing consumer awareness and exposure to underutilized fish and the local fishing industry. First, we recommend that fish markets and restaurants provide tasters of underutilized fish to potential customers. We

recommend that fish markets offer paired sales of both preferred and underutilized fish. We recommend that both fish markets and restaurants that sell fish train their employees to be knowledgeable about the local fishing industry and fish available at the specific business. We also recommend the implementation of specific visual and informative marketing techniques for underutilized fish. Finally, we recommend the continuation of this research by future project teams and organizations interested in creating a more sustainable fishing industry.

Through our recommendations we believe that fish markets and restaurants that sell fish will be able raise consumer awareness and expose many consumers to the benefits of purchasing locally available fish. With increased consumer awareness and exposure to locally available underutilized fish, we believe that the threat of a collapsed fish market will be greatly reduced.

Chapter 1. Introduction

The world's oceans are some of the most crucial resources that sustain life on our planet. According to the 2014 State of World Fisheries and Aquaculture (SOFIA), fish accounted for 16.7% of the global population's intake of animal protein (FAO, 2014). The way that the entire ocean's organisms work with one another in all the different ecosystems within our seas is extremely complex. Our seas were once filled with an abundance of many different and unique species of fish, but due to technological advancement in the fishing industry a large portion of these fish have been over exploited and driven to near extinction. The rapid development of advanced fishing technologies and concentrated consumer demand over the past 100 years has depleted much of the world's fish stocks and caused the worldwide fishing industry to gradually become unsustainable.

At the turn of the 19th century, the industrial revolution had finally caught up to the fishing industry and began to alter how people caught and received fish worldwide (Murawski 1999). The revolution brought about the invention of multiple advanced fishing technologies, such as the steam powered trawler, dredges, and purse seine nets. These inventions allowed fishermen to drag massive amounts of fish out from the bottom of the ocean. Fishermen now had the ability to catch thousands of pounds of fish per day with much less effort and time in comparison to their previous methods of catching fish. Although these new technologies supplied food to many populations worldwide, especially the citizens of New England, the

negative effects of these new technologies were noticed soon after their introductions (Murawski 1999).

These new advancements were adopted so quickly and unanimously that they began to acquire more fish from the ocean than could be reproduced. Fish stocks began to rapidly decline until the mid-to-late 1900's when governments worldwide stepped in and set regulations on fishing in order to prevent multiple fish populations and the fishing industry from crashing (Hennessey and Healey 5). Despite multiple countries like the United States implementing fishing regulations, many fish populations continued to be caught illegally or were too exploited to have any sort of quick recovery.

Today, we are still plagued by low fish stocks due to poor regulations, but are also faced with the problem of concentrated consumer demand for fish. In the United States, specifically New England, consumers have been found to prefer buying a select few popular fish such as: cod, swordfish, tuna, and salmon and not very many other available fish (Jared Auerbach, personal communication, 2015). This is a problem because consumer demand is putting pressure on fishermen and fish distributors to supply these high demand fish with strict catching regulations and low populations, when a vast majority of what fishermen typically catch are undervalued, "underutilized" fish (Jared Auerbach, personal communication, 2015).

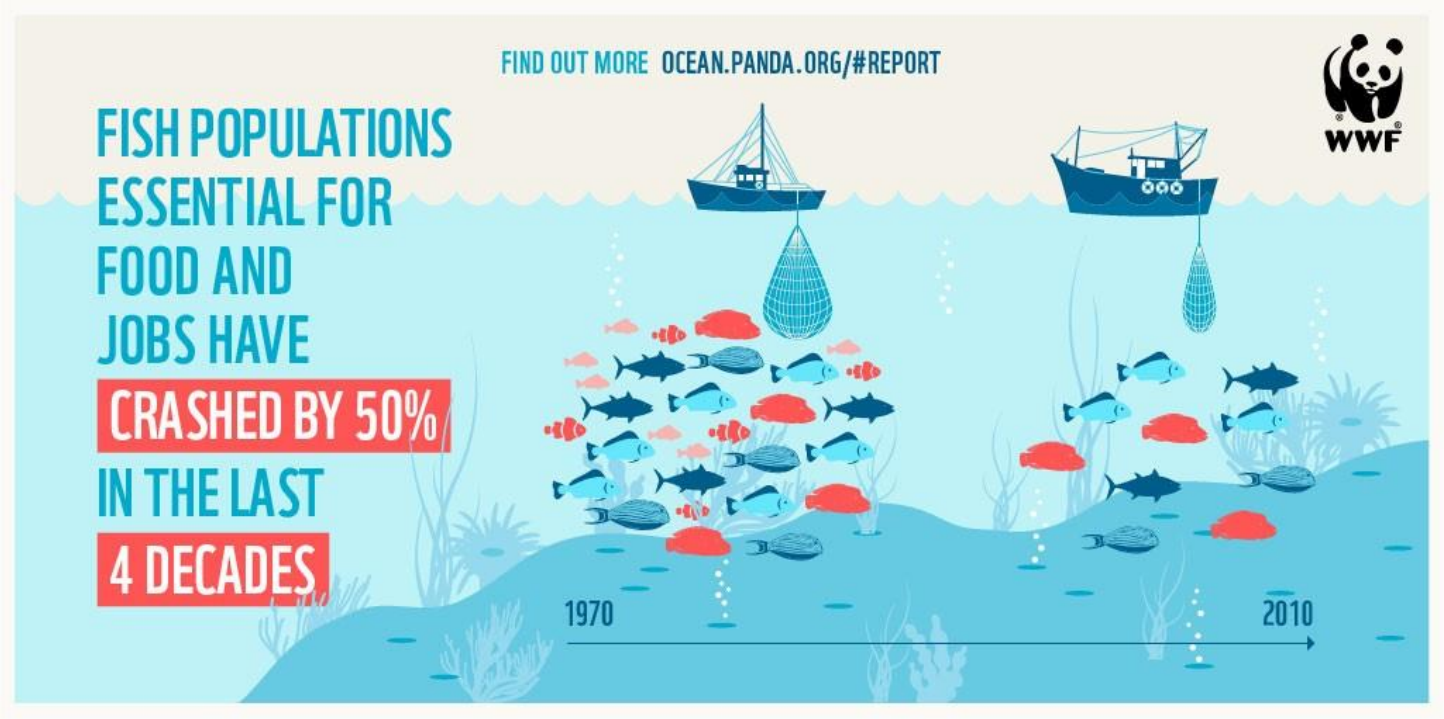

Figure 1. A Diagram Demonstrating the Decrease in Seafood Species from 1970 to 2010. Source "WWF's Living Blue Planet Report finds Essential fish populations crash by 50%," (2015).

Since the demand for certain fish has become so high and their populations so low it has caused a large price margin between preferred and underutilized fish. Actually, in 2015 the average price for scup was less than $1/lb., meanwhile salmon was around $5/lb. (IndexMundi, 2015). Large price differences like this make it difficult for the fishing industry and fishermen to sustain themselves because a majority of what is available and caught are inexpensive underutilized fish such as: skate, redfish, and mackerel. Fish price disparities also make it difficult on highly preferred species of fish such as: cod, swordfish, and haddock because not only do they already have low stocks but are targeted by fishermen in order to make more profit. This means that fishermen catch as much fish as possible in the hopes of catching and selling

more of these preferred species of fish in order to make more profit. Essentially, the mismatch between the available supply of fish and consumer demand has led to an increasingly unsustainable fishing industry. According to figure 2, the value and amount of fish brought to the New England fish market have both dropped significantly from 1975 to 2005.

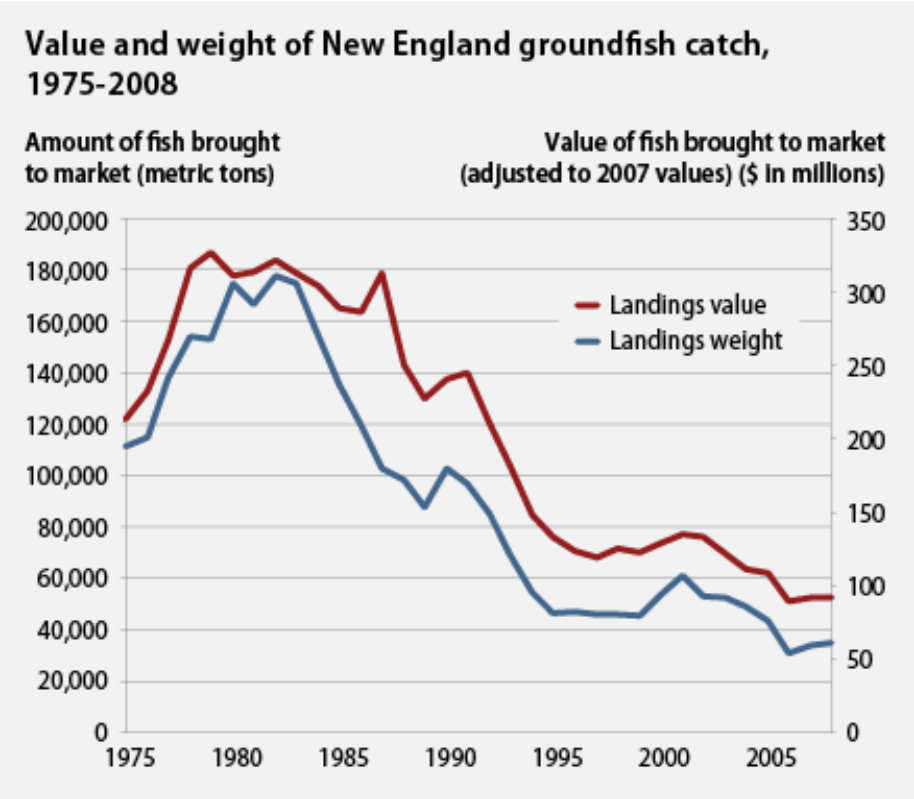

Figure 2. A Graph Demonstrating the Decrease in Seafood Species from 1975 to 2005. Source "Fish on Fridays: Maximizing the Value of America's Fisheries" (2011).

Red's Best, a fishery based in Boston, Massachusetts, has realized the significance of the crash in fish stocks and value, and has begun to investigate sustainable solutions that could remedy the disparity of local fish and consumer demand. The primary stakeholders in this problem are the New England fishermen, who do not have much control over which fish they are

able to catch and bring to a dock on any given day. Red's Best seeks to mitigate this disparity between the local catch and consumer demand by aggregating the daily catch of local fishermen, and by advertising their sustainable fishing practices and high quality product. These tactics allow Red's Best to sell their catch at prices that allow for consigned fishermen to support themselves and their families.

The mismatch also manifests itself in restaurants, and fish markets. Restaurants and distributors are reluctant to purchase different and more sustainable fish breeds due to the lack of demand (Robb Ahlquist, personal communication, 2015). Consumer fish preference makes it very difficult for markets and restaurants to offer or introduce anything other than the few consumer preferred species of fish, and ultimately leaves them unable and unwilling to sell the abundant underutilized species of fish.

In order to assist Red's Best with finding a solution to remedy the mismatch affecting the fishing industry, our project goal was to evaluate the factors that determine consumer fish buying habits and better explain the reasons behind the disparity between the daily fish supply of local fishermen and consumer demand. In order to provide Red's Best with recommendations to correct this mismatch, we studied the current fish market in New England by:

1. Examining the similarities and differences between the available supply of preferred and underutilized fish.
2. Identifying the variables that influence consumer fish buying habits.

3. Determining the level of influence that restaurants, fish marketplaces and fisheries have on the local fishing industry.

The information we collected along with outside research were used as the basis of our proposal to solve this major issue.

Chapter 2. Literature Review

In order to contextualize our project, we have provided information about the current state of the fishing industry and the variables that have affected it over the past century. We first analyzed research on how technological advancement and environmental changes have affected the fishing industry. We then discussed studies pertinent to our project in order to gather information on general consumer demand. Finally, we analyzed different initiatives about consumer food preferences, and suspected causes for concentrated consumer demand in the fish market.

Background

New England Fisheries have a long history of providing food to the region and livelihood for those who work those waters (A New England Food Vision, 2014). The industrial revolution, which had taken place during the mid to late 1800's in the United States, had not affected the fishing industry until the advent the 20th century (Murawski 1995). Once the technological advancements from the industrial revolution reached the fishing industry it began to drastically change the way fish were caught around the world. Before the revolution, most fish were caught through the use of baited lines, dories, and wooden side trawlers (Murawski 1995). These methods were very sustainable for the fishing industry, but the low amounts of fish that were able to be caught made them not very profitable. Steam trawlers were at the pinnacle of newly introduced advanced fishing technologies, and employed very fine trawling nets that were incredibly efficient at catching fish in vastly larger masses than the previously used fishing methods. The sea once provided a bounty of cod, haddock, and flounder -- all fish that are staples of New England seafood. These fish all fall under a category of fish called, "groundfish".

Groundfish are fish that inhabit the floor of the ocean, and are the type of fish that most fishermen aim to catch and sell.

For the past 400 years, increasing populations in New England have required the fishing industry to utilize advanced fishing methods in order to maximize their yield of groundfish (Murawski, 1995). The introduction of innovations such as Britain's steam-powered trawler in 1906 was the start of a huge change in how fish were caught, and quickly replaced the previously used smaller sail-boat fleets. These new trawlers were vastly superior to dories because they could sail faster and further with more freedom from the weather. The trawler's speed coupled with the utilization of small holed nets allowed fishermen to collect and provide more fish to consumers than ever before. Trawlers allow their nets to sink to 3,000 meters, twice the depth of most previously used technologies. An article written by Mark Schrope for the International Weekly Journal of Science states that the doubled reach of the trawlers increased the overall trawled area of the seafloor from 11% to 23%. "Trawling" is the name of the process by which these ships catch fish. Trawling consists of ships dropping large nets weighed down by heavy rollers that are dragged along the ocean floor to trap and collect fish. A visual explanation of trawling is shown by Figure 1 below.

Figure 3. An Example of a Trawler with Gillnet. Source "Insight for the International Fishing & Aquaculture Industry" (2011).

The speed at which engine powered ships could now deliver fish to shore added more value to trawler caught fish because of their freshness. New technologies such as trawlers, dredges, purse seine nets, as shown in Figure 2, allowed for fishermen to both catch and prepare enormous quantities of different breeds of fish while on board, something that was not possible with previous technologies and fishing techniques.

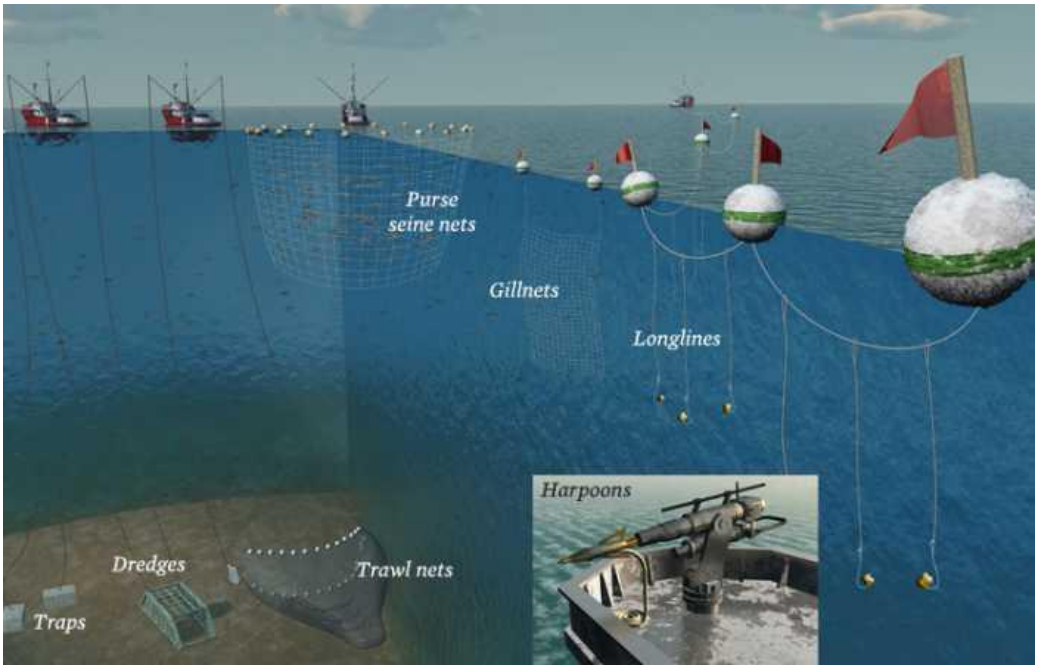

Figure 4. An Artist's Rendition of Different Fishing Technique. Source: " FKP1 – Background" (2015).

Due to rapid technological advancement and utilization of new technology within the fishing industry, the community and overall social dynamics of fishermen were changed forever. With these new innovations, fishermen were able to catch fish in massive amounts with very minimal effort and time. Scientists and officials who saw the trawlers and other new technologies begin to dominate the fishing industry were concerned that these new technologies were too powerful, and could threaten fish stocks. Scientific investigations at the time warned about this and suggested that the new technology be applied judiciously - but the capital that these new technologies brought in caused these concerns to be ignored (Murawksi, 1995). The government continued to invest in the fishing industry, saturating the United State's coasts with expensive technology that would be able to catch more fish than ever before (Hennessey and Healey 8). After the advent of the trawlers, the investments into the New England fishing industry began to be diverted from the purchase and upkeep of new fishing technologies to the

prevention of men and women losing their jobs (Hennessey and Healey 3). In addition to the purpose of investments into the fishing industry changing, the industry changed from focusing on respecting the ocean by taking just what was needed from the ocean to an industry highly focused on the exploitation of the ocean's consumable organisms for capital gain.

The continuous overexploitation of groundfishing has caused many fish populations, such as New England Cod, to be depleted to a fraction of their former population size (Heikkinen, 2015). Results from a 2003 study indicate that the biomass of high-trophic (groundfish) level fish have declined by two-thirds during the period of 1950 to 1999 (Christensen et al. 2002). Experts from the University of Dalhousie actually estimate that that the large predatory fish biomass, as of 2003, is only about 10% of pre-industrial levels (Myers and Worm, pp. 280-230). Based on data from 98 North Atlantic and northeast Pacific populations, a study found that marine fish had declined by a median of 65%, and 28 populations had declined by more than 80% (Reynolds et al, 2005). The populations of many fish have dipped so much so that most fish populations as of 2000 were considered fully exploited, overexploited, or crashed as shown in Figure 5.

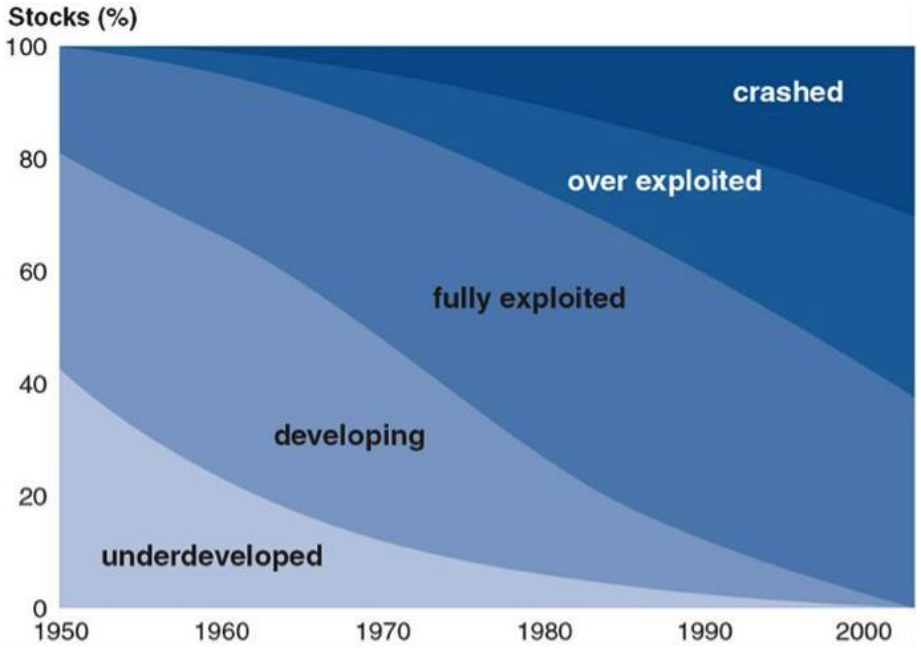

Figure 5. A Graph of Estimated Percent of the Global Catch. Source: " Grida-Arsenal at depths for the years 1950, 2000 and 2004"

The New England fish market, which once had one of the busiest and well known shipyards, has been forced to import and search farther waters for different species of fish in order to yield similar quantities to what they once had during the late 19th and early 20th century because of decreasing fish stocks (Murawski, 1995). One specific example of an extremely decreased fish stock is the total percentage of cod caught in New England between 1990 and 2015 as shown in Figure 6.

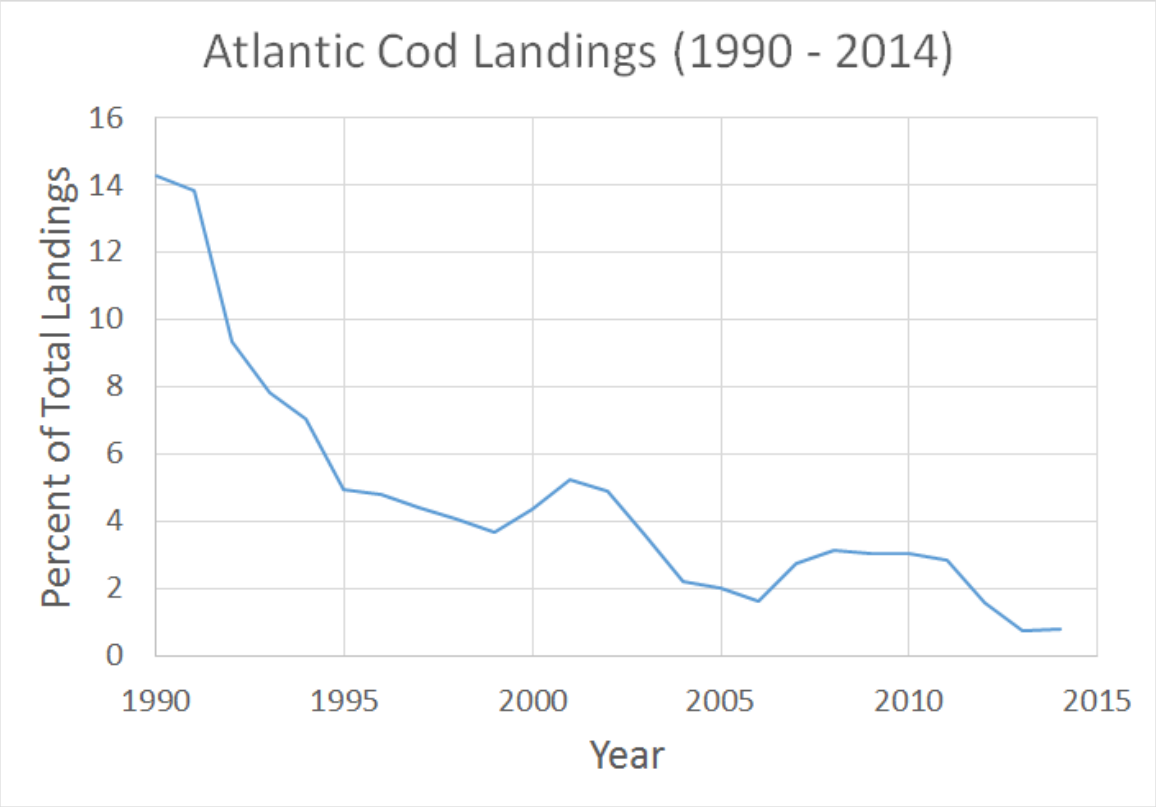

Figure 6. Percent of Atlantic Cod Landings in New England. Source:" National Oceanic and Atmospheric Administration .(2015)"

Saltwater groundfish such as cod typically prefer water that ranges from 32 to 50 degrees Fahrenheit at a depth of no more than 600 feet (Fahay, 1999). With New England's Ocean waters

warming over the past century, fish such as cod are gradually becoming unable to inhabit the New England coast any longer. Data collected about Greenland glaciers shows that these large ice masses are now melting, which indicates that the climate in this region is changing (Ice Sheets and Rising Seas, 2015). The data indicates that the overall climate around the Atlantic Ocean is warming and causing the sea-surface temperature (SST) to also rise. The temperature changes observed so far in the North Atlantic have been an increase of about 0.5°C (Increasing Sea Temperatures Already Causes Changes in Distribution of Marine Life , 2015). As a result, many fish populations are migrating from their current waters to the cooler more suitable northern waters ("Ice Sheets, Rising Seas and Global Warming", 2015). Increases in temperature are expected to continue, with a possible annual average increase of 6°C north of the latitude of Scotland by 2100 which, if it occurs, will lead to increased poleward movement of marine organisms (Increasing Sea Temperatures Already Causes Changes in Distribution of Marine Life, 2015). Figure 7 displays the northern migration of Atlantic fish so far from 1958 to 2002.

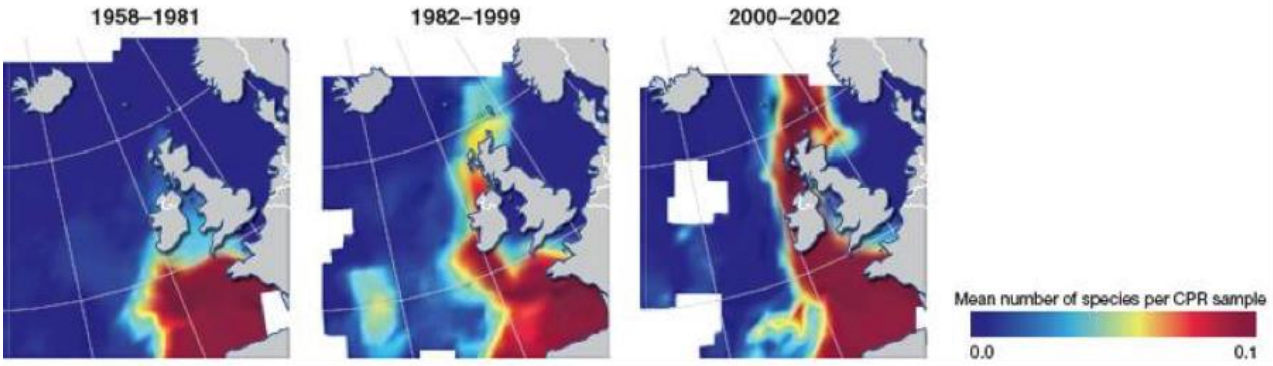

Figure 7. An Example of Global Heat Map of Migrating Sea Life in Europe. Source: " GRID-Arendal."

The search for a new habitat forces fish out of shallow, fishable waters and into more remote deep waters (Goode, 2015). The warming oceans have specifically forced cod to migrate

toward colder and deeper waters that are filled with predators, which present an increased threat to their already low population. With these fish now at a higher mortality rate and too far away for New England day fishers and trawlers to reach, the available fish populations are declining while other usually underutilized fish are thriving in its absence (Goode, 2015).

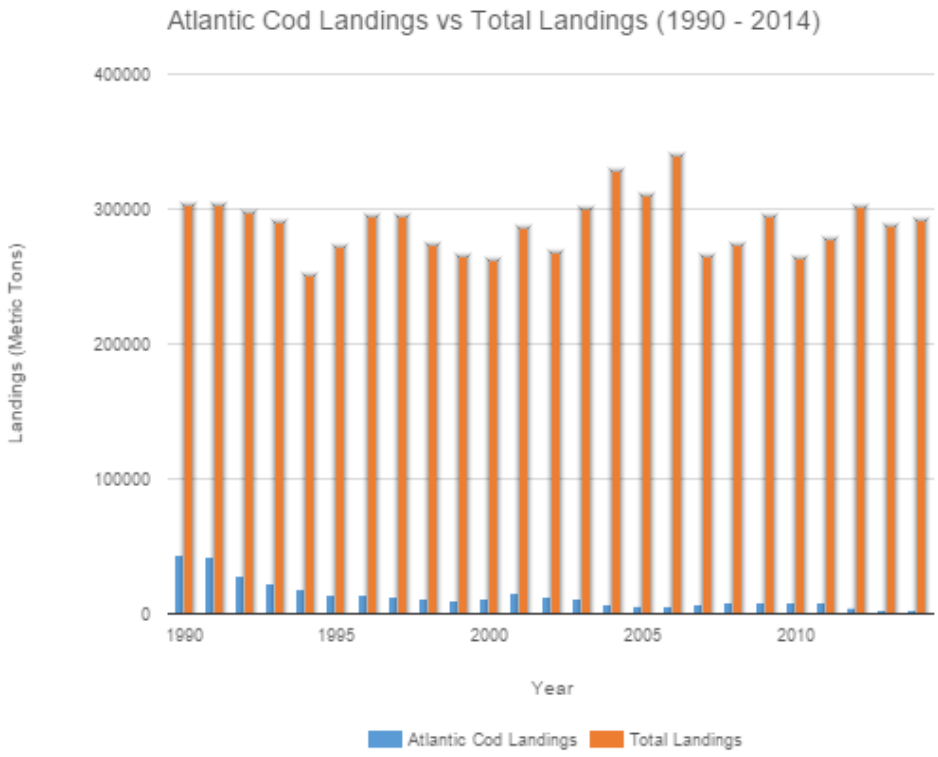

Figure 8. An Example of Cod Landings. Source: " National Oceanic and Atmospheric Administration. (2015)"

Warming seas are not only causing fish to migrate, but are also preventing many fish populations to rebuild to more sustainable levels. Direct effects of changes in ocean temperature have indicated to and may alter the physiological functions, behavior, and demographic traits of fish (Dohey et al, 2012). These effects lead to shifts in the size structure, spatial range, and seasonal abundance of fish populations (Dohey et al, 2012). According to research done by the

GMRI, University of Maine, Stony Brook University, the Bigelow Laboratory for Ocean Sciences, and NOAA's Earth System Research Laboratory, increasing water temperatures have reduced the number of new cod produced by spawning females (GMRI, 2015). Specifically, cod's larval stage is a very fragile phase in their life cycle so even slight rises in temperature put their early development and lives at risk (Goode, "Cod's Continuing Decline Linked to Warming Gulf of Maine Waters").

Their study also suggests that warming waters led to fewer young fish of multiple species surviving to adulthood. Less and less groundfish are reaching maturity thus causing their species to become rarer for New England fishermen. Many models used in 2010 to set fishing quotas did not take into account the negative effects that rising sea temperatures have on fish populations, so although fishermen stayed within their regulated catch quota, more fish were taken than some populations could sustain.

In an effort to bring fish populations to sustainable levels for fishing, government regulations have been implemented in order to prevent fishermen from driving specific species of fish to extinction. In the United States there are two sets of regulations on fishing, Federal and State, where Federal regulations always supersede the State. Only when certain species are not specifically managed by federal regulations are when states have the authority to extend regulations to residents of that state or vessels landing a catch in that state.

Government regulations restrict fishing using five categories: seasonality, fish size, amount of fish, method of catching, and fishing location. The United States has placed regulations on these five categories because these are the 5 ways in which fishermen are able to exploit certain populations of fish. Each breed of fish's regulations are unique to their specific species, and fish whose populations are dangerously low, such as Atlantic salmon, are protected

and are prohibited from being caught completely (National Oceanic and Atmospheric Administration 2015). An example of a regulation on a threatened species of fish is cod, where anglers are only allowed to catch 200 lbs. of it per day (Massachusetts Executive Office of Energy and Environment Affairs 2015). Certain fish also have restrictions on how they are required to be caught, such as only being able to be caught using the rod and reel technique. Regulations like these do help fish in rebuilding their populations and staying at sustainable levels, but also ends up driving up the price of these fish due to the difficult nature of catching them. Other forms of regulation include time constraints, for example, during striped bass season anglers are only allowed to fish on Tuesdays and Thursdays (National Oceanic and Atmospheric Administration, 2015). A few Federal finfish regulations for 2015 are presented in Figure 9 where season (fishing year), minimum size of fish (size limit), amount of fish (quota), and method of catching (gear) are all taken into account (Mid-Atlantic Fishery Management Council, 2015).

SPECIES	FISHING YEAR	INITIAL QUOTA*	SIZE LIMIT	GEAR	REMARKS
(F) Summer Flounder	Jan. 1 - Dec. 31	11.07 million pounds	14"	5.5" minimum diamond mesh; 6" minimum square mesh.	State-by-state quotas.
(F) Scup	Jan. 1 - Dec. 31	21.23 million pounds (Trimesters - see REMARKS)	9"	5.0" minimum diamond mesh; Gear Restricted Areas (GRA): Northern GRA restrictions from Nov 1 - Dec 31. Southern GRA restrictions from Jan 1 - Mar 15.	TRIMESTER QUOTAS & POSSESSION LIMITS: Winter I: (Jan-Apr) 9.58 million pounds (45.11%); 50,000 pounds per trip possession limit reduced to 1,000 pounds when 80% of the commercial quota is projected to be taken. Summer: (May-Oct) 8.27 million pounds (38.95%). Winter II: (Nov-Dec) 3.38 million pounds (15.94%); 12,000 pounds per trip possession limit. Possession limit will increase by 1,500 pounds for each 500,000 pounds unused Winter I period quota transferred to Winter II.
(F) Black Sea Bass	Jan. 1 - Dec. 31	2.21 million pounds	11"	4.5" minimum diamond mesh; Pots/Traps: circular vents: 2.5", square vents: 2", rectangular vents: 1.375"x 5.75". Two vents required in parlor portion of pot/trap.	State-by-state quotas.
(P) Bluefish	Jan. 1 - Dec. 31	5.119 million pounds**	none	none	State-by-state quotas.
(F) Surfclams	Jan. 1 - Dec. 31	3.400 million bushels	suspended	none	Individual Transferable Quotas (ITQ).
(F) Ocean Quahog	Jan. 1 - Dec. 31	5.333 million bushels	none	none	Individual Transferable Quotas (ITQ); Maine Ocean Quahog Quota - 100,000 Maine bushels.

Figure 9. An Example of Underutilized Fish Regulations. Source: " Federal Finfish Regulations. (2015)"

These regulations are critical because they make sure that fish are not caught in excessive amounts and not before maturity so that they have the opportunity to breed. On the other hand, there are certain species of underutilized fish that lack strict fishing restrictions and have abundant populations due to low consumer demand. These fish are so abundant, that they generally have little to no regulations.

Institutions such as the National Oceanic and Atmospheric Administration (NOAA) want to protect marine fisheries, wildlife, and habitats by strictly enforcing government regulations and international treaties concerning fish. NOAA sends out vessels to patrol United States waters to inspect and monitor fishing vessels in order to ensure that no regulations or laws are broken. In addition, the administration allows anyone to report violations in order to help NOAA reach their mission of being responsible for the stewardship of the nation's ocean resources and their habitat.

At the beginning of 1971, the United States deemed it necessary to split from the International Commission for the Northwest Atlantic Fisheries in order to protect and regulate its shores. Following this separation, the United States claimed rights for the bordering sea up to two hundred miles offshore (Hennessey and Healey 8). This proclamation was made in response to Eastern European fishing vessels that were thought to be overfishing U.S. shores. New England groundfish had first become regulated in 1977, when the quota for Cod had been filled by the month of June (Hennessey and Healey, 7). From 1977 to 1982, regulations on quota were enacted in order to prevent fish stocks from collapsing further. However, in 1982, these quotas were concluded due to noncompliance from fishermen (Hennessey and Healey 3). During 1982 to 1991, the government began to subsidize loans that allowed old fishing vessels to revamp old fishing vessels with more modern and environmentally safe equipment (Hennessey and Healey

8). From 1992 onward, the United States government has appeared to separate itself from the fishing industry by letting NOAA and state regulations govern the U.S. shores.

Today, New England fishermen are dealing with a combination of low fish stocks due to continued overfishing, migrating fish stocks, strict fishing regulations, and concentrated consumer demand for fish. For the past few decades, consumer demand for fish has become concentrated on select fish such as: Cod, Salmon, and Swordfish. Most fishermen do not target specific species of fish to catch due to the difficulty of accurately locating groups of specific species, but instead tend to catch whatever is available during their trip out to sea. Fishermen catch many different species of fish when they take their trips out to sea, but due to the factors listed above like concentrated consumer demand, it has become difficult for fishermen to make profit on anything besides a small group of high demand fish. Because a majority of fishermen's catch are usually these lower demand underutilized fish, price margins like these make it difficult for fishermen to sell their catch, obey regulations, and make enough capital to sustain them whether they sell their catch at popular fish markets or through fisheries.

Since consumers strongly prefer a few specific species of fish, fishermen have begun to try and stay away from catching mostly underutilized fish and instead focus on catching more consumer-preferred species of fish. During 2014, well known fish such as Black Sea Bass were fished to 121% of their given quota, while undervalued fish such as dogfish reached merely 26% of their quota (Massachusetts Executive Office of Energy and Environment Affairs 2015). In 2014, the average percentage of potential harvest for Redfish, Mackerel, Dogfish, Whiting, and Pollock all together were less than 30%, as shown in Figure 10 (GMRI, 2015).

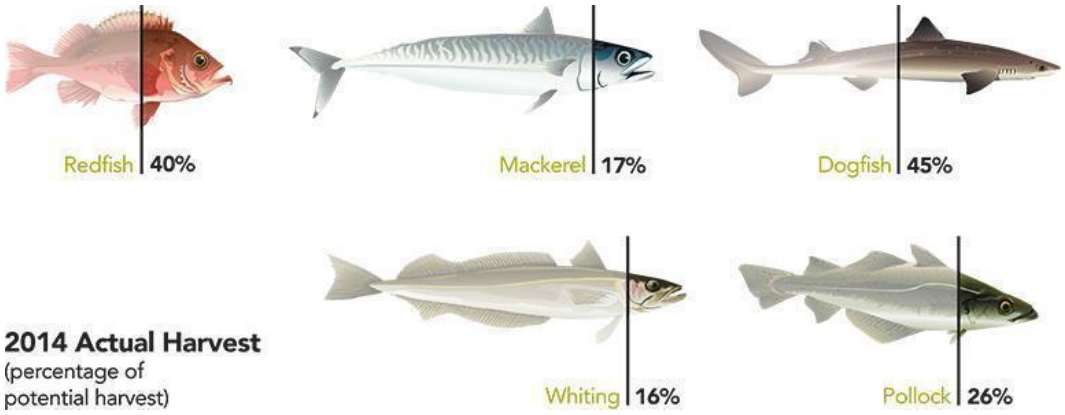

Figure 10. An Example of Harvest of Underutilized Whitefish. Source: " the Gulf of Maine Research Institute. (2014)."

This indicates that 70% of the available fishing quota for these underutilized species of fish was left untouched by fishermen due to the lack of consumer demand. Dogfish is a good example where the level of consumer demand has left a breed of fish almost completely unwanted, although chefs who have worked with dogfish compare it to working with the popular Mahi Mahi (GMRI, 2015). Consumer demand has become so specific that many underutilized species of fish have decreased in price because of low demand, while the price of other more popular fish has risen because of high demand and low supply.

With fishermen unable to consistently supply large amounts of well-known fish, fish distributors are forced to import fish from foreign countries. Accounting for 69.5% of all groundfish available in the United States, China has become the main provider of groundfish to United States distributors ("Groundfish - June 2014" 2015). Due to the nature of importing these fish from other countries, fish that once populated the New England shorelines have become expensive to both obtain and handle. Because the New England consumer's preferences are met by imports, much of the United States' domestically caught fish are exported around the world. In 2013, 5.5 billion dollars worth of fish were landed in the United States. Of that 5.5 billion

dollar sum, 5.19 billion dollars' worth of that fish were exported to other countries. Actually, more than 85 percent of the fish and shellfish consumed by the United States are imported. Without consumers having a change in their preference to local fish that are easier to obtain, the prices of these preferred fish are likely to continue rise for consumers.

The fact that New England consumers seemingly only want certain popular species of fish is of concern because it is causing the fishing industry to become increasingly more unsustainable. This problem is severe and incorporates multiple related issues, but it seems that there could be a possible solution within the consumer level of the fishing industry. Through an analysis of multiple fish markets, a book published by the University of Chicago Press in 1993 found that consumer preferences varied between different groups of consumers and that these preferences had the ability to change over time (Kinnicun et al. 1993). With the issue of unsustainable fishing rapidly becoming more known to the public, many people and organizations are acting to attempt to solve this problem.

Multiple organizations and initiatives have acknowledged this issue, and have set out in order to solve this mismatch between consumer demand and available supply. One such initiative is the Gulf of Maine Research Institute's, "Out of the Blue" campaign where they have begun to try and redistribute consumer demand more evenly within the New England fish market by promoting the consumption of the less popular but more sustainable fish found off the coast of Maine. In an effort to change consumer preference, the Out of the Blue campaign focuses on making these underutilized fish available and promoting them to the public. The GMRI's restaurant, institution, and retail partners work together to provide information, recipes, and cooking tips for these lesser known fish. They also provide opportunities to try these fish at special dinners hosted by GMRI's many culinary partners that have committed to promote

responsibly harvested seafood from fishermen and purveyors. Many institutions and campaigns have implement methods such as these in order to spread consumer demand more evenly throughout the fish market.

There is limited knowledge as to why consumer demand has become so focused on so few specific breeds of fish, but there is analysis available on current consumer bias and what perceptions the majority of the New England population have about fish. According to, "A New England Food Vision" most people have never learned the basic skills for handling and cooking unprocessed or minimally processed fish (A New England Food Vision, 2014). Analysis from, "A New England Food Vision" also indicates that consumers are not as familiar with fish in comparison to other foods such as beef or chicken. It has been speculated that most consumers of fish are also unaware that local fish have seasonal availability like many agricultural products.

Case Studies

Many studies have been done on various situations of mismatched supply and demand problems throughout the world in a variety of industries. Our team has researched some of these studies in order to learn about data collection methods and important tactics in trying to correct a mismatch of supply and demand.

Organic Food - Consumer Bias Case Study. A United Kingdom-based research report enumerated contributing factors of organic food purchase for consumption such as, "health consciousness, the assumed higher health value, as well as social aspects like support of local farming, fair trade and – further down the scale – environmental protection" (Foster and Padel, 2005). The report details several outcomes that heavily relate to our group's study. The research focused on both frequent and infrequent buyers of organic food. Their methodology included the use of the laddering interview technique. For their ladder interviews, subjects were prompted

with a question about their general opinion of organic food; after they answered they were asked why they felt that way. This technique focused on providing interviewers with more qualitative responses to better understand consumer biases about organic food purchasing.

The study focused on the entire spectrum of organically processed foods. The sampling proved that participants seemed to be knowledgeable about fruits and vegetables being organically processed, yet lacked awareness about the actual meaning of the word, "organic" concerning meat and dairy products. One of the major repeated occurrences of the study was that people generally associated the word, "organic" with healthy. Some of the consumer perceptions observed about organic food were that the caliber of food was overly expensive and exclusive. Understanding and accurately identifying consumer biases, similar to the United Kingdom's study, will allow our team to be able to understand and address New England consumer biases about fish.

This case study also reported on several perception barriers. Barriers include the issue of high price along with, "access and availability, visual product quality and presentation, mistrust of organic food in supermarkets, eating habits and lack of cooking skills" (Foster, Padel, 2005). These reported characteristic barriers are of significant interest because they confirm certain consumer behaviors. If any behaviors exist in our target group of consumers, then it is critical for our group to determine and understand these perception barriers.

The organic food initiative is plagued by consumer doubt and lack of knowledge. As such, this type of food is often overlooked. It is likely that many aspects of consumer preference towards different types of fish will be parallel with the consumer preference towards organic foods. Based on the observation that consumers seem to lack specific knowledge of organic foods our group hypothesizes that this lack of knowledge is comparable to the Red's Best case.

Both cases seem to involve understanding consumer-buying habits. What constitutes a consumer's decision to buy is often reflected by price and quality; consumers need to sense quality somehow in order for a perceived high price to be considered worth it.

Taiwanese "Warm Meat" Case Study. A Taiwanese study of consumer meat purchasing habits centered on, "warm meat," meat that has been immediately sold after butchering, was conducted in order to determine consumer purchasing behaviors. This case study was constructed using interviews of a random sample of consumers in Taiwan who purchase meat. More specifically, this sample group included local persons with families who cook and purchase meat for consumption regularly. The alternative is frozen prepared meats purchased in supermarkets. After compiling information through interviewing, some consumer preferences were revealed. Overall, the major preferences the interviewees reported as reasons to buy or not to buy, "warm meat" were the trust in the legitimacy of the source, choice of meat, and independence in purchasing product, and availability of butcher assistance with preparation.

Common factors of consumer preferences to deter from supermarkets are the mistrust in labeling practices and in supermarket corporations in general. Consumers who purchased meat through traditional markets, as opposed to supermarkets, generally had more concern for their, "consumer-producer relationship rather than in the production system itself" (Jen, Wang, 2015). If the consumer trusts the producer, then the consumer will likely trust the way the food is being produced and be more inclined to purchase the food. Many interview participants stated that they give little thought to where their respective meat is produced. Local markets can obtain such information from butchers while supermarkets only have what is written on a potentially untrustworthy packaging.

Comparatively, our study and the Taiwanese case study both require research to be conducted in order to understand consumer trends and potential reasons consumers may have for purchasing food products. This research case supports the assumption that consumer trends are a result of consumer baseline knowledge of source and quality of meats. In terms of our project with Red's Best, there is a current consumer base that purchases a certain amount of popular fish while underutilized fish that consumers are unaware of are consumed in vastly lesser quantities. A similarity between both cases is the necessity to have a good understanding of consumer-buying habits, understanding trends, and addressing the question of; why all people do not buy local fresh food if it is assumed to be healthier or a more trustworthy source by consumers.

European Fruit and Vegetables Case Study. The International Food and Agribusiness Management Review aggregated data from 40 different databases and studies from 1998 to 2007 regarding organic fruit and vegetable consumer purchasing habits. The aggregation of data was made in an effort to verify credence attributes of produce, as well as discover new and hidden attributes.

Moser's study suggests that, sensory appeal, price, and organic characteristics dominated the United States, Argentina, and Australia's general consumer buying habits. Sensory characteristics such as: visual, smell, and taste attributes proved to be the strongest variables that influence consumer's decision to buy sustainable food and vegetables (Moser, 2011). Organic, pesticide free, and grown-locally were also strong variables that influence consumers. The study concluded that the European culture values pesticides-free, locally grown and other sustainability characteristics less than the nutritional and sensory characteristics of food and vegetables (Moser, 2011). This is important for our group to take note of and understand, because it

demonstrates the possibility for consumers to make food purchasing decisions based off of sustainability characteristics as opposed to sensory characteristics.

In our project, the team has focused on structuring the hierarchy of variables that affect consumer preference. From this report, we are given a basis of which variables may have strong influence on consumers. The data also offers a peek into consumer psychology in the United States - providing us possible techniques to explore, such as publicizing the sustainability of a product. The study is similar to our project, however, we are searching for a solution to the mismatch between available supply and consumer demand. Fruits and vegetables are seasonal, similar to some fish, but are able to be imported during off season months. This aggregation of data may infer the strongest and most influential variables for fruits and vegetables, but we will test if these variables also hold true with fish.

The study not only discussed the hierarchy of consumer selection of food variables across the world, but also consumer knowledge. The consumers of the United States seemed to not be knowledgeable of what some key phrases definitions were. For example, Americans did not know that, “organic,” and, “pesticide-free” are the same characteristic of food (Moser, 2011). In our project, we will gauge consumer knowledge by interviewing distributors and providing questionnaires to consumers to correctly identify their opinions in the data that we collect.

Consumer Behavior at Indian Fish Retail Outlet. In 2011, a study was conducted in India detailing consumer purchasing behavior at a upper-middle class seafood retail outlet. The team employed two different surveys in an effort to capture concrete quantitative data, as well as open ended questions to understand consumer’s pre conceived notions of fish stored within ice chests (Mugonakar, Kumar, Krishnan, 2015). A majority of customers visited the outlet with a frequency of once per week. On average, most people bought between one and two pounds of

fish at the store. The study enumerated and tested the validity of eight different variables, including: quality, nutritional value, price, convenience, and brand name. 96.4% of people interviewed at the outlet indicated that the quality of fish as the strongest influence on their decision to buy, the second being nutritional value at 92.2% (Mugonakar et al., 2015). In our project we have accumulated list of possible variables that affect consumers decision to buy, very similar to this study's. We believe that in the United States the weight of these variables will be different, but that it is important to learn how the data from this study was gathered and how their population differs from our target population and why.

Chapter 3. Methodology

We met with our sponsor at the start of the project in order to understand the concerns and interests of Red's Best, which allowed us to formulate our goal and objectives. This interview allowed us to improve our original idea of objectives and methods through Jared Auerbach's experience with this mismatch. Based on our initial meeting we established the goal of our project: To evaluate the factors that influence consumer fish buying habits and to better explain the reasons behind the disparity between the daily fish supply of local fishermen and consumer demand. To accomplish this goal, we developed the following objectives:

1. To examine the similarities and differences between the available supply of preferred and underutilized fish.
2. To identify the variables that influence consumer fish buying habits.
3. To determine the level of influence that restaurants, fish marketplaces and fisheries have on the local fishing industry.

Objective 1: Differences and Similarities between Underutilized and Preferred Fish

In order to identify the similarities and differences between the available supply of preferred and underutilized fish, it was first necessary for us to determine which species of New England fish are consumer preferred and underutilized. We interviewed our sponsor, Jared Auerbach, the CEO of the Red's Best fishery. From this interview we were able to obtain relevant and current information about the available supply of fish and the local fishing industry. This interview was semi-structured which allowed an interactive process in which we addressed important questions we had about the project. This interview along with publically available New England landings data provided by NOAA, allowed our group to determine which species of fish were underutilized and preferred by consumer..

We then had a list of consumer preferred and underutilized fish available in the New England area. Our list of underutilized fish solely included locally caught fish and our list of consumer preferred fish was made up of both local and imported fish (APPENDIX E). We compared our lists of fish with landings data for New England from NOAA. The NOAA landings data along with information we received from our research and interviews helped us formulate questions designed to get consumers to compare preferred species of fish to underutilized local fish that are of consistent supply. Our initial interview with Jared Auerbach also revealed potential variables that affect consumer fish buying habits along with the issues that Red's Best has experienced while attempting to sell all of the different types of fish that they land.

Objective 2: Variables and Biases that Affect Consumer Fish Purchase

With extensive information about the similarities and differences between preferred and local underutilized fish, our group focused on our second objective: to identify the variables that influence consumer fish buying habits. In order to complete this objective, our group contacted three different community figures in the local fishing industry. We selected these individuals as a convenience sample and through the referral of our advisors: Sue and Art Gerstenfeld. The group then conducted three semi-structured interviews with these community figures using open-ended questions to gain insight on what these variables were. From there, we created questionnaires and restaurant experiments to determine the implication of potential variables.

Interviews with Local Fishery and Fish Restaurant Owners. Our project team initialized our interviewing process by first determining that it was a necessity to have all of our interviews formatted as semi-structured. This would allow us to gather more information by

accounting for further discussion that strict pre-determined questions may not have covered. Our project team concluded that it would be most valuable to our study if we asked each interviewee about what their respective ideas were on what the most pertinent consumer purchasing variables and biases were as well as what trends they have seen over time in the fishing industry and their businesses. We conducted each interview with all of our group members present for each one. During these interviews we had two members of our group taking detailed minutes of the conversation while our other two members asked specific open ended questions and held conversation with our interviewees.

The interview process began with again interviewing Jared Auerbach. Jared's extensive fishing background and owning his own seafood aggregator caused our group to consider him a valuable person to interview and get insight. During our interview with Jared we asked him what he suspected to be the most important variables that affect consumer fish purchases were. Our group was provided with a variety of information pertaining to trends of the availability of cod, scup, skate, and mackerel. We also received information on Red's Best's past initiatives to change the names of certain undervalued fish items to observe if sales increased after renaming the fish on the menu.

After interviewing Jared Auerbach, we contacted Karen Masterson-- co-owner of Johnny's Luncheonette located in Newton, Massachusetts. Johnny's Luncheonette is a casual diner that prides themselves on their initiatives to acquire all of their produce, meat, and fish from local sources; Johnny's Luncheonette's fish comes from Red's Best. Masterson spoke in great detail about her knowledge of fish consumer perceptions and biases. She stated that consumers in New England often assume that the all fish that they buy are caught in local New

England waters. Masterson also stated that consumers familiarity with fish is one of the most influential variables of consumer fish purchasing in restaurants similar to hers.

The last person we interviewed was Robb Ahlquist, who is the owner of the restaurant, The Sole Proprietor. The Sole Proprietor is a four-star seafood specialty restaurant that only purchases and sells fresh fish from nearby landings that are in season. This fresh, local, and sustainable approach to seafood motivated our group to meet and interview him. From our first semi-structured and open ended interview with Ahlquist we spoke of several topics including how certain fish species' popularities have changed over time, how the preparation and handling of fish dramatically affects their flavor and overall quality, and how the variables that affect consumer fish purchases varies between fish markets and restaurants.

From all three of our interviews along with our research, we established a list of possible variables that affect consumer fish purchases for both fish markets and restaurants. Our interviews revealed that all consumers rank influential variables differently into account when making decisions to purchase fish depending on where they make the purchase. In order to identify if this is true and determine which variables most affect consumer decision to buy fish, our group determined it would be most effective to sample consumers and analyze the information we received from our interviews in order to complete our second objective. Our team then created two different questionnaires to sample the Red's Best Kiosk and the Sole Proprietor.

Sampling of Fish Consumers. After we completed our interviews, we had enough information that led us to formulate two questionnaires that would be useful in discovering variables and consumer biases of fish purchasing. These two questionnaires were drafted under

the premise that we wanted to gauge consumer preferences of fish and how certain variables are weighted in consumers' minds. Our group developed with the variables that we tested in the questionnaires through the information gathered through our interviews with Ahlquist, Masterson, and Auerbach.

The team decided to sample fish consumers at the Red's Best Kiosk in Boston Public Market through the use of a questionnaire. We determined that fish markets and restaurants were the institutions that had most effect on consumer fish purchasing. The team sampled customers through the use of a questionnaire in the vicinity of the Red's Best retail outlet in the Boston Public Market. The questionnaire was administered to one hundred people who were interested in purchasing, or have purchased raw fish from Red's Best. These sampling sessions took place on Fridays, Saturdays and Sundays. Based on metrics from Red's Best, these days of the week have the largest number of individual purchases. We made sure to ask every consumer to not answer the survey multiple times on different days. This questionnaire spanned several evaluations including a ranking system for consumers to record specific variable's influence and recording of reasons for not purchasing specific underutilized fish in regards to consumer raw fish buying purchases. The team constructed cues (see Appendix C) dictated to recipients who did not understand our questionnaire. dictated to recipients who We began each questionnaire by asking each consumer about basic demographic information concerning their age, gender, and zip code to determine if any of our findings correlated with this data. We also asked each consumer about the frequency of their fish purchases. The next portion of our questionnaires determined how influential the suspected variables were on consumers. We then ended each questionnaire by asking participants to include any additional information that they felt was noteworthy that the questionnaire may not have covered.

To sample restaurant consumers, we collaborated with Robb Ahlquist of the Sole Proprietor to implement our questionnaire that was made specifically for restaurant consumers. The questionnaires were brought to consumers by waiters and waitresses of the Sole Proprietor to fill out after they finished eating and are waiting to pay their bill (See Appendix A). In order to ensure quality sampling practices, Ahlquist educated his staff to be knowledgeable of project's purpose and the goal of the experiment conducted at his restaurant. Ahlquist instructed his staff to make sure consumers did not fill out the survey multiple times, and to let people know they could say no to filling out the questionnaire and to record the number of number of people who refused to answer the questionnaire. This questionnaire was first completed by twenty fish consumers during the late half of December. This period was the pre-sampling of this questionnaire. This segmented period gave us feedback from Robb and his staff about the data received and how well the surveys were completed.

After we reviewed the results of the pre-sample, we conducted the actual sampling of restaurant consumers at the Sole Proprietor during the month of February.The questions covered the same demographical information listed previously, a section allowing consumers to rank the respective variables we compiled through our discussions with Auerbach, Ahlquist, and Masterson. In addition, the survey included a table that allowed a consumer to select certain variables that may have prevented them from buying different species of different fish. The fish included in the questionnaire were carefully selected from the fish we determined were underutilized as well as available to Ahlquist. All of this data was aggregated, into its own excel document that was fully reviewed by our team. To ensure accurate data collection and maintain the high integrity level of our data, one member entered in all of the Red's Best questionnaire results and later was verified by another team member who checked for data entry errors.

Our other questionnaire was targeted for consumers at the Red's Best kiosk, as the kiosk acts as a fish market that also offers prepared meals. At this Kiosk consumers have the option of ordering from various raw fish and shellfish and some of the many takeout options such as fish and chips, fish sandwiches, and fish tacos. We compiled our first iteration of this survey by focusing on asking consumers demographic information; their reason for going to the kiosk; their order and the quantity; their influence of the same selected variables from the menu questionnaire; and their list reasons they had not purchased certain of the undervalued fish available at the kiosk. The team conducted a pre sample for the The Red's Best Kiosk Questionnaire (See Appendix B) on a Friday. From the Kiosk's retail data we received from Jared Auerbach, we learned that the largest number of purchases at the Kiosk take place from Friday to Sunday. The team received forty responses from customers at the kiosk for the iteration of the pre-sampling of this respective survey.

In order to receive more relevant and potent data, we reworded our question, "What most affected your decision to buy the fish that you did today?" to "What most influences your decision to purchase fish in general?" In addition, we added, "Texture" to our list of variables that were included in our questionnaire as well including it within the table of variables that prevent a customer from buying specific underutilized fish. After reading How to Conduct your Own Survey by Priscilla Salant, we concluded that we needed to sample at least 100 consumers to compile relevant data (Salant and Dillman, 43). To ensure that we fully investigated this consumer group we made sure to sample on Fridays, Saturdays, and Sundays when most fish purchases occurred at the Kiosk.

Restaurant Experiments. In order to identify the variables that influence consumer's decision to buy fish, the team conducted two separate interviews with Karen Masterson and Robb

Ahlquist, owners of the two New England seafood restaurants we used in our study. We discussed suspected variables we obtained from our community fishing community figure interviews with each of them and returned with the following list of variables: appearance, the price of fish, taste, texture of the fish, the name of the fish, ease of preparation, knowledge of the species of fish, the nutritional value of the fish, and the environmental sustainability of the fish. In addition to drafting a list of variables, both Masterson and Ahlquist agreed to pursue experiments to quantify the magnitude of these variables. The experiment at Karen's restaurant, Johnny's, began the first day of February 2016 and consisted of two different phases that each lasted for two weeks. In the first phase, an insert was placed in each menu that debuted an underutilized fish as a special dish. These inserts were placed within the cover of the menus until removed at the completion of phase one's duration. The following two weeks included the menu item only listed on the specials board at the front of the restaurant. During both phases the Johnny's employees were instructed to mention the featured fish upon the customers receiving their menus. After Karen's data was given to the team, the results from each phase was compared to see which way of advertising the fish was more effective. The experiment conducted at Robb Ahlquist's restaurant, the Sole Proprietor, was designed to be similar to the Johnny's Luncheonette experiment in that it had 2 phases. However, in this experiment, the staff at the Sole proprietor delivered a single questionnaire (see Appendix A) to all of its customers during both phases. This questionnaire asked the recipient to choose a fish out of a column containing three underutilized and three environmentally unsustainable fish. The recipient then was able to choose one preparation out of six in another column. Similar to the Red's Best Kiosk Questionnaire, the recipient then ranked different variables on a scale of one to five, including a "non-applicable" option. The questionnaire then asked the recipient whether or not price factors

into their decision when purchasing fish in a restaurant. The recipient then provided reasons for not purchasing each of the underutilized fish featured earlier in the questionnaire. The questionnaire ended by categorically asking where the customer was coming from (home, class, or work) as well as asking to the recipient to provide their zip code. Using pollock, a underutilized fish breeds, the experiment featured dishes that had detailed descriptions at the top of the menu for two weeks. At the end of these first two weeks, the Sole Proprietor still offered the specials but advertised the specials through word of mouth from the waiters and waitresses.

Objective 3: Evaluating Influence of Restaurants and Fisheries on Consumer Preference.

One of the most essential aspects to this project is the impact of initiatives at various levels of the fishing industry. We investigated these initiatives on two facets, the fishing restaurant level as well as at the distributive level through interviews and restaurant experiments. This overall investigation led to insight and pertinent information regarding the impact that each level of the fishing industry had on the consumer market. After the methodology for objective one and two were completed, the team was able to complete objective three.

Comparing Data from the Restaurant Experiments and Kiosk Questionnaire. Our conversations with Robb Ahlquist and Karen Masterson helped us to design an experiment in which consumers were offered a dish featuring an underutilized fish. These experiments that were conducted at the Sole Proprietor and Johnny's Luncheonette allowed us to compare the magnitude of influence of fish markets and restaurant have on consumers. Both restaurants were selected because they encompass both fish specialty restaurants, as well as the casual atmosphere of a diner. The Sole Proprietor and Johnny's Luncheonette provided data of purchases from restaurants that supply fish items and fish specialty restaurants.

The Sole Proprietor experiment provided extra data for restaurant consumers by administering a menu questionnaire designed to evaluate consumer preferences, knowledge, and the variables that determine respective preference in fish.

Chapter 4. Findings

As a result of our methodology, our findings were developed through two questionnaires and two different restaurant experiments spanned across Red's Best Fish Kiosk, Johnny's Luncheonette, and The Sole Proprietor. Our group sampled 110 consumers at the Reds Best kiosk to determine how raw fish consumers purchase fish. We utilized Johnny's Luncheonette to conduct a restaurant experiment, to understand how advertising an item in a different areas affects its respective sales. Lastly, the wait staff at the Sole Proprietor aided us by administering our restaurant questionnaire to 127 restaurant consumers. The Sole Proprietor also completed the aforementioned restaurant experiment that showed us the power of attaching a narrative to fish items on the menu of a specialty restaurant.

Red's Best Kiosk Questionnaire

In order to ensure our kiosk questionnaire spanned a useful array of findings, our group made sure to only sample consumers who were purchasing raw fish at the Red's Best kiosk. The kiosk also sells made to order food item purchases and our presampling suggested that these people had a less robust opinion about raw fish then the customers purchasing raw fish. Our questionnaire assesses relevant information of fish consumers of specific consumer group as every nearby establishment is a local holistic food sourced kiosk spanning coffee to livestock. As such, there was likely bias from the type of individuals that visit the Boston Public Market since the location exclusively features outlets from local food producers. Note that all distributions involving kiosk respondent counts or response frequencies are out of the total population of respondents, which is 100.

Demographic Findings. For the implementation of our Kiosk Questionnaire we approached 110 consumers for interviews at Red's Best Kiosk in the Boston Public Market, and

received a total of 100 responses between December 2015 and January 2016. With a response rate of 90.9 percent, our questionnaire data displays less bias from self-selection, or the decision of whether or not to participate in the interview. Males and females were equally represented in our data - 52 percent of the respondents being female and 48 percent male. Many ages were represented by our respondent population, as shown below in Figure 11.

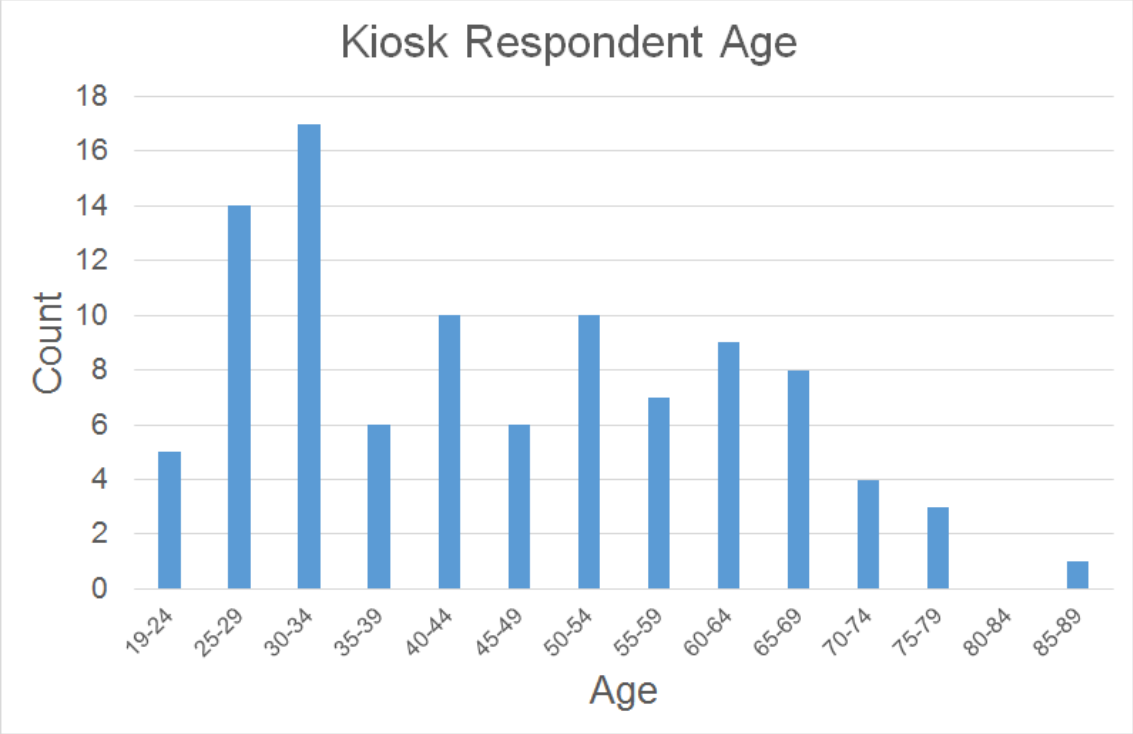

Figure 11. Distribution of Consumer Age

The average consumer respondent age was 45 years old with our youngest and oldest respondents being 19 and 89 years old respectively. It is also notable that 50 percent of our respondents were between 31 years old and 59 years old. The age demographic most represented in our questionnaire were 30 - 34 year olds. This data shows that young adults (19-24) are less likely to purchase raw fish.

Most respondents from the kiosk purchased fish frequently, which we defined to be once per week or more. 73 percent of respondents purchased fish at least once per week, and 89

percent of respondents purchased raw fish at least once every other week. The distribution of our respondent fish purchasing frequency is shown in Figure 12.

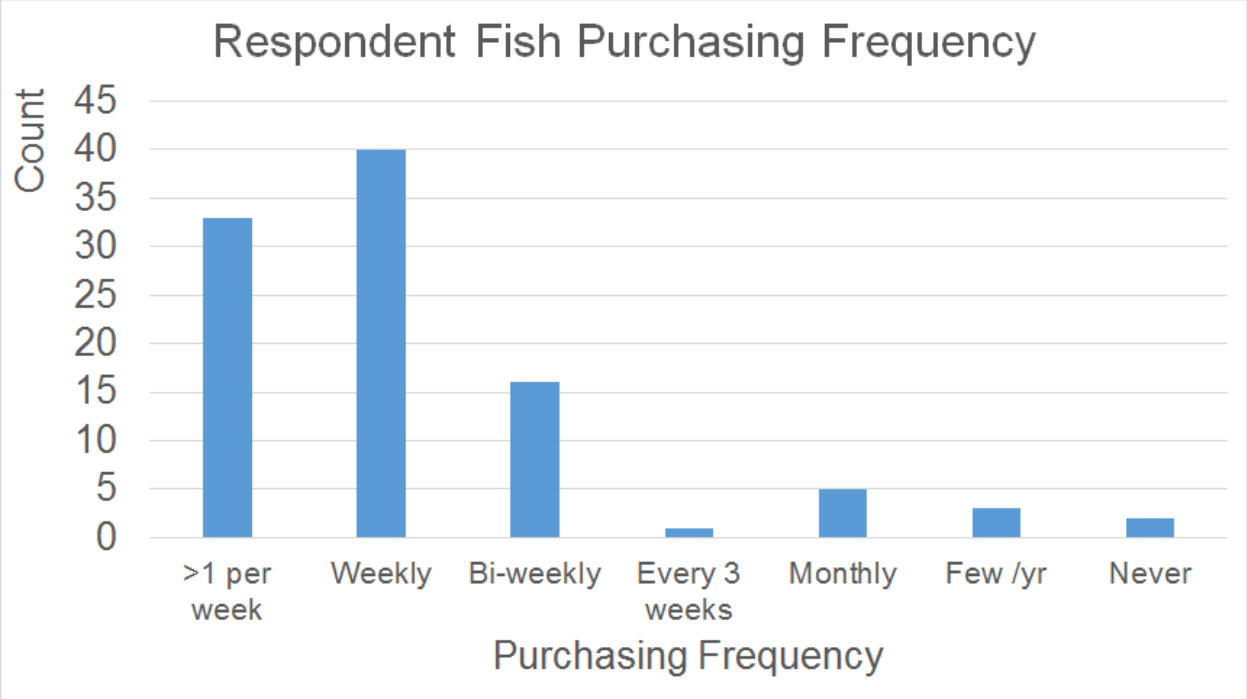

Figure 12. Kiosk Respondent Fish Purchasing Frequency.

The distributions of respondent gender, age and raw fish purchasing frequency indicate that the population that visits Red's Best's kiosk in the Boston Public Market is evenly comprised of males and females between about 25 and 80 years of age that purchase fish once per week or more.

Variable Ranking Findings. A likert scale was used in our questionnaire to understand what variables most influence a consumer's decision to buy fish. We asked consumers to rate a set of variables from 0 (not influential) to 5 (extremely influential) to gauge how influential the listed variables were on their purchase at the Red's Best Kiosk. On average, consumers at the kiosk valued taste and appearance the most on their purchase as those were the two highest ranking variables with mean influence ranking values of 4.48 and 4.23, respectively.

Rank	Variable	Mean Consumer Score	Standard Deviation
1	Taste	4.5	1.1
2	Appearance	4.2	1.1
3	Environmental Sustainability	3.8	1.4
4	Nutritional Value	3.7	1.6
5	Texture	3.6	1.4
6	Knowledge	3.5	1.4
7	Price	2.9	1.5
8	Ease of Preparation	2.8	1.7
9	Name	1.6	1.7

Figure 13. Variable Rankings Table.

Since taste is the highest ranked variable, that implies that a consumer has tried a particular fish and can compare that taste to the taste of other fish. Although, many consumers have no knowledge or have never tried many of the available underutilized fish. This leads us to believe that the actual taste of certain fish may not be the driving variable of consumer fish purchases but more so the perception of the taste quality of each fish, instead.

The data we collected also showed that consumers valued environmental sustainability nearly as much as taste or appearance, and was the third highest ranked variable as shown below in Figure 14.

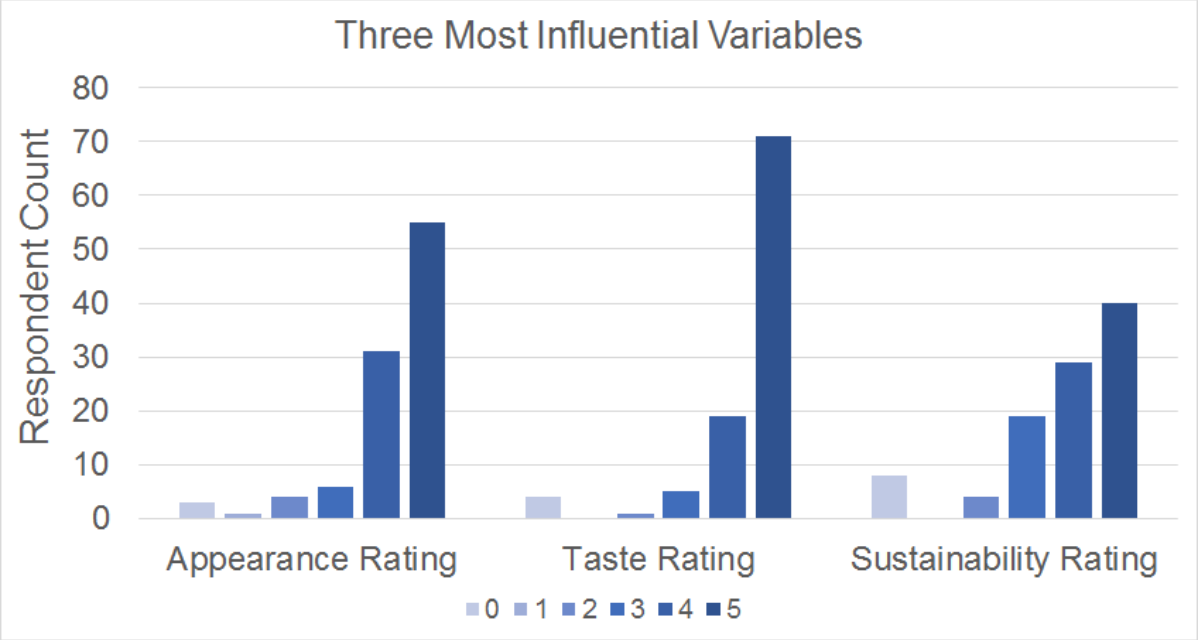

Figure 14. Top 3 Variables Ranked by Kiosk Consumers.

We believe this might be due to a bias from the type of individuals that visit the Boston Public Market since the location exclusively features outlets from local food producers.

Most respondents from the kiosk indicated that they either cared about how easy certain fish are to prepare, or were ambivalent when considering a purchase at the kiosk. It is notable though that there is a certain portion of consumers who are concerned with the ease of preparation for certain fish. This is important because it reveals that offering underutilized fish that are simple to prepare may have more success in sales compared to fish that are difficult to prepare for consumption.

Research and interviews have suggested that different types of consumers may care about price, how easy to prepare a fish is, or whether or not a fish is locally sustainable when considering purchasing fish than other types of consumers. In order to determine if different types of consumers have different purchasing habits or biases towards certain factors when considering purchasing fish, we analyzed the relationships between consumer traits such as age,

gender and how often they purchase fish against different factors or variable rankings. Visual analysis of plots of key consumer traits like age, gender or frequency of purchase against variable ratings such as price, ease of preparation and environmental sustainability have suggested that there is no significant correlation between any of these traits and any of these factors. Figure 15 conveys that consumer traits have no visual correlation with the importance of price when considering purchase of fish.

Figure 15. Plot of respondent age against price ratings.

In order to confirm that there is no significant relationship between these traits and factors, we ran Chi-Square tests for independence on these pairs. Each Chi-Square test indicated that there was no significant relationship between these trait/variable pairs. Age, gender and frequency of purchase were found to have no significant effect on consumer purchasing bias at Red's Best's kiosk.

Finally, we also found it extremely notable that employees were able to strongly influence consumer's decision to purchase fish. We noticed this through observation and verbal feedback from many respondents of our questionnaire. Many respondents indicated that the kiosk employees were very helpful in assisting them make their fish purchase decision by giving them information on the available fish items.

Fish Deterrent Variables Findings. For the final portion of our kiosk questionnaire we included a multiple choice table that evaluated the reasons why consumers did not purchase certain underutilized fish. The table gave consumers the option to choose any of the variables listed in our previous Likert scale for why they did not choose to purchase 3 specific underutilized fish. In the event that a consumer had purchased one of the 3 fish listed in this section then we left the portion of the table blank where they would indicate why they did not purchase that fish as it would not be applicable to them.

We found that most consumers did not choose to purchase mackerel, skate, or redfish due to a lack of knowledge of these species and because they believe that they are difficult to prepare, as seen in figure 16. This suggests that many consumers are not purchasing different species of fish because they do not know enough about them, which means increasing the overall knowledge or educating consumers about different species of fish (particularly underutilized species) may create more interest in the underutilized fish.

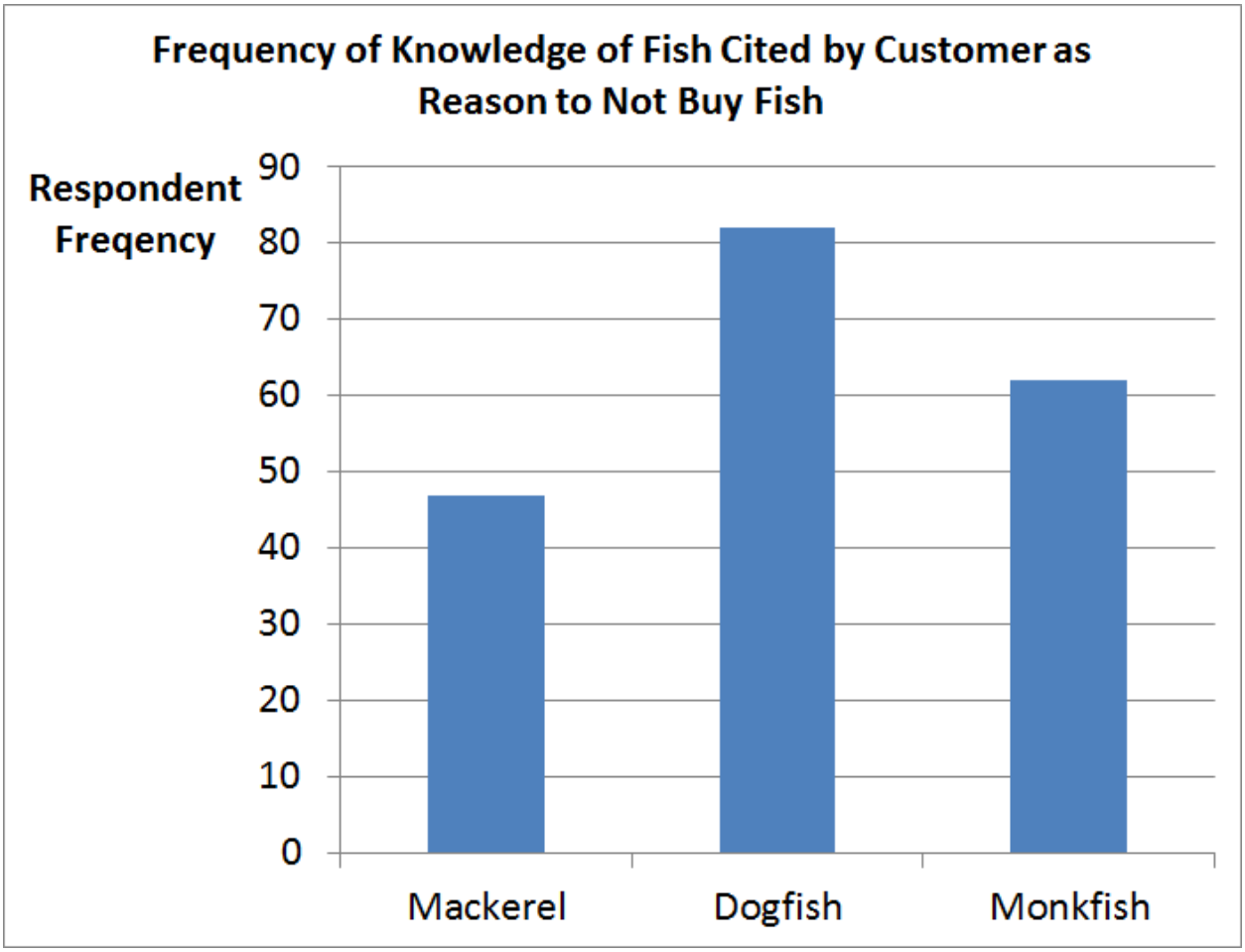

Figure 16. A Histogram comparing the frequency of the reasons consumer did not buy a fish.

Johnny's Luncheonette Experiment

This experiment was intended to test the effectiveness of two specific sales approaches by evaluating and comparing the change in sales data for Johnny's Luncheonette during the experiment. The experiment was made up of two parts with each part running for an entire week. The first half of the experiment consisted of placing a paper insert on the front of every menu advertising a special dish featuring the underutilized fish pollock. The second portion of the experiment consisted of removing the inserts from the menus and instead posting the dish on the restaurant's "specials board" and having the servers talk to customers directly about the dish upon arriving at their table. The information delivered to us by the co-owner of Johnny's

Luncheonette, Karen Masterson, consisted of twelve specials being sold the first week and ten specials sold the second week.

Based upon the execution of the experiment at the Johnny's Luncheonette, we were unable to utilize the information we received. The experiment only spanned two weeks in total, which we determined was too short to rely on data concerning the implementation of a new food item. We were also unable to verify the consistency of the wait staff mentioning the special dish to consumers upon their arrival. There was also no way to determine how the wait staff spoke about the specialty item as there were no cues or script assigned to them. Based on these factors we felt that the data we received from Johnny's Luncheonette was unreliable and inconsistent.

The Sole Proprietor Experiment

In order to evaluate the variables that affect consumers decision to buy fish in restaurants, we worked in collaboration with The Sole Proprietor to conduct an experiment that was made up of two parts and spanned a total of 28 days. The first part of the experiment consisted of featuring a new underutilized fish item on The Sole Proprietor's menu for two weeks. The second part of the experiment was exactly the same as the first, but also included a brief story about the underutilized fish item featured on The Sole Proprietor's menu. Due to it's availability, pollock was chosen to be the featured underutilized fish on The Sole's menu. Throughout the experiment The Sole Proprietor also distributed a questionnaire created by our team to all of their customers (Appendix A). The questionnaire was administered by employees of The Sole Proprietor who received training to be knowledgeable about the fish and our specific project.

Questionnaire Findings. Our questionnaire was comprised of three primary sections which included a hypothetical scenario for choosing a specific fish meal, Likert scale, and

multiple choice data table. We collected a total of 127 responses for the restaurant questionnaire from The Sole Proprietor which we were able to receive data from and analyze.

From the responses received we found that both salmon and swordfish were the most preferred fish among respondents when given a list of both underutilized and preferred fish to hypothetically choose as a meal option from. Salmon was the most preferred fish with 49.6 percent of respondents selecting it as their hypothetical fish of choice. Meanwhile, dogfish proved to be the least preferred fish with a total of 0 respondents selecting it as their hypothetical meal option as shown in Figure 17.

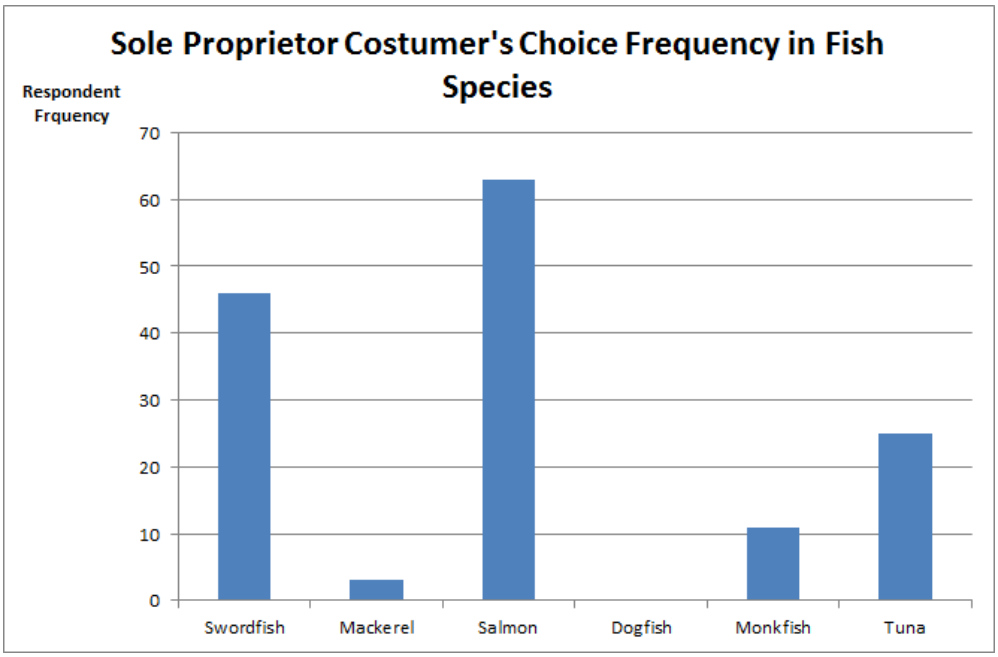

Figure 17. A Histogram Showing the Frequency of Fish Selected in the Restaurant Questionnaire.

In total we found that 90.5 percent of respondents selected a preferred fish for their hypothetical meal of choice, while only 9.5 percent of consumers selected an underutilized fish item. This data not only verifies that consumers strongly prefer certain species of fish and almost completely ignore others, but also leads us to believe that the reason people chose these

overexploited fish may be due to the popular opinions surrounding them. The questionnaire also asked consumers whether or not price affects their decision in buying fish at a restaurant. Out of 127 responses, 47 recipients answered yes, and 61 answered no. 19 people provided no response to this question.

Exactly like the results of the Red's Best Kiosk Questionnaire, taste was the the highest ranked variable by respondents in the Likert scale portion of the questionnaire. Taste, nutritional value, and texture were the top three highest ranked variables as shown in Figure 18.

Rank	Variable	Mean Consumer Score	Standard Deviation
1	Taste	4.5	1.1
2	Nutritional value	3.7	1.3
3	Texture	3.7	1.3
4	Knowledge of fish	3.5	1.5
5	Appearance	3.2	1.5
6	Ease to Consume	3.0	1.5
7	Environmental Sustainability	2.8	1.6
8	Name	2.3	1.7

Figure 18. A Table Listing Variables and Their Mean Consumer Influence and Standard Deviation.

Similar to what we mentioned in our Kiosk Questionnaire findings, taste, nutritional value, and texture imply that a consumer has knowledge of or has tried a particular fish and can compare the taste of each fish. It is interesting to note that the name of the fish is the least influential variable ranked by respondents. This is notable because it may suggest that the name of the fish is not a significant variable but that the perception consumers associate with the overall profile of certain fish is significant.

Sales Findings. We found this experimental tactic of item advertisement to be a successful and a reliable source of information as the experiment was administered in an appropriate way. The Sole Proprietors employees are knowledgeable about fish and were trained on what to say about the fish item. Specifically, the fish item used was pollock based and showed an increase in sales once the tactic of adding a narrative was implemented. The sales data stated that after the first two weeks the Sole Proprietor sold 94 dinners and once the tactic was implemented and the Sole Proprietor changed the name of Pollock to "Blue Cod" the sales of this item increased to 241 dinners sold over the following two week period. This displays the immense success of this tactic in improving the sales of an underutilized fish product. This experiment also display the clear benefit of giving a narrative to an individual fish and highlighting it on a menu in order to generate sales. We believe that by using the name "Blue Cod," the dish exploits the consumer's knowledge of cod, a very well known and high quality fish, and entices consumers who enjoy cod to buy the dish. We also believe that the name of the fish is the variable influencing the consumer the most in this experiment. Our reason for believing that name is a confounding variable stems from our findings in Figure 14, where consumers ranked name with an average score of 2.5 on a likert scale.

Chapter 5. Recommendation

After thorough analysis of our findings, our team developed six recommendations for fish markets and restaurants that sell fish. The primary goal of these recommendations are to assist in remedying the mismatch between consumer preferred fish, and the abundant supply of local underutilized fish. Our recommendations will do this by increasing consumer awareness and exposure to underutilized fish and the local fishing industry. We first recommend that fish markets and restaurants provide tasters of underutilized fish to potential customers. We recommend that fish markets offer paired sales of both preferred and underutilized fish. We recommend that both fish markets and restaurants that sell fish train their employees to be knowledgeable about the local fishing industry and fish available at the specific business. We also recommend the implementation of specific visual and informative marketing techniques for underutilized fish. We provide specific examples of these techniques that would increase public awareness and appeal to consumers. Since this is an exploratory project, another deliverable of this project is data that can be utilized by fish markets, restaurants, other external organizations, and other project teams looking to continue our research. Finally, we recommend the continuation of this research by future project teams and organizations interested in creating a more sustainable fishing industry.

Through our recommendations we believe that fish markets and restaurants that sell fish will be able raise consumer awareness and expose many consumers to the benefits of purchasing locally available fish. With increased consumer awareness and exposure to locally available underutilized fish, we believe that the threat of a collapsed fish market will be greatly reduced.

Fish Tasters at Restaurants and Fish Markets

Based on information we received from our experiment at The Sole Proprietor and the Red's Best Kiosk questionnaire, we recommend that fish markets and restaurants provide tasters of underutilized fish to potential customers. Our findings suggest that consumers do not purchase fish that they are unfamiliar with or not attracted to. A major in effect was that consumers are unwilling to risk wasting time and money on something they are unfamiliar with or have no knowledge of. We believe that consumers will be best educated about the quality and benefits of purchasing local underutilized fish markets through free fish tasters (Figure 19).

Figure 19. Image of Example Fish Taster

These fish tasters would consist of offering small portions of fully prepared fish to potential consumers, and could be implemented at both fish markets and restaurants. Fish markets would offer the sampler to anyone who walked in close proximity of the shop. This would expose people that try the tasters to many underutilized fish, and we expect to also entice them to purchase said fish. These fish tasters can also be used in restaurants as a means to introduce underutilized fish to customers looking to make a purchase for immediate consumption. For both

locations, we also recommend that the underutilized fish given away in tasters also be available as its own purchase option at the specific locations.

Fish Pairing Sales at Fish Markets

Based on information we received from our experiment at The Sole Proprietor and the Red's Best Kiosk questionnaire, we recommend that fish markets offer paired sales of both preferred and underutilized fish. We expect that providing paired sales of these fish will help expose customers to different fish. Using the data in Appendix E.2, which highlights differences in breeds of underutilized fish, we suggest holding sales in which when purchasing an unsustainable preferred fish, the customer also receives a free amount of an underutilized fish "similar" to the desired fish. This recommendation would remove the financial fear of purchasing a fish that may be unappetizing to the customer.

Employee Training Advertising Tactic

While conducting our questionnaire and experiments, we noticed that employees have the capacity to greatly influence a consumer's fish purchase, especially those who have not come to the market with a recipe in mind. Based on the data from our experiments and questionnaire, we recommend that both fish markets and restaurants that sell fish train their employees to be knowledgeable about the local fishing industry and fish available at the specific business. Employees would be trained on the available fish so that they could be effective in proactively suggesting fish items to consumers upon their arrival. This would give even more exposure to many underutilized species of fish and in turn increase sales of said fish at the specific restaurant or market.

Visual Advertisement of Fish at Fish Markets

Due to our discovery that appearance is a major influence in the average consumer's decision to buy a fish, we recommend that fish produce be displayed in fillets with skin and flesh exposed in fish markets as shown in Figure 20.

Figure 20. Example Fish Market Display

We believe that the customers will be more inclined to buy a fish when they can see both the skin and the flesh of the fish. Some fish have very unappealing appearances, so showing filets that are nicely presented could make the decision to buy an unfamiliar fish easier for consumers.

Displayed Information of Available Fish

We recommend that fish restaurants and fish markets provide more engaging information and material to consumers. This recommendation is made based upon the success of The Sole Proprietor experiment. Restaurants and fish markets that explicitly declare the fish name in a dish would provide menu items that feature underutilized fish with a compelling description

attached. From our data, implementation of this tactic should increase the popularity and sales of many local underutilized fish.

We also recommend providing these underutilized fish with both appealing profiles and names. Our findings indicate that customers may make assumptions about certain fish solely by their name. These profiles and names could be incorporated in menu item descriptions or distributed as card handouts at fish markets and restaurants. An example of a fish profile card is shown in Figure 21.

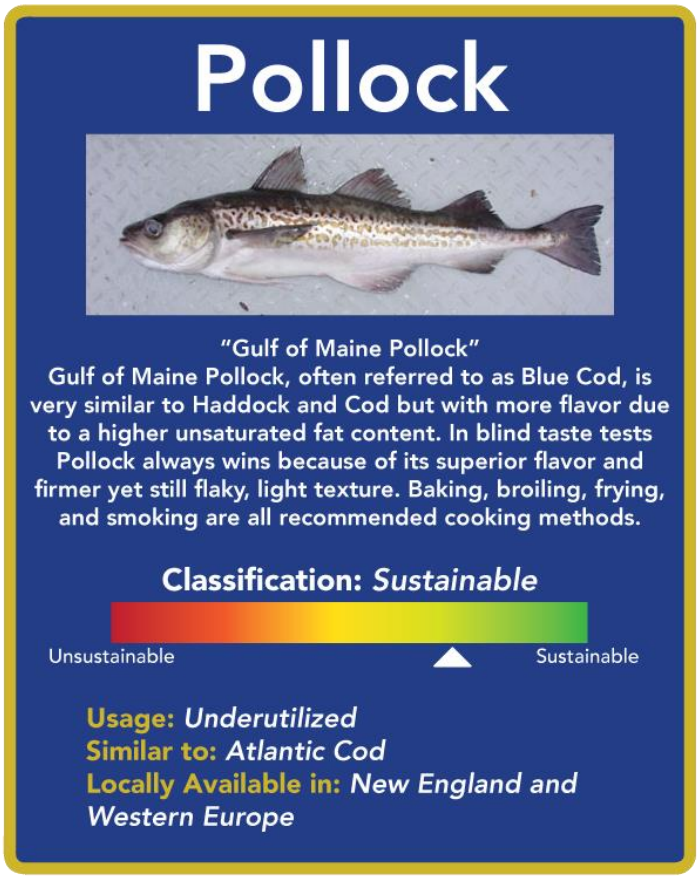

Figure 21. Example Fish Market Handout

These appealing fish profiles and names should have some ability to alter or create an initial perception of specific underutilized fish with consumers and encourage them to purchase less popular underutilized fish.

Future Projects

Due to our findings and the amount of recommendations that our group created, we recommend the continuation of research by future project teams and organizations interested in creating a more sustainable fishing industry. We recommend the creation of another IQP focused on educating target populations on the mismatch between the local fish supply and consumer demand. This project would still be exploratory and could lead to effective and innovative ways to solve the mismatch between supply and demand within the fishing industry. We also recommend a business or marketing MQP that would focus on developing and implementing new marketing strategies and tactics in order to distribute consumer demand more evenly across the available fish supply. These project groups would assist in remedy the mismatch between the available local supply of fish and consumer demand while collecting more valuable data about the issue.

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Appendix A - Sole Proprietor Questionnaire

This Questionnaire is supplied by a group of students at Worcester Polytechnic Institute doing a studyof the New England Fish industry. This questionnaire will be given out to customers at The Sole Proprietor who is participating in the study. The purpose of the questionnaire is to gauge consumer knowledge consumer bias. Please answer accurately and honestly about which fish you prefer and its preparation. Your responses shall remain anonymous and will be aggregated for materials for the student's project. If there are any questions that you feel uncomfortable answering, please refrain from providing responses to them. Answering this questionnaire is voluntary

Menu Questionnaire

Instructions: Please select (by circling) both a Fish and Preparation option that you would most prefer to eat at a restaurant

Fish	Preparation
Swordfish	*Grilled with tomato pesto, cherry tomatoes, basil, sweet onions and braised kale.*
Mackerel	*Roasted and doused with a lemon garlic marinade. Served with roasted baby potatoes and brussel sprouts*
Salmon	*Grilled and topped with cracked black peppercorns, feta cheese, sun-dried tomatoes, scallions and basil. Served with Spanish rice and mixed vegetables.*
Dogfish	*Fried and topped with a lemon caper butter sauce. Served with jasmine rice and grilled tomatoes.*
Monkfish	
Tuna	

What most affected your decision to buy the fish that you did?

Please rank the following variables by circling the appropriate number (1 being the least influential and 5 being the most)

Appearance ——— NA 1 2 3 4 5
Taste ——— NA 1 2 3 4 5
Texture ——— NA 1 2 3 4 5
Name ——— NA 1 2 3 4 5

Ease to consume ——— NA 1 2 3 4 5
Knowledge of fish ——— NA 1 2 3 4 5
Nutritional Value ——— NA 1 2 3 4 5
Environmental sustainability ——— NA 1 2 3 4 5

*Other (Please explain):*_____ NA 1 2 3 4 5

Does price affect your decision to buy fish at a restaurant?
YES / NO

If you did not choose any of the fish listed below, please check the boxes that indicate the reason why you did not choose these fish.

	Appearance	*Price*	*Flavor*	*Name*	*Ease of consumption*	*Knowledge of fish*	*Nutritional value*	*Texture*
Mackerel								
Dogfish								
Monkfish								

*Other (Please explain):*_____

Please indicate where you are coming to The Sole Proprietor from (home, class, work et.) by providing your zip code _____

Appendix B - Red's Best Questionnaire

Time: _____

Kiosk Questionnaire

Age: _____ **Gender:** _____ **Zip code:** _____

How often do you buy fish? _____

1. Why did you decide to come to the kiosk today?

2. What did you order at the kiosk today, and why?

3. Using a scale of 0 (not influental) to 5 (extremely influential), please rate which variables affect your decision to purchase raw fish.

Appearance	*0 1 2 3 4 5*
Price	*0 1 2 3 4 5*
Taste	*0 1 2 3 4 5*
Texture	*0 1 2 3 4 5*
Name	*0 1 2 3 4 5*
Ease to prepare	*0 1 2 3 4 5*
Knowledge of fish	*0 1 2 3 4 5*
Nutritional Value	*0 1 2 3 4 5*
Environmental sustainability	*0 1 2 3 4 5*

*Other (Please explain):*_____ *0 1 2 3 4 5*

Please check the boxes that indicate the reason you did *not* buy any of the fish below.
(if applicable)

	Appearance	*Price*	*Flavor*	*Name*	*Ease of preparation*	*Knowledge of fish*	*Nutritional value*	*Texture*
Skate								
Mackerel								
Redfish								

*Other (Please explain):*_____

Appendix C - Red's Best Questionnaire Cues

How often do you buy fish?

Why did you decide to come to the kiosk today?

What did you order at the kiosk today, and why?

Appearance - How the physical appearance of the fish affect your decision?
Price - What is it about price that makes it a factor in your choice?
Taste - How much do you care about the taste of the fish?
Texture - Does the texture of fish affect your decision?
Name - How strongly does the name of the fish factor into your decision?
Ease to Prepare - How does preparing/cooking the fish affect your choice of purchase?
Knowledge of fish - How does your prior knowledge of a fish influence your decision?
Environmental Sustainability - How does the aspect of a breed of fish's sustainability affect your choice?

Other - Are there any other aspects of the buying fish that we didn't cover that affect your choice?

Here is a list of 3 underutilized fish that are abundant in the ocean. From the variables above, is there a reason you can cite for not buying any of them today. Are there any other reasons why you did not purchase an underutilized fish today?

Appendix D - Site Description

Boston's fish market is a thriving part of New England livelihoods and history. Fresh fish has a place in traditional dishes ranging from fish chowder to New England boiled suppers, and many area Catholics continue to honor, "fish on Friday" as a part of their weekly meal planning. One of the most unique fish distributors, known as Red's Best, is a fish distribution company based in South Boston, Massachusetts started by former Boston fisherman, Jared Auerbach. The company strives to minimize the complexity and cost of transactions between local fishermen and consumers by managing distribution of locally caught fish under the brand name, "Red's Best." The Boston Magazine ranked Red's Best as the top Boston vendor in 2015, citing their high quality Bluefin tuna, and scallop ceviche as their best products.

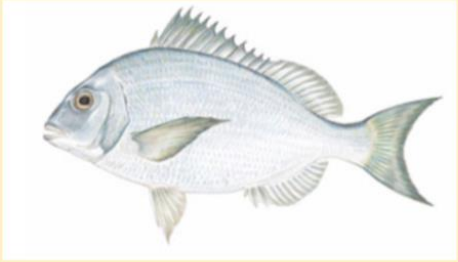
Fish that are caught and brought to Red's Best by fishermen are not paid for until they are purchased by consumers. This relationship allows fishermen to specialize in supplying fish more efficiently while Red's Best handles the point of sale transactions with distributors and consumers (Red's Best™, 2015). Red's Best also currently owns a kiosk that is located in the seaport district of Boston that Red's uses to sell their freshly prepared meals and fish produce. Red's Best uses this kiosk as a part of their plan to provide local fresh fish to consumers. The kiosk contains an assortment of options from frozen fish that need to be prepared, to premade meals available for purchase on site. Red's Best strives to reduce stress on fishermen by unifying New England fishermen through the aggregation and distribution of locally caught fish in the North Eastern region of the United States.

Red's Best equips fishermen with web-based software that allows them to document their fishing spots and product information with ease. Their website allows anyone to view specific statistics – average weight, length, and location - of different breeds of fish. Using a barcode, packages of fish or mollusk can provide information on where, when, how, and which local sea captain caught the fish (Hughes 2015). Consumers can scan this barcode with their phones to learn more about the fish they eat. Red's Best's software also replaces the inefficient paper tracking mechanism used by many fisheries and provides product and information from National Geographic and Seafood Watch. Red's Best's product transparency - giving the location, vessel, and date of the catch - has led to more demand increasing the quality and amount consumers will pay for local fish.

Appendix E.1 - Utilized Fish Profiles

Cod		**Texture:**Delicate
		Availibility: Peak: mid april-early may, late may-late august limited:jan-mid april, early-late may, sept-oct, none: nov-dec
		Common Preparations:bake, broil, deep-fry, saute, steam
		Utilized
Haddock		**Texture:** Moderatly-Firm
		Availibility: Peak: All-year
		Common Preparations: Bake, Broil, Deep-Fry, Poach, saute, smoke
		Utilized
Atlantic Salmon		**Texture:** Delicate
		Availibility: Peak: All-year
		Common Preparations:bake,broil, grill, poach, saute, smoke, sushi
		Utilized
Swordfish		**Texture:** Firm
		Availibility: Peak: All-year
		Common Preparations:bake, broil, grill, saute, smoke
		Utilized
Atlantic Bluefin Tuna		**Texture:** Firm
		Availibility: limited: All-year
		Common Preparations:broil, grill, saute, smoke, suchi
		Utilized

Appendix E.2 - Underutilized Fish Profiles

Skate		**Texture:** Moderatly-Firm
		Availibility: peak: mid June-late Oct limited: nov-early june
		Common Preparations:peak: mid June-late Oct limited: nov-early june
		Undertilized
Scupp		**Texture:** Firm
		Availibility: Peak: April-November, Limited: Jan-Feb, None:December
		Common Preparations: fry, grilled, broiled steamed, roasted
		Undertilized
Mackerel		**Texture:** Firm
		Availibility: Year-round
		Common Preparations: Roast, Grill, Broil, Smoked,
		Undertilized
Dogfish		**Texture:** Moderatly-Firm
		Availibility:peak:Aug-Oct, limited: May-July, Nov none: Jan-April
		Common Preparations: Bake, Broil, Fry, Grill, Saute, Smoke
		Undertilized
Monkfish		**Texture:** similar to lobster
		Availibility: Peak: July-Dec, limited: Jan-Jun
		Common Preparations: fried, roasted, grilled, roast
		Undertilized
Redfish		**Texture:** Firm
		Availability:peak: March-Nov, limited:Dec-Feb
		Common Preparations:grill, bake, fry, roast
		Underutilized

Appendix F - Summary of Interview with Jared Auerbach

Discussion:

Jared: We started Red's Best in 2008 and we have a retail location in Boston Public Market.
Jared: How Red's Best works: boat goes out fishing, Red's Best meets at doc to take fish and give ice to fishermen for next day, fishermen don't get paid until after Red's Best sells the fish, fishers trust Red's Best to sell their fish at the market at a good price.
Jared: Red's Best's wants to take care of local fisherman.
Jared: Competitor advantage has allowed Red's Best to expand fast.
Jared: Has specialized software that greatly helps in running the business and is amazing because removes the factor of redundant data entry. Red's Best has 200-300 transactions a day sometimes.
Jared: We noticed consumers like to see where their fish come from and various info about fish (Red's Best's software provides this to consumers).
Jared: Red's Best has tons of data that can be used by business owners and consumers.
Jared: Red's Catch university program: Sells fish at fixed cost for universities.
Jared: Red's Best's 10 years dream: "directly connect digital information to consumers fridge".
Jared: Needed information on consumer buying patterns.
Jared: Red's Best is branded as providing local fresh fish.
Jared: People buy fish like it is a commodity, they want to consume more fish, but people are not knowledgeable about the preparation of fish and fish in general.
Jared: So much regulation when catching fish now.
Jared: Many wholesalers resell fish and brand it as, "Red's Best fish". We need to know what affects a consumer's decision to buy fish in general.People don't tend to treat fish with dignity. (there are expensive fish and cheap fish, but it all can be cooked and tastes good) There are seasons for different fish, but consumer preference don't follow the seasons. It's really notable how wild salmon can cost over 20 dollars per pound and mackerel is nearly 30 cents per pound. It's a perfectly good flakey white fish.
Ben: Is the mismatch in people's ability to prepare a dish?
Jared: I think the issue may be deeper than that. Mackerel, dogfish, scup, pollock and hake are perfectly good fish that are sold at a frustratingly low price while other fish like salmon go for outrageous prices.

Jared: Name modification such as changing dogfish to cape shark and scup to cape cod searing resulted in a negligibly small increase in sales.
Jared: Pollock and hake are actually starting to become more recognized and are in more restaurants. High scale restaurants may also have more types of fish too.
Jared: To talk a little more on the trends, prices of cod and haddock have slipped but hake and Pollock have come up a little. Media about certain fish is exaggerated a lot and this seems to be a factor as to why Cod prices are so high.
Zahr: Is there a difference between restaurant types in consumer purchasing variables?
Jared: Definitely. There's a different customer base that goes to restaurant like Johnny's and those who go to a high scale fish restaurant.
Jason: Is there any way you can send us your data for fish species by weight for each catch?
Jared: Of course! Just email me about it later so I don't forget. Fisherman are very nomadic. They go where the fish are so this data may appear to be very sporadic.
Jared: Fishermen get paid for what they bring in by weight of each fish.
Jared: We fail as consumers because we only want specific things, I think we should make the market more diverse to regulate each population of fish.
Jared: Currently we are exporting the undervalued fish and import popular fish from other countries. For example we supply England with 90% of their fish and chips and we import popular fish like cod, salmon and tuna from dirtier waters such as China.

Notable Information Gained:

- Local oceans have lots of variety, but consumers tend to only buy certain fish species
- Consumers buy fish like a commodity and haven't very open to many other options
- Fish supply has gone down drastically over the past century
- There is a difference when people are buying fish from the market, at seafood restaurants, and normal restaurants that serve fish
- Preferred fish: cod, swordfish, tuna, haddock
- Underutilized fish: red fish, skate, scup, monkfish, dogfish
- Many people are not conscious of the sustainability of the fishing industry or just don't care
- Not much information available about why consumers buy certain species of fish (the reasons that affect their decision to buy fish)