Template for Providing Access to Local North Carolina Seafood in Low-Income Communities

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1. Executive Summary

The local seafood movement offers many benefits for individual producers and consumers. It also assists entire communities by empowering economic development, decreasing food miles and developing or accessing a cultural identity around food. Ecological benefits that can be captured through local seafood systems include the use of sustainable fishing practices and reduced pressure on heavily fished species. These advantages are significant, and should be implemented on a wide scale. However, there remain significant barriers to making local seafood accessible to low-income, low-access and rural communities.

In North Carolina, there are almost 2 million food insecure individuals who may not know where their next meal is coming from. Additionally, there are fishers along coastlines and freshwater systems whose job security is being threatened by unsustainable fishing practices, habitat destruction, regulation, and competition from international and industrial fishing fleets. While some of the fish species available for harvest have high demand and sold at high price margins, others are currently less favored by the public, have lower demand and are therefore sold at lower price points. Despite their lack of favorability in markets, many of these fish—termed as underutilized species—have the flavor profile, processing characteristics and sustainability metrics that could make them desirable to a food-conscious population. These underutilized seafood species can potentially be sold to regions with high food insecurity at lower prices to help close the hunger gap.

This Master’s Project provides a comprehensive overview for a client, NC Catch, regarding the opportunities and obstacles associated with creating a market for underutilized species in communities where people tend to be food insecure. The researchers focused on two pilot communities in North Carolina, Garysburg and New Bern, which represent diverse environments and demographics and have significant food security needs. The researchers took a three-pronged approach to begin building supply chains into these communities and to enable network opportunities that will more efficiently facilitate the process.

The first task was to identify potential underutilized species. Because there is currently no method for distinguishing underutilized species, the researchers collected possible species from discussions with relevant authorities including fisheries biologists, fishers, chefs and processors. Next, the researchers worked with communities in focus groups to determine taste preferences for fish species and methods of preparation that are lesser known but can support health outcomes. Working with communities also led to recognition of potential points of sale for seafood in the communities. Finally, least-cost routes were identified between fish houses and points of sale. Breakeven costs for distribution were constructed for NC Catch to use when pricing seafood.
The researchers were able to identify 17 species caught off North Carolina that meet acceptable management, sustainability and processing requirements to be considered viable for this project. In addition, community focus group results showed that there is overwhelming enthusiasm for the inclusion of more local fish into accessible retail markets. Since seafood can be sold fresh, frozen, processed and value-added, there is potential to introduce seafood in a number of forms before determining which are more attractive to consumers and which can generate revenue for fishers and operators along the supply chain. The cost analysis demonstrated that Garysburg town residents will likely have to pay more for seafood to cover distribution costs if NC Catch is responsible for distribution. This is particularly unfortunate as the entire town of Garysburg is considered a food desert by the USDA and has limited private and public intervention programs in place to provide food assistance.

As a result of these findings, the researchers make the following recommendations to NC Catch and other stakeholders of this project:

• Investing in refrigerated trucking will give NC Catch autonomy over distribution channels. Only when costs for local seafood are prohibitively high for the communities should NC Catch utilize alternative existing distribution routes.

• Outreach is important for two reasons: to provide information and to demonstrate commitment to the wellbeing of communities. We recommend that NC Catch continues to engage with communities of interest by hosting more focus groups, partnering with community centers and hosting cooking and informational events.

• Individuals in food deserts with cars have better access to healthy food options. Seafood should therefore be sold at centralized locations where individuals do not need a car or public transportation to access them. This can include convenience stores, accessible farmers markets, and mobile markets.

• Residents of Garysburg and New Bern are familiar with fried fish. Introducing new fish and preparation can overwhelm these communities, so NC Catch should be cautious of introducing too many new choices at once.

• Because underutilized species are targeted less frequently and have fewer ports with reliable landings, NC Catch should work with a number of fish houses at all times to maximize options for distribution and to minimize costs.

• Because of additional processing and distribution costs, fish that costs more than $2/lb. ex-vessel should not be considered for this project in the current economic climate.

• The cost of in-store refrigeration is significant and has not been included in this analysis, but should still be considered to understand total costs.
2. Introduction

In recent decades, the conversation surrounding food production and consumption in the United States has evolved to emphasize concepts such as “wellness,” “local,” “fair trade,” “organic” and “sustainable.”1 These topics have entered the public sphere through well-known documentaries including *Super-Size Me* and *King Corn*, which have underscored the negative role of processed foods on public health and the ways in which multinational corporations and government agencies have historically enabled an unhealthy food system with a large carbon footprint. As a result, a local food movement has evolved with the effort of changing production, preparation, aggregation and distribution of foods and re-engaging consumers with producers.2 The aforementioned deleterious food culture has had a disproportionately negative impact on low-income and minority communities who often lack access, education, time and money necessary for purchasing and preparing healthier food. The local food movement has consequently, albeit slowly, evolved to serve minority, low-income and rural populations and explore ways to assist communities in need of access to healthier foods.3 The local food movement has introduced and delivered fruits, vegetables and more humanely raised livestock with a smaller environmental footprint to retail centers such as farmers markets, grocery stores, and through community supported agriculture shares.4 Seafood education and distribution, however, is often not included in these newer markets.

Certain seafood products have many health benefits to pregnant women, children and individuals at risk of coronary heart disease. The Food and Agriculture Organization, the World Health Organization and the US Environmental Protection Agency have noted these benefits.5,6 As a result, seafood should be accessible and affordable to everyone. Seafood has begun to demonstrate its place in the local food movement. There are over 40 community-supported fisheries in North America that promote the sale of locally harvested fish.7 The majority of community-supported fisheries serve niche communities that can afford not only the price premium but also the time and effort to prepare fresh seafood products. Seafood markets and specialty stores such as Whole Foods also source fresh, local seafood, often with a price premium. Their methods of operation and overall objectives vary greatly, but many local seafood retailers focus on providing high-quality and fresh products that are harvested locally and have cultural significance.

Many local seafood retailers promote the purchasing and consumption of underutilized fish species.8 Underutilized species are typically characterized as having low market demand and an annual catch that is below catch limits and sustainable yields.9 Underutilized fish have great diversity and can offer additional sources of nutrition for human populations.10 Synonyms for underutilized seafood include “trash fish” and “unloved fish.”11 Because of their lower demand, underutilized species typically have lower market value and
aren’t directly targeted by fishers.* Some underutilized species have unattractive names and unfamiliar textures, tastes and preparation methods for the typical American consumer. Often by working with local chefs and restaurants, stakeholders of local seafood access identify palatable and interesting recipes for underutilized species in an effort to increase their popularity and market share. Underutilized species are often considered sustainable and have many health benefits; they can serve as an important substitute for other foods and can be sold to lower-income communities at lower price points than other foods.

Some, but not all, retailers of locally sourced foods accept government assistance payment programs such as SNAP/EBT and WIC, which allow individuals and families meeting certain income and need categories to subsidize the cost of food. Other ways to provide local food access to families in need include food hubs and mobile markets that can aggregate food in areas with limited access to make it more available. In 2015, the Obama administration launched Local Foods, Local Places, an initiative to empower communities with limited food access by establishing and strengthening local food systems. In addition, there is a recent growth in the utilization of community and religious centers to promote the benefits of consuming food that is local, and often organic and healthful. All of these sources of local food access represent places where local seafood can be provided to communities in need.

This paper conveys the feasibility, opportunities and obstacles behind providing two low-income communities in North Carolina that have limited access to healthy and affordable food with locally harvested and processed seafood that is affordable. The client of this project is NC Catch, a non-profit organization that focuses on promoting local seafood to North Carolina and working to ensure that supply-chain laborers earn a fair wage. Because of the nutritional value of seafood and the capacity to harvest species locally, there has been interest in and mobilization for the provision of avenues to engage low-income and malnourished communities with local seafood products. Researchers have only begun to conduct studies in order to determine if low-income communities have sufficient willingness to pay for local seafood products to generate revenues that trickle to the level of the harvester. The local seafood movement in America is nascent and stakeholders are only beginning to define values and standards. There are many perceived economic and regulatory challenges and hurdles to overcome in this field, only some of which are related to access and equity.

* There is no official definition for underutilized seafood. Likewise, there is no ideal threshold for percentage of potential harvest or cost that deems it as such. As such, the term underutilized is subjective and dependent on market trends, price fluctuations, international trade and more. In addition, some groups consider underutilized species to be those that are harvested and targeted, but not sold and consumed locally or domestically.
2.1 Research Questions

This project aims to determine if underutilized species represent food products that can be sold at lower prices than popular seafood products and to provide recommendations to NC Catch on how to implement a supply chain that generates revenue while encouraging equitable seafood consumption. In order to accomplish these goals, three fundamental research questions were identified. These research questions and their components are described below.

1. **Species Identification.** Which species are considered underutilized or affordable in North Carolina?
   a. What are their average costs?
   b. What are their seasonal availabilities?
   c. Where are they caught?
   d. How are they managed?
   e. How can they be prepared and processed?

2. **Community engagement.** What do people in pilot communities eat or like to eat?
   a. Do people purchase prepared and processed foods?
   b. Where do community members buy food? (e.g. convenience store and farmers market)
   c. Do people cook and eat out?
   d. Do people eat seafood already?
   e. What perceptions do community members have about seafood?

3. **Pricing and Distribution.** How does the supply chain need to look?
   a. What elements of necessary infrastructure are already present? (e.g. processing equipment, trucking routes, in-store refrigeration)
   b. Where does infrastructure need to be built?
   c. What are the costs of fish purchase, processing, and distribution?
   d. What prices can these fish be sold at so that harvesters can generate revenue?
   e. Which individuals, organizations, and companies need to be involved? (e.g. fishers, fish houses, convenience stores)
   f. To what extent does NC Catch need to be involved?
   g. Which local and federal policies play a role in the supply chain of underutilized species in North Carolina?

Methods for answering these questions included a literature review, interviews, decision analyses, cost modeling, focus groups and survey implementation.

In sum, NC Catch wants to recreate a local food value chain for fresh seafood that provides it at a cost that is as low or comparable to that of a can of tuna, thereby making it affordable and accessible to low-income
communities while achieving the objectives of the local food movement. The ultimate goal of NC Catch is to bring seafood into communities in North Carolina that are low-income and low access (typically defined as living more than 1 mile from a supermarket in urban areas, and 10 miles in rural areas). One way to do this is by localizing the supply-chain for seafood so that it more closely resembles a local food value chain. (Figure 1).

![Figure 1](image_url)

Figure 1. The left image illustrates a globalized supply chain for a seafood product that is sold in the United States.\(^{19}\) Seafood suppliers hoping to simplify this chain and localize it can reduce the carbon footprint, ensure freshness and provide fishers with a fair wage for their labor. The right image\(^{20}\) represents a local food value chain model, according to local food system experts. Every aspect of the supply chain is conducted locally (i.e. within a defined geographic region).

The results of this work demonstrate a number of key points. Broadly, these are: 1) There are low-income communities that are interested in expanding current seafood access. Additionally, there is wide diversity of taste preferences within communities and it is unlikely that one fish or method of processing will be palatable for everyone; 2) Distribution channels in the state of North Carolina for local foods are extremely limited. As such NC Catch will have to invest in distribution infrastructure (most notably, refrigerated transportation and storage) and; 3) There is no standardized process by which to evaluate underutilized species. Viable fish options will change based on price, regulation, ecology, availability and more. It is best to always consider a suite of fish species from different landing points in North Carolina to source local seafood from. As a result, relationship building with multiple seafood suppliers will be fundamental in this process.
3. Background Information

3.1 History and Social Context of North Carolina fisheries

Fishing in North Carolina holds significant economic, cultural, and historical importance. It has, in some form or another, occurred along North Carolina coastal waterways since prehistory, with shellfish and small finfish making up a large component of the aboriginal diet. Native Americans employed a number of methods to capture fish for subsistence, many of which impressed early European arrivals with their ingenuity. Subsistence fishing continued into the colonial era as European settlers arrived. Commercial fishing began in the late colonial era (1730s), when salted herring started to be exported out of the state. The first large scale commercial fishery in North Carolina began in 1807 in Edenton at a plantation owned by a man named Joseph Skinner. At this point, commercial fishing in North Carolina typically utilized slave labor in plantations where haul seine fishing served as supplemental income to agriculture. American shad and river herring were the primary targets of such endeavors, as they were easily preserved with salt, before ice was available. These fisheries continued to grow into the mid- and late-1800s as gears, fishing methods, and technological developments increased efficiency.

The American Civil War marked a transition for commercial fisheries in North Carolina. The destruction and societal change wrought by the conflict motivated improvements in infrastructure, transportation, and storage technologies. The availability of ice and new markets in the North coincided with a decline of shad and river herring populations, leading to a diversification in species targeted. Bluefish, white perch, flounder, trout, and striped bass all became the targets of commercial fishing between 1866 and 1872. Carteret County became a center for fish trade in the mid-1870s, with processors in Morehead City and Beaufort. In nearby Craven County, New Bern's local fish markets were economically empowering black communities; eight African Americans owned and operated fish stalls, selling gar, catfish, eels, sturgeon, and other local species. While North Carolina's fisheries were highly productive, they could not maintain the high level of fishing that was occurring in the 19th century. Many fisheries were failing by the early 1900s, leading to the first implementation of management for the previously open-access fishery. This management continues today, through national and state fisheries agencies, including the North Carolina Division of Marine Fisheries (NCDMF) headquartered in Carteret County.

Commercial fishing has continued in North Carolina, supporting many families and informing the cultural identity of the region. Commercial fishermen in the region however, are facing a number of challenges from a

† North Carolina’s early fishing history also included a small shore based whaling fishery that thrived on coasts of the Core, Bogue, and Shackleford Banks. It occurred from around the 1660s to the late 1800s, after which it declined and came to a final end in 1917 (Reeves & Mitchell, 1988)
variety of sources. Imported seafood, sold at a lower price, now makes up much of the seafood consumed in
the United States.27 This source of competition undercuts the prices of local fishermen and forces them to
sell at smaller profit margins. The lower price of imported seafood is often due to lowered labor costs in
exporting countries like China.28 Farmed shrimp imported to the United States from Thailand has been
traced back to operations utilizing slave or forced labor.29 Seafood produced in this way can threaten the
prices that domestic fishermen, who do not utilize slave labor and economies of scale to lower costs, simply
cannot afford to reduce.

Fishers are also threatened by a myriad of environmental challenges. Anthropogenic problems including
climate change, declining water quality, and habitat destruction put strain upon the fish stocks whose health
fishermen rely on to make a living.30 Fishermen have noticed unpredictable changes in species distribution,
migration, and health in recent years.31 Knowing where and when is best to catch fish is a significant skill that
a fisherman must have in order to be successful. Rapidly changing conditions can make proven and time-
honored knowledge obsolete, requiring fishers to adapt to these conditions to survive. The recognition of the
adverse impact on stock productivity due to loss or degradation of habitat has been incorporated into
fisheries management through the concept of Essential Fish Habitat (EFH), leading to further regulatory
action designed to combat overfishing.32 Unfortunately, regulatory instruments like quotas, gear and time
restrictions, and licenses only address the fishing pressure put on stocks and not the myriad environmental
variables that might contribute to declines in fish populations.

Adding to these problems is the heavy dependency on commercial fishing that many fishing families possess.
A NCDMF economic profile analysis of commercial fishing communities reports that over 60% of active
participants in commercial fishing in North Carolina rely on fishing for over half of their income.33 When
fishing is not providing enough income, these fishers, who possess few other skills and interests, have little
else to turn to. Thus, these fishermen are at a high risk to feel the adverse effects of complex regulation,
environmental changes, and limited income diversification opportunities in North Carolina.

The effects of these factors are observable in the trends in the number of people participating in the industry.
The NCDMF report mentions that while the number of commercial fishing licenses issued has remained
stable at 8,500, the number of licenses being used has declined steadily between 2008 and 2012. Currently,
less than half of the commercial fishing licenses issued are in use.34 An analysis by Garrity-Blake and Nash in
2007 found that 39 of 117 fish houses in North Carolina closed between 2001 and 2006, with an overall
decline of wholesalers of 33.3%.35 A 2012 update of this report conveyed a loss of nine more fish houses
from 2006 to 2011, which contributed to an overall net loss of 36% of fish processing facilities from 2001 to
2011.36 These declines mean a weakening of the infrastructure necessary for distribution of seafood in North
Carolina. Structures like fish houses, railways, and working waterfronts and harbors are being replaced by other land uses, including tourism and high-value residential development. Once lost, this infrastructure can no longer be used to transport fish to inland North Carolina markets. While this reduction in distribution infrastructure might mean increases in efficiency, inland markets would likely be impacted by consolidated distribution routes that are well-established but reflect existing coastal networks.

In terms of the distribution networks that are in place in North Carolina for seafood, the most developed are of the south-to-north variety, in which fish houses freeze and transport their catches to northern markets such as New York. This distribution channel is defined by the existence of large wholesalers with consistent delivery schedules and transportation. Evans Trucking and Wanchese Fish Company make up the two major transportation companies that operate in these channels and utilize the Interstate-95 for much of their distribution. The east-to-west distribution channel, which could bring North Carolina Seafood to North Carolinians, in comparison, is not as well coordinated or as mature as the channel moving seafood to the north. The east-to-west distribution channel lacks several major components that block the establishment of a stable shipping route. These include a lack of cold storage and flash-freezing infrastructure and no major inland seafood auction house that can handle large amounts of iced, un-frozen seafood for distribution to the major inland markets. At the same time, the processing capacity for value-added product is minimal.

The lack of a well-defined distribution channel from the coast inland may be the result of a negative feedback loop in which few inland markets exist because of the inherent risk involved with trying to create demand in an area where supply is restricted. In 2013, a report by The Rural Center found that fish house owners are aware of the potential of inland markets, but are fearful of investing in such an endeavor with limited capital. The risk of establishing new markets for their product is too high for these owners, especially if they are doing it individually rather than collectively. Because there is an existing successful commercial north-to-south route for seafood, there is even less incentive to develop necessary infrastructure inland.

The highly variable nature of the seafood industry in North Carolina is also a major obstacle to local seafood distribution. A number of factors contribute to an uncertain supply of fish, including seasonality and adverse weather. According to NC Sea Grant’s Seafood Technology and Marketing Specialist, Barry Nash, the seafood industry is unpredictable, which can be bad for business. This uncertainty makes it difficult for North Carolina seafood to be included into the wares of large retail grocery stores, which place value on consistency and thus tend to carry imported seafood that enters the country in high volumes and is available year round.
3.2 Underutilized seafood

As previously stated, underutilized species are typically characterized as having low market demand and an annual catch that is below catch limits and sustainable yields. Low demand for a “trash fish” (as they are often referred to) can be the result of a number of factors.

One such factor for certain species is the difficulty and limitations associated with cleaning and processing. One example is the spiny dogfish, a species of small shark harvested in the Atlantic (including North Carolina) but rarely seen in domestic markets. Spiny dogfish bodies contain urea. Improper handling of spiny dogfish and other sharks allows the urea to remain in the body, degrading the quality of the meat and causing an unpleasant ammonia odor. Thus, special handling, including immediate bleeding and icing of the fish, is required, which can impose an extra cost onto fishermen catching spiny dogfish. Another major reason for low-demand of an underutilized species may be unaccustomed palates. American preferences in seafood often lean towards milder flavors. Those who dislike seafood entirely tend to be averse to “fishy” odor or tastes. In a National Public Radio (NPR) interview, seafood author Paul Greenberg asserted that Americans often shun “flavorsome” fish such as bluefish or mackerel. These species have darker, oilier meat and stronger flavor; both are often considered underutilized.

Despite lack of retail sale of underutilized fish in domestic markets, these fish are still caught and sold for food as well as purposes other than direct human consumption. These include inclusion into terrestrial livestock and aquaculture feed. Aquaculture is heavily dependent on inputs of nutrients in the form of fishmeal and fish oil, at least some of which is created from the processing of underutilized fish. Inclusion of fishmeal and fish oil into aquaculture feed is predicted to decline for a number of reasons, including the increase in direct human consumption of forage fish species and increasing public pressure on aquaculture operations to forgo fish meal and fish oil in the name of sustainability.

In the U.S., underutilized fish are beginning to attract notice. There are a multitude of reasons for this, ranging from ecological to economic and even moral reasons. For example, in a 2013 Huffington Post blog, a popular Massachusetts chef named Michael Leviton argues that we all must embrace sustainable seafood in order to combat overfishing, which means an increased emphasis on underutilized seafood. Targeting underutilized species would result in something called fisheries diversification, wherein rather than focusing on few species of fish and discarding others, fishermen target, land, and sell whatever fish species they might catch. This alleviates fishing pressure and mortality present on those fish that were previously heavily targeted and reduces discards. Fisheries diversification increases economic security and resilience of fishing communities, since these communities no longer place reliance on a small number of high-value species.
taking into account species interdependencies, uncertainty, and sustainability constraints, the harvesting of multiple species can be used to balance risk and reward in harvest. Communities that target and sell underutilized species are thus no longer “putting all their eggs in one basket”.

Provincetown, Massachusetts is a community whose fishermen have largely shifted to catching previously underutilized species. This was not due to any particular moral obligation to sustainability or fisheries diversification, but rather economic need. Previously, fishermen in Provincetown relied on the Northeast groundfish fishery, one that has diminished in recent decades. Once higher-value fish could no longer be depended on for income, underutilized fish made their way into fish holds, sustaining the profitability of fishing operations in Provincetown. In this community, a focus on underutilized species has supported fishermen when historically popular species could not.

Attracting consumer demand to such species has been a concerted effort by catch groups, fishermen, fish dealers, chefs, and others involved in the seafood industry. Common awareness campaigns for underutilized seafood are events called “trash fish dinners,” in which chefs prepare underutilized species for the public to try. These events are employed readily in New England in order to promote species like skate and dogfish. Ideally, such events will enter underutilized species into the minds of consumers who might then purchase those fish, driving demand. A choice experiment by Witkin et al (2015) has found that this method has been effective. Respondents to a survey offering both historically popular and underutilized species were more likely to select an underutilized species if they had already been exposed to that species. Some groups have foregone this model of spreading awareness and then attempting to sell underutilized species in conventional manner. The alternative to this is the creation of a processed fish product. For example, Dock to Dish, a Community Supported Fishery (CSF) from Montauk, New York, has championed a product called “Fish Burger.” This is a patty made up of a blend of unused trimmings of tuna as a base and any of 36 different underutilized species included in the program. The Fish Burger (and presumably processed fish products like it), according to Dock to Dish, has several advantages. Processed fish products like the Fish Burger do not rely on filets of fish, which are often expensive. As a result, they tend to utilize flesh that would otherwise be thrown out or used for non-human consumption. These processed products are also more affordable and more easily sold for use in places like school cafeterias. The roadblock to implementing such products could be processing. In places like New York, where Dock to Dish operates, infrastructure for these products is readily available. This may not be the case in rural North Carolinian fishing communities.

While the usage of underutilized species is a part of achieving more sustainable fisheries, it is not full proof. As demand for these species rises, so does their price. As such, fishermen might begin targeting a single previously underutilized species as it becomes valuable, creating the same type of fishing pressure that
historically popular species had experienced, especially as certain underutilized species are not always managed under a Fishery Management Plan (FMP) and do not have sufficient data to determine sustainable quota yields. An example of this can be found in monkfish. Pre-1980s, monkfish was a poorly studied incidental catch species with low-value, often less than $0.10 per pound.\textsuperscript{59} In response to foreign demand from Europe and Asia, this price jumped to more than $2.00 per pound, with livers fetching up to $5.00 per pound. In the 1990s, monkfish landings peaked at over 25,000 tons and $50 million in value, annually. In just ten years, a fish that was routinely discarded developed a highly-valuable direct fishery. As signs of overfishing began to show, fishers urged managing agencies to implement a FMP for the species. By the late 1990s, survey indices for the species increased, showing recovery.\textsuperscript{60} Underutilized species are an untapped resource, but care needs to be taken so that these resources are harvested responsibly. If done correctly, these resources can be utilized to increase food access and security for the long term.

3.3 Food deserts and access in America

According to the USDA’s 2008 Farm Bill, a food desert is defined as an “area in the United States with limited access to affordable and nutritious food, particularly such an area composed of predominantly lower-income neighborhoods and communities.”\textsuperscript{61} About 23.5 million people in the U.S. live in food deserts. Nearly half of them are also low-income. A decrease in access to healthy food could be partially attributable to changing prices. A USDA analysis of price trends between 1980 and 2006 demonstrates that Americans are paying relatively more for fresh fruits and vegetables now than they were 27 years ago.\textsuperscript{62} Communities in over 80 counties in North Carolina are classified food deserts or have limited access to food (Figure 2)

![Figure 2. Food Deserts (1 mile from grocery stores in urban areas, 10 miles from a grocery store in rural areas) in North Carolina according to the USDA.\textsuperscript{63}](image-url)
Individuals and families with limited access to food can utilize a number of private and public programs that provide assistance, education, food or community development infrastructure that can help ease the burden of food insecurity and low access. The USDA’s principal food assistance program, SNAP (Supplemental Nutrition Assistance Program) provides food assistance to millions of American families who meet certain criteria. SNAP users are provided with an EBT (electronic benefit transfer) card, which looks like a credit or debit card that they can use in stores accepting SNAP benefits. There are certain restrictions to what SNAP users can purchase. For examples the purchase of alcohol and hot or prepared foods using SNAP benefits is not allowed. WIC (Women Infants and Children) is another form of government assistance program meant to meet the nutritional needs of pregnant, breastfeeding, non-breastfeeding postpartum women as well as infants and children of up to five years. WIC food allowances have more restrictions than SNAP benefits and are generally limited to: juice, milk, eggs, cheese, canned fish, fresh fruits and vegetables, bread and peanut butter. Private food assistance programs include soup kitchens and food banks. They receive food donations from food companies, grocery stores, restaurants, individuals and more and distribute food through emergency food pantries, soup kitchens, and shelters. While such programs can ensure that individuals get food, they cannot always ensure that the food is healthy or locally sourced.

Farmers markets are seen as one vehicle by which to increase access to healthy food while supporting local economies as “access is fundamental as a prerequisite for the consumption of healthy food.” Farmers markets servicing low-income communities are, at best, physically accessible, affordable and accept government benefits, such as SNAP/EBT and WIC. Some farmers markets and benefit programs will include financial incentives to reward consumers who purchase healthier foods (e.g. by giving 30 cents for every SNAP dollar spent on targeted fruits and vegetables).

In 2014, there were over 8000 farmers markets in the US. Of those, more than 5,170 were authorized to process SNAP benefits compared to 2008, when only 850 farmers markets could process SNAP benefits. Certain literature suggests that it is a misconception that prices of food at farmers markets are prohibitively high for certain socioeconomic classes, especially because the cost of food in food deserts is higher than food sold in urban supermarkets. In some cases, shoppers in food deserts pay between 3 and 37% more than counterparts shopping in suburban stores. There have not yet been comprehensive studies demonstrating the long-term impact that farmers markets have on low-income communities, but many targeted studies in the US demonstrate that access to farmers markets in low-income areas and food deserts is welcomed by the community and has benefits including positive changes in consumption and physical activity behavior.
There is reason to believe that because of the quality of farmers market produce and the added benefits to local economies, residents of low-income communities do not necessarily consider farmer markets products prohibitively expensive. Studies in low-income communities in North America demonstrate a number of key themes and prove that there is market potential for the introduction of local, healthy food in low-income, low-access areas. Heads of households interviewed for these studies described household health and food production methods, food quality (e.g. freshness), economic development, civic-mindedness, self-respect, self-reliance, and geographic and economic equity as characteristics influencing willingness to pay price premiums in farmers markets.72 Furthermore, studies have demonstrated a genuine interest in supporting local economic development by purchasing from local farmers, food processors, and food retailers, and a higher willingness to pay if the consumer knows the money is going to the harvester instead of a large corporation.

There are still, however, a number of obstacles that may limit farmers market access even if they are located in or close to low-income communities. However, these are not barriers, and can be addressed. In order to accept SNAP benefits at farmers markets, vendors need a government issued designation code (known as an FNS number), access to a point-of-sale machine that attaches to wireless cables, and back-end accounting and product management.73 Another drawback of the current farmers’ market program is timing. Farmers markets are normally open once or twice a week, for a limited amount of time, meaning residents are limited as to when they may shop.

In sum, low-income and low-access areas represent market penetration opportunities for local, sustainable food markets that can support local communities and small companies. Individuals and heads of households who make purchasing decisions make them based on a number of factors, aside from price. These include choice, social relationships, sensory preferences, health status, likes and dislikes, influence of food marketing, and advertising. If the technology is established in farmers markets or in other food hubs or retail centers and if they are located in regions that are made accessible (mobile markets can partially fill this purpose), there exists an opportunity to provide food for low-income people while benefitting harvesters and introducing further capital into local economies.

3.4 Community Supported Fisheries and their Distribution Models

Local seafood can be sold through a number of retailers including: farmers markets, seafood markets, specialty stores (e.g. Whole Foods), off the dock or boat and through community-supported fisheries (CSFs).74 There are over 40 CSFs in the US and they offer great diversity with respect to their philosophy, structure, geographic scope and operation. Based on their diversity, “the term ‘CSF’ does not currently refer
to a specific structure or type of organization, but rather an approach to seafood marketing used by a variety of organizations with broadly similar production philosophies centered on engaging and informing consumers around traceable, domestically sourced seafood.\textsuperscript{75} CSFs can connect consumers to producers, trace fish to a harvester or community, provide consumers with information about seafood, and simplify supply chains between seafood harvest, processing and sale.\textsuperscript{76} CSF’s also can, but do not always, introduce consumers to less popular, or underutilized, seafood. CSFs represent localized seafood supply chains that can be used to model seafood access projects in lower-income regions.

CSFs in North America have existed since 2007 and academic literature on them is limited. However, current studies have captured the many benefits for producers and consumers in some CSF models. These include increased environmental stewardship and sustainability, the fostering and support of local economies and communities, healthy regional food systems, transparent supply chains, and increased access.\textsuperscript{77} Based on a survey conducted by Duke University researchers, highlighted benefits to consumers include: knowing that they are helping the seafood industry, higher quality, decreased environmental impact, local food, and building face-to-face relationships.\textsuperscript{78} On the supplier side, after two years “fishers participating in the Walking Fish CSF received 33% more revenue for their catch compared to the average monthly ex-vessel price of finfish and shellfish landed in the surrounding region, and an additional 14% to 18% more per dollar by way of year-end profit sharing.”\textsuperscript{79} Harvesters benefit from CSFs partially because consumers are willing to pay a high price premium.

Walking Fish is one CSF that provides seafood from coastal North Carolina to the Research Triangle Area (Durham and Raleigh), which is about 175 miles inland and therefore disrupts the existing norm of what defines local food (i.e. 50 miles).\textsuperscript{80} Walking Fish is both a CSF and a co-op in which fishers, processors and community members are part-owners. Walking Fish demonstrates the high level of involvement among every level of the supply chain that that may be fundamental for the execution of a project that provides seafood for lower-income communities throughout the state. Below are the steps in the supply chain of Walking Fish.

3.4.1 Walking Fish Value Chain

Walking Fish seafood comes from fishers associated with Carteret Catch, a catch group that includes the ports of Morehead City, Beaufort and Smyrna.\textsuperscript{81} Walking Fish has harvested and delivered at least 31 locally landed species, some of which are high-value (e.g. flounder) and some of which are lower-value and considered underutilized (e.g. spot). Gears and harvesting methods used in catches include pots and traps, gill nets, trawls, hook and line and aquaculture. One of Walking Fish’s goals is to develop markets for underutilized species by including them in the shares. Doing so has the added benefit of reducing the overall
cost of seafood shares. Cooperation and relationship building among fishers and fish houses is key for this process.

Walking Fish has all of their fish processed through one seafood processor, Fishtowne Seafood, which is also located in Carteret County. Fishtowne has all the necessary HCCAP and health certifications. The co-op pays Fishtowne Seafood for the volume of seafood processed. Bill Rice runs Fishtowne Seafood and is part of the Walking Fish co-op leadership. Rice has served on a number of coalitions, working groups, and boards, including the Board of Directors of Carteret Catch and the Carteret County Marine Fisheries Advisory Board as a retail representative. “Headed and Gutted” or “Filleted” are the only fish processing options offered to customers. While some CSFs (e.g. Real Good Fish in California) make value-added products to diversify shares, Walking Fish does not. Contracting at least one processing center with the capacity to process seafood in the way needed is necessary for this aspect of the supply chain.

Walking Fish delivers to locations in Raleigh and Durham (over 175 miles away from landing) on weekly or bi-weekly bases. Walking Fish distributes their supply in seafood coolers and does not pay for distribution costs; one of the fishermen from the Carteret Catch group already has a distribution route to the Triangle region, and has delivered Walking Fish shares at no cost. At pick-up locations, Duke University student volunteers and fishermen distribute the shares, also for no cost to the cooperative. Customers wait at pick-up locations where they have the opportunity to interact with fishermen, distributors and Duke University students, all of whom are involved in the process. Distribution and retail requires a refrigerated truck, driver, pick-up location with refrigeration capabilities, and individuals to sell seafood at the designated location.

There are a number of share options that vary in amount, price and processing at Walking Fish. However, the price per pound for all shares ranges from $11.45/lb. to $12/lb. Conversely, in a Triangle area Wal-Mart, lower-value staple products such as frozen tilapia, frozen salmon and canned tuna are sold for as little as $2.75/lb., $3.68/lb. and $2.25/lb., respectively. It is the goal of this project to identify fish species and processes that can allow for fresh and local fish to be sold at prices more comparable to those accessible to low-income families. Other optimal requirements are that the products are SNAP and WIC eligible and can potentially be frozen or processed into value-added products. It is important to define local in the context of this project. Because many communities that would benefit from increased seafood access are more than 50 miles from fish houses, and because Walking Fish and other CSFs have adopted the term local for distribution networks that are hundreds of miles between dock and dish, local here is defined as fish that is caught, processed and distributed within the state of North Carolina. As the project scales, this definition can grow to include fish supplied by neighboring states such as Virginia and South Carolina, especially as many
underserved communities in North Carolina will have more accessible distribution routes with those other states.

3.5 Relevant Policies

There are a number of state and federal agencies and policies that guide the supply chain of underutilized fish species into markets. Agencies include the Food and Drug Administration, the Department of Health and Human Services, the Department of Agriculture, the North Carolina Department of Health and Human Services and the North Carolina Department of Environmental Quality. The policies and guidelines for protocol and procedures from these agencies do not appear to limit the development of underutilized fish as a processed or value-added product into farmers markets or other retail centers; in fact many programs can support, encourage and fund the creation of an underutilized species market.

Depending on spatial range and territory, different fisheries are governed and managed by various authorities. Many fisheries are managed under a Fishery Management Plan (FMP), which describes relevant information about the fishery including management goals, stock status and assessments, habitat and water quality considerations, social and economic impacts of the fishery and more. An FMP also provides management recommendations for the fishery including quota limits, seasonal or area restrictions, bag limits and more. FMPs are designed to be adaptive, such that if the status of or pressure on the stock changes, management plans can be revisited and revised for sustainability. The Mid-Atlantic Fisheries Management Council, the Atlantic States Fisheries Management Commission, and the North Carolina Division of Marine Fisheries can manage the underutilized species considered for this project.

Food products that are processed or distributed throughout the United States are subject to the Food and Drug Administration’s (FDA) guidelines on food processing known as the “Current Good Manufacturing Practice in Manufacturing, Packing or Holding Human Food” and The Food Safety Modernization Act of 2011. The Food and Drug Administration (FDA) also made effective regulations regarding the “Safe and Sanitary Processing and Importing of Fish and Fishery Products” in 1997. These measures include a “Fish and Fishery Products Hazards and Controls Guide” directing the transportation, storage, processing and preparing of seafood products in processing centers, industrial kitchens and retails markets with specifications for preparing food (such as grocery stores with hot bars). Processing includes: storage, handling, holding, heading, gutting, packaging and treating with chemicals. Components and regulations within these guidelines that are particularly relevant for the processing and distribution of seafood include proper storage, mixing of food, the handling of raw materials, maintenance of frozen foods, and sanitation involved with the mechanical manufacturing (e.g. washing, peeling, trimming) of food.
The FDA has guidelines for the processing and distribution of seafood in the United States. The FDA guidelines for seafood are in the “Safe and Sanitary Processing and Importing of Fish and Fishery Products,” a text that has seen no major changes since its 1997 publication and focuses mainly on interstate commerce and imported seafood products. This comes despite the fact that local seafood demand and access has increased in the past 20 years and a number of new seafood species and products have entered the market. The “Fish and Fishery Products Hazards and Controls Guidance” was established in 2011 and provides aid for processors to develop their own Hazard Analysis Critical Control Plant (HACCP) plans. HACCP plans can be designed and modified to fit the work of individual facilities, but they are required of every processor in the US. None of the aforementioned guidelines or regulations is particularly prohibitive or restrictive. Rather, they encourage food handlers to manage processed products in a way that minimizes contamination, microorganism growth and invasion of pests and that maximizes quality. All fish processors must be HACCP certified. These regulatory guidelines do impose costs on processors and may be prohibitive, but since there are no policies barring the entry of new seafood types, processing centers will not incur any new costs upon introducing different species and processing methods into their facilities to meet this market demand.

Therefore, expanding processing and distribution for underutilized seafood in North Carolina requires utilizing a processing center that is already HACCP certified or developing a new processing center that meets HACCP requirements and has all the necessary licenses.

There are a number of programs that guide retail of food products in the United States, mostly through the US Department of Agriculture (USDA). The Farmers Market Nutrition Program (WIC-FRMP) is an USDA program, which provides eligible citizens with cash vouchers for farmers markets products; it can therefore be used to help subsidize the cost of local seafood products for pregnant women and recent mothers. Federal policy through the Farm Bill (USDA) allocates funding to promote and aid the establishment and expansion of farmers markets through the Farmers Market Promotion Program (FMPP). Funding for programs for farmers market were first approved by congress in 2002 and by 2012, 575 grants totaling over $32 million were awarded in all fifty states. Funding has been used to increase vendor sales, diversify products sold and vendors available, improve capacity to accept EBT/SNAP payments, offer cooking and nutrition classes to the community and provide trainings for farmers and market managers. Grants represent opportunities to offset the risk of introducing a new product into the market before the benefits are realized. In 2014, 8 grants were provided to North Carolina from the FMPP, totaling almost $600,000 in grant money and involving local healthy food vendors all over the state. There are no FMPP incentives focusing on seafood.
The only federal agency program focused exclusively on funding local seafood is the National Fish and Wildlife Foundation’s Fisheries Innovation Fund. This program, established in 2010, works to foster capacity-building and enabling environments in fishing communities, such that fishers have local infrastructure (cold-storage and processing) and spaces to exercise control and to have an impact on the governance and supply chain of their products. It also promotes and helps build community-supported fisheries. The program does not specifically look for initiatives that seek to provide access to low-income community members or expand the use of SNAP/EBT and WIC benefit for seafood products at retail markets.

This policy review demonstrates that while there are many agencies that have jurisdiction over seafood supply chains in the United States, few of them restrict the development of a market for underutilized species. In fact, grant money established from various bills and incentive programs serve as potential conduits for stakeholders of local food to obtain seed funding and to establish underutilized seafood value chains into these markets. Policies represent one type of barrier that could limit the introduction of underutilized species into affordable markets. Other barriers can be economic, cultural, and physical. This paper looks to identify those barriers and offer recommendations for overcoming them or finding alternative solutions.

4. Methods
4.1 Pilot community selection and research
Two study sites in North Carolina were selected for this project, New Bern and Garysburg. All of Garysburg is classified as a food desert, while portions of the city of New Bern qualify as food deserts. Sites were chosen after several consultations between the researchers, NC Catch, and environmental professionals who focus on community development and income inequality in North Carolina. Sites were chosen not based on national statistics, but because experts indicated that these two regions varied demographically but had food access limitations and various levels of public and private intervention programs. Because the ultimate goal of NC Catch is to expand seafood access to many counties in North Carolina, there is no favoritism or preference for Garysburg or New Bern; they merely serve as the pilot from which a comprehensive framework will be created.

4.2 Background data collection
In order to gain an understanding of the topics relevant to establish a supply chain of local seafood to low-income areas, multiple resources were consulted. An extensive literature review was conducted, focusing on the history and status of the commercial fisheries of North Carolina, local seafood in North Carolina, local food supply chains and models, food deserts, and local food systems in low-income communities. Along with this were in-person or phone interviews with 25 individuals or group stakeholders involved in commercial
fishing, marketing of underutilized species and community development (Exhibit 1 in Appendix). Interviews were tailored towards the particular focus of each interviewee. Fishermen, for example, were asked what species they caught and sold that they would consider to be underutilized fish. The fishermen were then asked why they thought those particular species were underutilized or lower-value than other species of fish that they caught and sold. The participants of the interview were selected using a snowball sampling method. First, NC Catch provided the researchers with relevant contacts with whom they were familiar. From there, those contacts provided additional names. In addition, Nicholas school alumni and community non-profits were cold called. Without providing notice, the researchers travelled to several fish houses and fish markets along the North Carolina coast to collect information.

4.3 Identification of viable species to consider

After consulting with a number of fishers, fish dealers and fisheries scientists, a list of 25 fish species that are landed in North Carolina was compiled. Certain interviewees had strong political opinions toward fisheries management and the viability of certain fish species according to regulation. In order to confirm the assertions made by interviewees, several metrics were considered. Criteria consulted for each species was status of the stock, Monterey Bay Aquarium Seafood Watch (MBASW) rating, management practices in place (size limits, quotas etc.), average ex-vessel price in North Carolina, ease of cleaning and processing, and accessibility of recipes. The researchers were preferentially looking for fish that are considered viable (not overfished or experiencing overfishing), are assigned a “Best Choice” or “Good Alternative” rating from MBASW, have a fishery management plan in place, an average ex-vessel price of under $2.00/lb.

4.3.1 Decision matrix

Of these criteria, stock status, MBASW rating, and ease of cleaning were graded for each fish on a 3-point scale, with 3 being “worst,” 2 being “acceptable,” and 1 being “best.” Grades were added, resulting in each fish having one number grade, with 3 being the best possible grade and 9 being the worst. Fish species with overall grades of 7-9 were removed from consideration.

4.3.2 Landings data

After the number of fish for consideration was reduced to represent more favorable species, granular data for 2013-2014 was requested from the North Carolina Division of Marine Fisheries. This data provided landings data for every month and several bodies of water as well as lowest, highest and average ex-vessel price for each line item. From this point, the researchers were able to determine seasonal and regional availabilities as well as expected costs per pound upon landing, not including additional costs associated with purchasing from a fish dealer, processing or distribution.
4.4 Focus groups

In order to assess how receptive consumers in Garrysburg and New Bern are, focus groups in these communities were held in January and March of 2016. Two focus groups were conducted in New Bern and one in Garrysburg. Focus groups were organized through local non-profit partnerships and conducted during a time period where attendees would have normally been present (e.g. town hall forum, community development center child pick-ups). Fish were chosen based on the final list created and the seasonal availability of fish markets in the Triangle area. Recipes were developed using the guidance of Chef Ricky Moore, owner and chef of the Salt Box of Durham, a board member of NC Catch and active participant of seafood conversations in North Carolina, as well as a former resident of New Bern. Recipes were developed for whiting, trout and bluefish, and can be found in Exhibit 2 of the Appendix.

In each focus group, attendees were asked either verbally or through surveys about their current tastes and attitudes towards seafood. Then they were given three samples of local North Carolina seafood. The samples differed in taste, texture, flavor, boniness and mode of preparation. Recipes were made available to all participants. During and after the tastings, attendees were encouraged to engage in a discussion on what they enjoyed and did not enjoy about the samples and what barriers they perceived to accessing seafood in their communities. Information gathered at the focus groups was used to gain an understanding on the potential for locally sourced seafood to be bought and consumed in the pilot communities. From the discussions and surveys, recommendations can be made concerning the taste, price, preparation requirements, and other characteristics of fish species that might be sourced to low-income communities.

4.5 Distribution costs & GIS analysis

Distribution costs between landing, processing and retail depend on a number of variables, such as the locations of and distances between each point along the supply chain, processing costs, and the price of renting or buying a refrigerated truck and truck driver for transport. These individual costs were estimated and then aggregated using a number of different methods. A GIS analysis examined routes between storage from fish houses along the coast to potential points of seafood distribution in study communities. Because fish can be landed and processed in many different regions, it was important to optimize those distances for each of the two communities.

Fish houses that could conceivably source local fish were located by utilizing information gathered from a combination of internet searches, community interviews, and a list of fish houses provided by Dr. Barbara Garrity-Blake of NC Sea grant. Fish houses or markets west of Interstate 95 (I-95) were excluded from this analysis, as it was assumed that these locations sourced fish from coastal areas or elsewhere. There were 29
such sites identified in this manner. Potential ends to the distribution route were determined in each community based on the results of the focus groups. In Garysburg, the site chosen was the farmers market currently in development in the town’s closed elementary school. In the Garysburg town hall meeting, high priority was placed on developing the farmers market on that site. The site is also located close to other important community buildings, such as the town hall, fire department, and police department. For New Bern the Duffyfield Child Center is a proxy end, since it is located in the heart of a low-income neighborhood and is theoretically accessible in the community.

Each point was created in ArcGIS using an excel spreadsheet containing metadata for each location (Lat/Long, affiliation/type, address, etc.). Each start point was paired with the two end points, resulting in two point shapefiles for each fish house. These start and end pairs were then overlaid on a road network obtained from the North Carolina Department of Transportation. Using the Network Analysis toolbox within ArcGIS, the shortest route between start and an end pair was identified (recorded in miles). In the case of fish houses in Snead’s Ferry, NC, a polygon-restricted area was applied to the road network in order to prevent the tool from routing through closed roads on Marine Corps Base Camp Lejeune. The resulting routes were then merged into one polyline shapefile for each endpoint, containing the length information for each individual route in a table format. These tables (one for each end location) were then converted into excel spreadsheets.

In addition, trucking research data was collected to determine the average cost of fuel, depreciation and labor-per-mile based on national statistics. The length spreadsheets were used to apply per-mile operation costs derived from the American Transportation Research Institute’s (ATRI) “An Analysis of the Operational Costs of Trucking: 2015 Update.” These were operational costs for straight trucks and tractor trailers. To approximate the operational costs of a commercial van, mpg estimates and 2015 average gas prices were acquired from the US Department of Energy’s website to calculate fuel costs. Other components of operational cost were assumed constant between trucks and vans. By dividing cost of transportation from a fish house to market by a theoretical price per pound, the amount of fish needed to sell to breakeven can be determined.

Interviews with local distributors and processors were also conducted to compare the actual costs to those predicted by researchers in the trucking and transportation industry as well as the average costs of fish through different levels of the supply chain and to understand where existing distribution routes could be utilized to increase access in low-income and rural areas.
4.6 Compiling into a template

After all these steps were taken, the researchers aggregated it to have a clear idea of what the obstacles and opportunities are present in each aspect of the supply chain. From this, a framework that can be applied to New Bern and Garysburg as well as other communities was developed. This can also be used when applying for grant funding to finance initial and overhead costs before the operation generates sufficient profit.

5. Results and Discussion

5.1 Pilot Communities – Garysburg

5.1.1 About Garysburg

Garysburg is a small town within the county of Northampton in northeastern North Carolina, close to Virginia along the 1-95 corridor, “but not a destination.”95 As of the 2012 census, the population of Garysburg was 1,057. 96% of Garysburg is black. 28.4% of the entire community, and 35% of children under 18, are classified as living below the poverty line.96 The town has a median household income of $22,604 as of 2010 and 23.51% of the population was unemployed. There is a lot of farmland in Northampton County, with over 340 farms, many of which produce commodity crops in large volumes. Northampton, as a county, is 2nd in the state for cotton, 8th for peanuts, and 13th for soybeans. Currently, there is almost no diversification of crops; 95% of total crops grown are cotton and soybeans, and 3% are corn.97 Other major industries in Garysburg are transportation, warehousing and construction. The closest fishing community to Garysburg that is in North Carolina is the Outer Banks, which is 66 miles away. Garysburg’s most public connection with seafood is an annual herring breakfast fundraiser that has been hosted since 1982 to support the volunteer fire department. Every Saturday morning, for three months in the beginning of each year, the local fire department and the Ladies’ Auxiliary group prepare and serve over 1,000 pounds of herring, fried potatoes, hush puppies and coffee. The event is incredibly popular in the area and is rumored to sell out before 8 AM each Saturday.
5.1.2 Garysburg Food Hub & Farmers Market

As of fall 2015, Garysburg had launched a farmers market in an elementary school building that was abandoned in 2009. A fifth-generation farmer from Garysburg, Julius Tillery, who also served as the contact for this project is advocating the utilization of this school to become a food hub and farmers market that supports local economies. Tillery is the Farm Resources Coordinator for the Resourceful Communities wing of the Conservation Fund. Together with the Frank Hawkins Kenan Institute of Private Enterprise, Tillery conducted a feasibility study for the food hub and farmers market, also known as the Heritage Market. The goals of the hub are to encourage local farmers to diversify their crops and include higher-value vegetables such as cabbage, green bell peppers, and sweet potatoes. The hub will aggregate these higher-value crops for local sale and distribution. As the volume of crops increases, the hub will have the capacity to serve as a processing, distribution and storage center and eventually sell locally harvested crops to nearby markets. The hub will function as a limited liability corporation (LLC) and be co-owned by the town, private partners and farmers. The elementary school is centrally located in Garysburg, near the town hall so it is easy to access in this small community. The Heritage Market will serve as the point of sale for seafood products.

5.1.3 Food Availability and Health in Garysburg

There are no grocery stores in Garysburg, but there is one convenience store. According to members of the focus group who have lived in Garysburg for many generations, this convenience store used to sell local fish
on Fridays. However, upon transfer of ownership, the convenience store no longer offers these products. The Roanoke Valley Farmers Market in Roanoke Rapids, which is 10 miles away, serves customers from 7 counties and provides fresh fruits and vegetables. In addition, Atlas Seafood is in Roanoke Rapids and sells locally caught, fresh seafood. For consumers in Garysburg with cars, travelling to Roanoke Rapids for groceries is not an onerous burden. However, for individuals without cars, it is.

The top three health concerns of Northampton County are obesity, diabetes and teen pregnancy and the leading cause of death is heart disease. Similar to lack of food access, individuals without cars in Garysburg suffer because of limited health and wellness care practices in the community. In the February town hall forum meeting, a member of the Department of Parks and Recreation cited the importance of having the Heritage Market site for mobile clinics and wellness promotional programs can serve the community and where children are free to play and exercise. The plot of land, on which the school rests and where the food hub and farmers market is located, is 14 acres. This space can serve food and overall community health initiatives.

5.2 Pilot Communities – New Bern

5.2.1 About New Bern
New Bern is located in eastern North Carolina, in Craven County. The 2012 census recorded a population of 30,216 with more racial diversity than Garysburg. 57% of the community is white, 33% is black, 6% is Hispanic, and 4% is Asian. While the median household income is higher than for Garysburg, at $37,493, over 24% of the population lives below the poverty line which is still significantly higher than the overall poverty rate in the state of North Carolina. Major employers in New Bern include the Marine Corps, the Fleet Readiness Center East, the Carolina East Medical Center, B/S/H Home Appliances, and Weyerhauser Company. Prominent industries include food service, physician’s offices, grocery and retail stores, and employment services. Craven Community College and the University of Mount Olive are also located within New Bern.

5.2.2 Food Availability and Health in New Bern
Grocery stores present in the New Bern area include Harris Teeter, Piggly Wiggly, Food Lion, Wal-Mart, as well as small regional stores such as Editha’s Grocery, Armstrong Grocery Co, and Merchant’s Grocery. Most of these stores accept SNAP benefits. There are a number of fish markets located in New Bern as well. One is Tryon Palace seafood market in downtown New Bern and another is B&Js Seafood Market along highway I-70, which is not easily accessible without a car. There are a number of private food assistance programs in New Bern. The Food Bank of Eastern and Central North Carolina that serves over 3.5 million people has a
distribution center in New Bern. The Food Bank does distribute seafood and has HCCAP capabilities for tuna and processed foods.\textsuperscript{102} Based on an existing relationship with NC Catch, the Food Bank is eager to receive more local, fresh seafood and has the capacity to receive such donations. The Food Bank was one of two New Bern contacts where a focus group was held. The other non-profit partnership was Coastal Community Action, which supports family development and provides food for children and families in various development centers. Other organizations that provide food assistance in New Bern include Religious Community Services, an NGO, and several churches.

The three leading causes of death in New Bern are cancer, heart disease and cerebrovascular disease. \textsuperscript{103} All leading causes of death besides chronic respiratory diseases and unintentional injury have higher rates in minority populations. 70.2\% of eastern North Carolina residents who responded to a survey reported that they are overweight or obese.\textsuperscript{104} Nutrition counseling services are available from the health department in New Bern.

### 5.3 Viable Fish Species

A decision matrix was created to narrow the list of 25 fish species recommended by various fishermen, processors and fisheries biologists. This was done because their levels of knowledge regarding sustainability and need and their stakeholder interests vary. As a result, several suggestions had questionable legitimacy as viable fish species for this project. The three considerations in the matrix were: 1) the stock status according to its managing authority; 2) the rating for that fish and region provided by the Monterrey Bay Aquarium’s Seafood Watch program and; 3) the ease of “cleaning” of the fish, based on online forums and conversations with fishermen and processors. Each individual consideration received a final grade between 1 and 3 and the total grades were combined. The lowest possible grade a fish could receive was a 3 (best) and the highest was a 9 (worst). 17 of the 25 species received a grade of 6 or below, and were considered for this project. The final species were: amberjack, Atlantic croaker, black drum, bluefish, carp, catfish, kingfish, pigfish, porgy (scup), spot, spotted seatrout, squid, stingray, striped (jumping) mullet, and white perch. Bowfin (Grinnel) was given a score of 6, but was removed from the list because of the species’ high rates of bioaccumulation of mercury and other heavy metals.\textsuperscript{105} Certain fish that are harvested in fresh bodies of water may also have notable levels of mercury and other toxins depending on which body of water they are caught in. Refer to Exhibit 3 in the Appendix to see scores in the decision matrix. In addition, black sea bass and spotted seatrout were removed from consideration because of high ex-vessel prices.

The species identified through this process are considered as possible fish to source for the supply chain with the understanding that conditions in the commercial fishing and seafood industries can experience rapid
change depending on environmental, social, ecological, and economic factors. Changing conditions could preclude certain recommended species from being viable for this project or make a previously removed species an option. Small scale changes in availability might also make one of the recommended species temporarily unavailable; factors like seasons and weather act to change what is available. A good example demonstrating issues in reliability and availability occurred in the course of this project. A large storm that occurred a week before the first two focus group sessions meant that the fish market originally tapped to source the fish for samples did not have the product that was needed. This was because the storm kept their suppliers’ boats from fishing, which meant they had none to sell to the researchers, who subsequently had to find a fish market that did have the required product. The three fish species ultimately used for this project were whiting, bluefish, and trout.

After the 17 species were selected, monthly and regional data about them was evaluated in order to better understand of how seasonal, regional and cost availability varies throughout a year. Getting a better understanding of where and when to purchase fish for this project will allow stakeholders to streamline their resources and outreach efficiently and appropriately. Tables, maps, and charts demonstrating information about underutilized species and their seasonal and regional landings can be found in Exhibit 4 of the Appendix.

5.4 Focus Group Results

5.4.1 Garysburg

5.4.1.1 Pre-focus group observations

The focus group in Garysburg was held on January 25th, 2016 in Garysburg's town hall during the convening of a semi-regular meeting of Garysburg and Northampton county residents and stakeholders. Approximately 30 people were in attendance and 20 samples were taken for the focus group. Stakeholder groups at the meeting included county level agencies, non-governmental agencies focusing on economic development, and residents of Garysburg. The overall purpose of the town hall meeting was to develop plans for the future of the Heritage Market and elementary school space. Because of the size of the school and its adjoining field, stakeholders are interested in a multi-purpose use of the space including the Heritage Market and food hub, a health clinic, an education training facility and a center for small business development. The focus group and seafood access project was pitched by town administrators as an example of the varying ways to collaborate with local food distributors to provide more options to the community while enabling economic development opportunities. The focus group provided an opportunity to examine the receptiveness of this community to the types of seafood that a supply chain from the coast might offer. It was also a way to learn about the opportunities and obstacles guiding local access to seafood.
At the town hall meeting there were refreshments offered for the duration of the meeting, which included chips, soda, bottled water, coffee, packaged cookies, and fruit punch. The town hall meeting began with a prayer and an introduction of certain attendees representing various interests. Member demographics varied, although the large majority of those in attendance were black and everyone was an adult. There were several people who were not from Garysburg, but were involved in local foods movements and organizations and could comment on Garysburg from an outsider but still informed perspective. It is worth noting that the presence of stakeholders from elsewhere in Northampton County could have provided answers that are not representative of the community as a whole, particularly members of the community without a car or younger people who were not present.

5.4.1.2 Focus Group Results
Questions and discussion topics for the focus group were outlined in a script that can be found in Exhibit 5 of the Appendix. Community members participating in this focus group were generally familiar with seafood as a whole and commented that they regularly ate seafood. When asked about foods they enjoy, fish, shrimp, and shellfish were among the answers (which also included beef, chicken, and vegetables). The large majority of the group responded affirmatively when asked if they had purchased or eaten seafood in the last month. Flounder, whiting, tilapia, and salmon were noted as fish that had been consumed by those who had responded affirmatively to the previous question. Participants mentioned that the salmon they purchased was wild caught.

Some participants in the focus group responded that they did not regularly prepare or consume seafood. They cited fear of heavy metals in seafood, the quality of farmed fish from outside of the US, and concerns over storage and handling of fish as reasons for caution. These participants said that these concerns generally prevented them from purchasing any seafood, but did not mention cost or access.

The bluefish served at the Garysburg Town Hall focus group was well received. Words and phrases such as “nice and smoky,” “chewy,” and “darker” were all used to positively describe the taste of the fish. No participants spoke negatively about this fish. Several participants had not eaten bluefish before. Those that had heard of bluefish indicated that their impression was that it is landed and sold in the Northeast and was not available in the Southeast.

Unlike the reaction to bluefish, the reaction to trout was relatively mixed. While most, if not all, participants were familiar with trout, only two people said that trout was their favorite sample out of the three. Some said that the taste was overly fishy. Others did not like the bones that made it into some samples. Some
participants did say, however, that they did not mind bones, and that bones did not have any impact on the taste of the fish.

Whiting was the overall favorite of the three samples provided, with the majority of participants reacting favorably to the fish. Some however, noted that they were not used to the preparation of the sample. These participants said that they were accustomed to consuming fried whiting, rather than baked or sautéed. Some noted that Texas Pete hot sauce was a favorite topping for fried whiting, but they were receptive to the sweet taste of the prepared whiting sample. However, one man mentioned that the preparation of the whiting turned him off.

After the tasting, certain attendees commented that they were initially nervous about trying the fish. These participants cited that they were worried about the preparation of the samples. The samples were served cold, which made certain participants wary of the taste and quality. Others did not know what species had been provided until they were informed during the focus group process, which contributed to apprehension. The preparation and temperature of the seafood samples were commented on by several participants. These participants said that, although they enjoyed the samples, different results might occur if the fish were served warm. Some were rather apprehensive about eating cold fish, and a common remark was that there was some surprise that chilled fish could taste good. Other comments on the preparation referred to the recipes used, none of which included breading and frying. Certain focus group participants recommended that any attempt to introduce new seafood to a community should consider preparation methods that are familiar to residents. Overall there seemed to be some interest in new fish that is prepared in different ways, and encouraging foods that are not fried to the community at large.

When asked if they would purchase these species should they become available in Garysburg, all participants responded in the affirmative. Many respondents, however, mentioned that they had already purchased seafood in one form or another in Roanoke Rapids at the Atlas Fish Market. Every participant of the focus group who lives in Garysburg drives to the neighboring Roanoke Rapids for many of their grocery needs, however they mentioned that mobility remains an issue for those without cars in the community especially as public transportation is limited. Some older participants were familiar with other seafood species, including whiting, herring, butterfish, and flounder. This is owed to the existence of a local convenience store that once served these fish species on Fridays. Because of the relative proximity to the coast, participants mentioned that families used to go fishing off of Norfolk, Virginia. They lamented that this is no longer a tradition in Garysburg. The overall consensus was that there was a willingness to purchase North Carolina seafood, should the fish be sold at a Garysburg Heritage Market, food hub or other accessible retail market.
5.4.2 New Bern
5.4.2.1 Focus Group 1
5.4.2.1.1 Pre-focus group observations
On February 29th, close to 80 participants enrolled in a focus group held in the Duffyfield Child Development Center in New Bern, a property owned and run by Coastal Community Action (CCA). Families were native and non-native English speakers. CCA community members in the focus group were white, black, Latino and Asian. While specific ages of participants were not recorded, the familial generations ranged from infant to grandparent. CCA development specialists, kitchen staff and teachers also participated in the focus group. CCA sent an email blast and posted flyers up in English and Spanish asking people to RSVP, and received 100 responses. After the regular 1 PM pick-up, the families filed into the cafeteria where the tables and chairs were arranged to be facing the presenter. Each individual signed in and signed a consent form for themselves and their children, and was given information about the Master’s Project as well as fliers from NC Catch and The Seafood Nutrition Partnership. Once the majority of the participants were seated, the moderators introduced themselves per the script to explain the project and remind participants of the confidentiality of the program, and that they could leave at any time. Once this happened, seafood was distributed and the moderator travelled to the individual families to have informal interviews. This was a last-minute decision as it proved to be too difficult to re-engage the group after sample distribution. The results reflect this change in receiving information.

5.4.2.1.2 Focus Group Results
Of the three samples, participants almost always harbored a strong preference for only one. They indicated that while the fish species were not always unfamiliar, the way they were prepared was. Many people had not tried bluefish before. Those that had mentioned that it was normally fried. They suggested that if and when processed seafood products using local fish become available and accessible, there should not be too much diversity in the types. The participants credited this to the fact that many of them already eat fried fish and may initially be wary of many new options. Conversely, certain people expressed a desire to have access to more varieties of fish, especially sushi restaurants.

Many participants said that they regularly purchase frozen salmon and tilapia from grocery stores. Some participants are interested in buying local seafood, contributing to local economies and helping fishermen become more economically sufficient. These two perspectives are not mutually exclusive; people are open to buying frozen and fresh fillets of farmed fish as well as fresh local fish depending on time, availability, and mood.
People were generally offended that there is a conclusion drawn that low-income individuals are not willing to pay more for healthier, higher quality food. There was consensus among the group that the issue is a lack of access, not willingness to pay. Many people discussed their perception of the origin of limited access in low-income and rural communities. Certain participants who are grandparents or great-grandparents felt that limited access problems can be rooted to the industrialization of agriculture in the eastern part of the state which caused a migration outside of small towns into cities, thereby closing local businesses and limiting income opportunities. From this, fast food corporations capitalized on an increase of working mothers with less time to prepare food, and a fast food industry grew in what was once a region with a deep cultural connection to the land and its bounty. Members of the community agreed that food in rural and low-income communities generally cost more than in suburban grocery stores, so they are already paying more. This does not necessarily indicate a rich history of eating diverse types of local seafood, however it does emphasize a recognition and disappointment among the community regarding the current state of industrialized food in the region.

Nutrition and wellness were important topics for participants in this focus group. Heads of household are incorporating healthier options in their home cooking. Many mentioned opting for olive oil or coconut oil over vegetable oils and frying less frequently. Individuals involved in local church activities mentioned that there are many health and wellness initiatives through churches. These include the purchasing of farm land to harvest and provide more vegetables, as well as hosting potluck dinners and cooking workshops. Lastly, some children were very enthusiastic about eating fish, and others weren’t. Many children indicated a preference for healthier foods (specifically fruit and organic fruit juices).

Similar to the Garysburg focus groups, there seemed to be an expressed interest in providing seafood to all members of the New Bern community, and particularly those with limited access, low-income and health concerns.

5.4.2.2 Focus Group 2

5.4.2.2.1 Pre-focus group observations

On March 17th, close to 60 Food Bank of Eastern and Central North Carolina clients came to the Undenominational Pentecostal Holiness Church in New Bern for a monthly distribution. The clients represented multiple ages, races and socioeconomic conditions. Some of the clients regularly received donations from the food bank and others were emergency recipients, who expressed a shorter-term need for food assistance. This was the only focus group where participants were definitely receiving one form of food assistance (other focus group participants were not asked this question). The distribution window ran from 12:00 PM to 1:00 PM; as such there was no way to commit every participant to a certain period of time for a
focus group. In response to this, each participant was given two surveys developed by the researchers to complete (surveys can be found in Exhibit 6 of the Appendix). One survey was filled prior to eating the samples and the other was given after. Many clients were reluctant to participate, some citing that they had already eaten and others expressing a dislike or disinterest in seafood in general. In total 14 surveys were filled out. This sample size does not provide enough empirical evidence for a thorough analysis but it equivalent to the level of content that would be provided by a smaller focus group.

5.4.2.2.2 - Focus Group/Survey Results

Figure 4. Pre-Sample Question 1 was an open-ended question.

![Question 1: What are some of your favorite foods?](image)

Everyone who answered this question included at least one type of seafood (e.g. fish, lobster, shrimp, or flounder)

Figure 5. Pre-Sample Question 2 was a multiple choice question asking if seafood had been purchased in the past month. This can include fresh, frozen, processed, canned, prepared etc.

![Question 2: In the past month have you bought seafood?](image)
Figure 6. Pre-Sample Question 3 asked respondents to indicate which generally positive or generally negative statements regarding seafood they agreed with.

These results demonstrate that there were generally more positive than negative statements reflecting participants’ feelings towards seafood.
Figure 7. Pre-Sample Question 5 was about people’s ability to prepare seafood in their homes. This is important for determining what level of processing may be necessary for seafood introduction.

![Question 5: Do you know how to prepare raw/uncooked seafood?](image)

Figure 8. Post-sample Questions 1, 2, 3 were about the individual samples, whether or not people enjoyed them and the reasons that they did or did not enjoy them.

![Did you like the sample?](image)

![Why did you like or dislike the sample?](image)
Q5. If the samples you tried were sold at a store near you, would you think about buying them?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I Don't Know</th>
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<tr>
<td>7</td>
<td>0</td>
<td>2</td>
<td>5</td>
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Q6. Would you be interested in trying other seafood products?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I Don't Know</th>
<th>No Answer</th>
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<td>8</td>
<td>1</td>
<td>0</td>
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</tbody>
</table>

Table 1. Post-Sample Questions 5 and 6 were asked in order to determine if there is an interest in continuing to introduce new fish types and methods of preparation and if people would purchase them.

5.5 Distribution Costs & GIS Analysis

5.5.1 Garysburg

The majority of the sites (25 out of 29) initially identified as possible sources of seafood were greater than 100 miles away from the town of Garysburg (see Exhibit 7 of the Appendix for additional map). The closest fish house was Perry-Wynn’s Fish Company, located along the Chowan River and owned by Murray L. Nixon Fishery, Inc. The calculated cost of a one-way trip from Perry-Wynn’s to Garysburg with a commercial van would be $73.66, while a commercial truck would cost $92.72. The average price for a one-way trip from the 4 fish houses less than 100 miles away was $103.42 for a van and $130.19 for trucks. As shown in Table 2, doubling these values to obtain cost for a two-way trip gives $206.84 and $260.38, respectively. Dividing two-way cost by price per pound gives the number of lbs. of fish needed to sell simply to break even. This was calculated at 2.99, 1.99, and 0.99 per pound. This price does not include the ex-vessel price for the fish before it was bought to the fish houses. For vans, 44.839, 67.371, and 135.422 lbs. needed to sell for each price point mentioned, while for trucks it is 56.444, 84.807, 170.471 lbs.
Garysburg is notable for its close proximity to I-95 as well as the more developed town of Roanoke Rapids, which is home of Atlas Seafood. A phone interview with an employee of Atlas Seafood on March 19th confirmed that the dealer that supplies the store with fresh North Carolina seafood is Atlantic Seafood, located in Hampstead, NC. Atlantic Seafood is located 168.1 miles from the site of the proposed Garysburg Heritage Market, which is a much longer distance than locations such as Perry-Wynn’s or Murray L. Nixon. However, Atlantic Seafood has access to I-95 because it leads to major northern markets like Washington D.C. and Baltimore. Because of this, it makes sense that despite closer proximity to several fish houses in the northern coastal plain and outer banks of North Carolina, Atlas Seafood sources from Atlantic Seafood. Atlantic Seafood is distributing its seafood farther north, so that the well-established northern distribution routes can be capitalize to increase access to seafood in Garysburg.

5.5.2 New Bern

In comparison to Garysburg, New Bern is much closer to a wider variety of fish houses in North Carolina (see Exhibit 7 in the Appendix for an accompanying map). It also is located at the crossing of two state routes, 70 and 17, which travel east-west and north-south respectively. Thus New Bern has close access to fish houses in Carteret and Onslow counties, which contain the traditional fishing communities of Beaufort, Morehead City, and Snead’s Ferry, among others. Of the 29 fish houses examined in this analysis, 19 were within 100 miles of New Bern, and 11 were 60 miles or closer. Average cost of one-way travel for these 11 fish houses was $67.03 for a van and $84.38 for a truck. Price for a two-way trip is then double these values, at $134.07 and $168.77, respectively. When divided by price points, as described for Garysburg, required sales for breaking even for vans is 69.178, 103.941, and 209.931, while for trucks it is 87.082, 130.842 and 263.005 lbs., which can be seen in Table 3.

Table 2. Two-way distribution costs and needed sales to break even for Garysburg

<table>
<thead>
<tr>
<th></th>
<th>Van</th>
<th>Truck</th>
<th>Sales to Break Even (lb.)</th>
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</thead>
<tbody>
<tr>
<td>Two-Way Costs ($)</td>
<td>206.8416</td>
<td>260.3753</td>
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</tr>
<tr>
<td>Price ($/lb.)</td>
<td>2.99</td>
<td>1.99</td>
<td>0.99</td>
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<tr>
<td>Van</td>
<td>69.178</td>
<td>103.941</td>
<td>209.931</td>
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<tr>
<td>Truck</td>
<td>87.082</td>
<td>130.842</td>
<td>263.005</td>
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</table>
Table 3. Two-way distribution costs and needed sales to break even for New Bern

<table>
<thead>
<tr>
<th></th>
<th>Van</th>
<th>Truck</th>
<th>Sales to Break Even (lb.)</th>
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</thead>
<tbody>
<tr>
<td>Two Way Costs ($)</td>
<td>134.0677</td>
<td>168.7664</td>
<td>Price ($)/lb.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Van</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.99</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>44.839</td>
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<tr>
<td></td>
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<td>56.444</td>
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<tr>
<td></td>
<td></td>
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<td>170.471</td>
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</tbody>
</table>

It is likely that much of the supply for fish to New Bern is based in Carteret County, since Beaufort and Morehead City are such prominent fishing communities. There are two fish markets (left off this list because they are markets only, and as such do no processing) in New Bern, Tryon Palace and B&J Seafood. The owner of B&J Seafood, Brent Fulcher, has recently purchased and is rebuilding a fish house known as Beaufort Inlet Seafood, located adjacent to Pivers Island in Beaufort. Beaufort Inlet Seafood will likely provide a processing facility for B&J Seafood. As in the case of Garsburg, a distribution channel to a location just adjacent to the study community exists; tapping into that distribution channel is likely a good option.

5.5.3 Interviews with Processors & Distributors – Atlantic Seafood

Atlantic Seafood is a large distribution company, employing 20 salesmen with territories from Florida to Maryland and serving hundreds of accounts. One of these accounts happens to be Atlas Seafood in Roanoke Rapids, previously discussed as having been located adjacent to the community of Garsburg but unreachable from that location without a car. When asked about the accuracy of the price estimates per mile that had been calculated by the researchers, Atlantic Seafood’s representative responded that they did not base wholesale prices directly on the distance that would need to be transported but on a flat rate applied to the price of the fish after purchase from a fish house or dealer. An estimate of $0.30/lb. was given as an example of a flat price, with the representative adding that Atlantic Seafood was more of a high-volume and low-profit margin outfit than other distributors in the state. The flat rate quoted by Atlantic Seafood was enough to cover transportation costs, profit for the driver, and profit for Atlantic Seafood, and would be adjusted depending on market conditions. The representative also provided an estimate of wholesale prices for a number of underutilized species (Table 4). It was also pointed out that the greatest costs associated with purchasing and selling seafood in a new location (e.g. a farmers market in Garsburg), would not be the transportation and purchase costs associated with buying product, but for the capital that would need to be invested in at the point of sale. Refrigeration equipment and walk-in coolers are often necessary and expensive, and represent the largest cost. In the opinion of the Atlantic Seafood representative, selling fish is the easy part.
Table 4. Estimated wholesale prices for Atlantic Seafood for select species. These are prices that retailers such as Atlas Seafood in Roanoke Rapids would pay.

As for the distribution chain, this representative confirmed the findings of literature that stated that distribution channels running north-south were well developed, while those running east-west were relatively fragmented. I-95 was considered a main route of travel; some fish sourced from the west coast often had to be flown in to a location along the I-95 corridor in order for it to end up in Atlantic Seafood’s distribution center. The reason for this was cited as the lesser demand for seafood in inland cities. According to the representative, customers who understand seasonality and the wide variety of seafood available are more likely to be willing to purchase a wide variety of species. Customers living in an inland state like Tennessee are generally aware of fewer seafood species.

6. Concluding Remarks

From the results of this project, several recommendations can be to NC Catch in order to facilitate their goal of implementing a supply chain that would improve access to locally caught and processed seafood in low-income areas of North Carolina.

The first of these is community engagement. As has been shown, communities lacking access to North Carolina seafood are just like any other community in that they are made up of a diverse assemblage of people with differing tastes, ideas, obstacles, and wants. Understanding how this diversity might impact efforts to improve access to North Carolina seafood is essential, as there is no “one size fits all” method for success. Community members must also have an awareness of what is available to them, what might be made available to them, and the positive benefits associated with North Carolina seafood in order for demand for local seafood to be demonstrated. Because of this, proper marketing is essential for success of any program
designed to improve access to North Carolina seafood in these areas. While the study communities in this project showed a general awareness of local seafood and its benefits, it is important to note that these communities are still located within the coastal region of the state. More inland communities in the Appalachian foothills or the Piedmont region might not possess cultural knowledge of the variety of seafood potentially available to them. As previously stated, the perceived lack of knowledge of these communities is already a cited reason as to why the east-west distribution route is not utilized by seafood distribution companies. If NC Catch desires distribution of seafood to these communities, it will have to assess this knowledge and implement marketing to improve it if needed.

Community engagement also fosters positive relationships with community members, the seafood industry, and other stakeholders. In the course of this project, a number of fishers, fish houses, processors, and community groups were identified that seemed willing to contribute to a program designed to bring North Carolina seafood into underserved communities. These relationships represent opportunities to strengthen such programs by tapping into resources already present in target communities. For example, this project has shown that distribution routes for seafood exist in close proximity to study sites in both Garysburg and New Bern (operated by Atlantic Seafood and Beaufort Inlet Seafood, respectively). The GIS analysis conducted in this project shows that there are significant distribution costs for seafood, especially for Garysburg, should NC Catch decide to invest in transporting seafood themselves. Fostering relationships with those fish houses and processors that utilize pre-existing distribution routes could open up the opportunity to utilize these routes, reducing costs for NC Catch. Relationships with fish houses and processors are also necessary to gain access to the full variety of underutilized species available in North Carolina, as availability of underutilized species is not always regular. Maintaining a steady supply of fish for the program would require the ability to know when and where fish is available. NC Catch must be able to communicate with many fish houses at a time to determine this availability.

Relationships with community organizations would also be beneficial in terms of dissemination of information as well as the establishment of points of sale for local seafood. In the case of Garysburg, the establishment of the Heritage Market represents a potential location for sale of North Carolina seafood. Without connections with the Town of Garysburg and the Conservation Fund, this opportunity might not be as readily available to NC Catch. Building on this and other relationships is highly recommended. Along with these investments in social capital, it is recommended that NC Catch invest in improved infrastructure and distribution. Lack of facilities for cold storage, flash freezing, and more advanced processing (for value added products) is a significant obstacle for improved seafood access in low-income communities. In a “Farm to Fork” brainstorm meeting between local food producers and vendors of northeastern North Carolina, there was an overarching consensus that a lack of distribution networks is what
inhibits the progression and evolution of local food systems within the state of North Carolina, particularly to lower-income and rural areas, though there exists no empirical data to support or deny this claim. The lack of an established east-west distribution route is at least somewhat caused by this gap in infrastructure. A potential avenue for this might be to raise the capital to buy or rent a truck, to employ distributors and to establish the proper relationships within the supply chain. Hiring someone from the community for distribution is a small but considerable addition to economic development for low-income regions. The development of a for-profit affiliate organization charged with distribution, marketing and relationship building between stakeholders might be possible, with the added benefit of potentially providing funds to NC Catch’s non-profit activities while attracting investors and shareholders. Exhibit 8 of the Appendix includes financing organizations that could be interested in such a project.

Finally, it is up to NC Catch to take action. This project was experimental in nature, and the information herein has not been applied. Establishment of pilot programs is a recommended step that must be taken to fulfill NC Catch’s ultimate goals. These programs could follow the lead of similar projects conducted by the municipality of Greensboro, NC in which convenience stores in food deserts agreed to temporarily stock fresh fruits and vegetables in place of processed foods in order to see if people would purchase the healthier food options, and they did. Pilot projects conducted by NC Catch would be able to gather empirical information on the feasibility and profitability of larger scale programs to improve access to North Carolina seafood.

Through the course of this project it has been shown that both the desire and need for healthy, local seafood is present in low-income areas. At the same time there are many underutilized species being caught within North Carolina that represent viable options for direct human consumption in these areas. With the proper use of relationships with community organizations, fishers, fish houses, and processors, it may be possible for NC Catch to begin improving access to local North Carolina seafood in underserved areas.
7. Appendix

Exhibit 1. Interviews for development of Master’s Project

<table>
<thead>
<tr>
<th>Color representing primary reason for interview</th>
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<tbody>
<tr>
<td>Underutilized Species</td>
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<tr>
<td>Health and Wellness in North Carolina</td>
</tr>
<tr>
<td>Local Distribution</td>
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<tr>
<td>Recipe Development</td>
</tr>
<tr>
<td>Processing information</td>
</tr>
<tr>
<td>Focus group development</td>
</tr>
</tbody>
</table>

Table 5. List of Interviewees Involved in Master’s Project Development

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<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Date of Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calvin Allen</td>
<td>Rural Forward NC</td>
<td>Aug-15</td>
</tr>
<tr>
<td>Melanie Allen</td>
<td>Conservation Trust of NC</td>
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</tr>
<tr>
<td>Brandi Bynum</td>
<td>Rural Forward NC</td>
<td>Sep-15</td>
</tr>
<tr>
<td>Jess Hawkins</td>
<td>NC Division of Marine Fisheries</td>
<td>Oct-15</td>
</tr>
<tr>
<td>Ali Donargo</td>
<td>Cape Cod Fisherman’s Alliance</td>
<td>Nov-15</td>
</tr>
<tr>
<td>Ryan Speckman</td>
<td>Locals Seafood</td>
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<tr>
<td>Gabe Cummings</td>
<td>Working Landscapes NC</td>
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<tr>
<td>Halifax County Farm to Fork working group</td>
<td>North Carolina Public Health Foundation</td>
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<tr>
<td>Ed McGovern</td>
<td>Stingray Cafe, Tryon Palace Seafood</td>
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<tr>
<td>Chris McCaffity</td>
<td>Walking Fish</td>
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<td>Bill Rice</td>
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<td>Alan Bianchi</td>
<td>NC Division of Marine Fisheries</td>
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<td>Ashley O’Neal</td>
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<td>Debbie Callaway</td>
<td>Walking Fish</td>
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<td>Ricky Moore</td>
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<td>Charlotte Neely</td>
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<td>Julius Tillery</td>
<td>Conservation Fund</td>
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<td>Carter Crain</td>
<td>Food Bank of Eastern and Central North Carolina</td>
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<tr>
<td>Veda Fisher Kennedy</td>
<td>United Missionary Baptist Church, New Bern</td>
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<tr>
<td>Traci Bryant</td>
<td>Seafood Nutrition Partnership</td>
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<tr>
<td>N/A</td>
<td>Atlas Seafood</td>
<td>Feb-16</td>
</tr>
<tr>
<td>Jacob</td>
<td>Atlantic Seafood</td>
<td>Feb-16</td>
</tr>
</tbody>
</table>
Exhibit 2. Recipes for Focus Groups (developed by Chef Ricky Moore)

**Bluefish Recipe**
*Ingredients:*
- 6 tbsp. prepared blackening spice
- 4 6-oz. bluefish fillets
- 2 tbsp. canola oil
- 1 tbsp. unsalted butter

*Instructions:*
Sprinkle blackening seasoning over both sides of fish, coating well.
Heat oil and butter in a large skillet over medium-high heat.
Sauté fish until just cooked through, about 4 minutes on each side.

**Whiting Recipe**
*Ingredients:*
- 2 lbs. whiting fillets
- 1/4 c. soy sauce
- 2 tbsp. brown sugar
- 1 clove garlic, minced
- 1/4 tsp. crushed red pepper flakes
- 2 tbsp. butter, melted
- 4 scallions, sliced

*Instructions:*
Place fish in a bowl. Combine remaining ingredients and pour over fish.
Marinate 1 hour.
Place filets on a broiler pan and broiling about 5 inches from the heat for 10 minutes per inch of thickness, turning once halfway through the process.
When fish is tender and flakes easily, remove from grill and serve hot.

**Trout Recipe**
*Ingredients:*
- 2 ea. Filleted trout
- 2 tbsp. olive oil
- Limes/Lime juice
- 2 white onions, peeled and chopped
- 6 cloves garlic, peeled and chopped
- 1 can whole tomatoes
- 2 pickled jalapeño peppers, chopped
- 3 tbsp. pickled jalapeño juice
- 2 tbsp. chopped fresh parsley
- Salt and freshly ground black pepper, to taste

*Instructions:*
Cut two slits on both sides of the fish sprinkle with salt and place in a shallow pan. Cut limes in half and squeeze juice all over filets. Place lime halves in pan, cover, and marinate in refrigerator for 1 hour.
Heat oil in a large sauté pan over medium-low heat. Add onions and cook until golden, about 15 minutes. Stir in garlic, and cook for 1 minute.
Add tomatoes (break up if canned); cook for 10 minutes. Add jalapeños, jalapeño juice, parsley, and herbs. Season with salt and pepper; cook over low heat for 20 minutes. Add fish and marinade, cover, and cook, turning once, for 8 minutes per side. Discard bay leaves and limes. Serve immediately with tortillas, rice and fresh limes wedges.
### Exhibit 3. Decision Matrix for Considered Species

Table 6. Decision Matrix and Total Scores (chosen species in neon green)

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
<th>MBASW Rating</th>
<th>Ease of Cleaning (1-5)</th>
<th>Matrix Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alewife</td>
<td>Depleted in the Albemarle Sound. Otherwise unknown.</td>
<td>Limited Information</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Amberjack</td>
<td>Not overfished or experiencing overfishing</td>
<td>Good Alternative</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>American Shad</td>
<td>Concern</td>
<td>Avoid</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Atlantic Croaker</td>
<td>Concern</td>
<td>Best Choice &amp; Good Alternative</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Black Drum</td>
<td>Not overfished and not experiencing overfishing</td>
<td>Limited Information</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Black Seabass</td>
<td>Not overfished and is experiencing overfishing</td>
<td>Best Choice</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Bluefish</td>
<td>Not overfished and not experiencing overfishing</td>
<td>Best Choice &amp; Good Alternative</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Carp</td>
<td>Unknown</td>
<td>Take a pass unless its Naturland ecolabelled</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Catfish</td>
<td>Unknown</td>
<td>Best Choice</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Gar</td>
<td>Unknown</td>
<td>Limited Information</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Grinnell (Bowfin)</td>
<td>Unknown</td>
<td>Limited Information</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Hickory Shad</td>
<td>Depleted</td>
<td>Avoid</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Kingfish</td>
<td>Viable</td>
<td>Limited Information</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Nanny Shad</td>
<td>Unknown</td>
<td>Avoid</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Pigfish</td>
<td>Unknown</td>
<td>Limited Information</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Porgy</td>
<td>Not overfished and not experiencing overfishing</td>
<td>Good Alternative</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Pufferfish</td>
<td>Unknown</td>
<td>Limited Information</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Skate</td>
<td>Not overfished and is experiencing overfishing</td>
<td>Avoid</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Spiny Dogfish</td>
<td>Not overfished and not experiencing overfishing</td>
<td>Avoid</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Spot</td>
<td>Concern</td>
<td>Limited Information</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Spotted Seatrout</td>
<td>Unknown</td>
<td>Best Choice/Good Alternative</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Squid</td>
<td>Unknown</td>
<td>Good Alternative</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Stingray</td>
<td>Unknown</td>
<td>Limited Information</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Striped Mullet</td>
<td>Viable</td>
<td>Best Choice</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>White Perch</td>
<td>Unknown</td>
<td>Limited Information</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>
### Exhibit 4. Prices & Landings for Underutilized Species (2013 & 2014)

#### Table 7. Species of fish selected as underutilized species given the results of the decision matrix

<table>
<thead>
<tr>
<th>Species</th>
<th>Management Authority</th>
<th>Status</th>
<th>Management Approaches</th>
<th>2014 average ex-vessel $/lb. in NC</th>
<th>MBASW Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amberjack</td>
<td>South Atlantic Fisheries Management Council</td>
<td>Not overfished or experiencing overfishing</td>
<td>Snapper-Grouper FMP. Trip Limits, Seasonal Closures, Size Limits</td>
<td>1.03</td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Alternative</td>
</tr>
<tr>
<td>Atlantic Croaker</td>
<td>North Carolina Division of Marine Fisheries</td>
<td>Concern</td>
<td>Atlantic Croaker Intergovernment FMP. Annual Quota</td>
<td>0.71</td>
<td>Best Choice &amp; Good Alternative</td>
</tr>
<tr>
<td>Black Drum</td>
<td>Atlantic States Fisheries Management Council &amp; Mid-Atlantic Fisheries Management Council</td>
<td>Not overfished and not experiencing overfishing</td>
<td>Interstate FMP for Black Drum. No regulation in North Carolina.</td>
<td>0.63</td>
<td>Limited Information</td>
</tr>
<tr>
<td>Bluefish</td>
<td>Mid-Atlantic Fisheries Management Council</td>
<td>Not overfished and not experiencing overfishing</td>
<td>Bluefish Intergovernment FMP. Annual Quota (adjusted annually, state-by-state)</td>
<td>0.44</td>
<td>Best Choice &amp; Good Alternative</td>
</tr>
<tr>
<td>Carp</td>
<td>North Carolina Wildlife Resources Commission</td>
<td>Unknown</td>
<td>Unknown</td>
<td>0.09</td>
<td>&quot;Take a pass unless it's Naturland ecolabelled&quot;</td>
</tr>
<tr>
<td>Catfish</td>
<td>North Carolina Wildlife Resources Commission</td>
<td>Unknown</td>
<td>Unknown</td>
<td>0.3</td>
<td>Best Choice</td>
</tr>
<tr>
<td>Kingfish</td>
<td>North Carolina Division of Marine Fisheries</td>
<td>Viable</td>
<td>North Carolina Fishery Management Plan, bag limits, size limits.</td>
<td>1.05</td>
<td>Limited Information</td>
</tr>
<tr>
<td>Pigfish</td>
<td>North Carolina Division of Marine Fisheries</td>
<td>Unknown</td>
<td>Size limits, bag limits.</td>
<td>0.4</td>
<td>Limited Information</td>
</tr>
<tr>
<td>Porgy</td>
<td>Atlantic States Fisheries Management Council &amp; Mid-Atlantic Fisheries Management Council</td>
<td>Not overfished and not experiencing overfishing</td>
<td>Size limits, bag limits.</td>
<td>1.75</td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Alternative</td>
</tr>
<tr>
<td>Spot</td>
<td>Atlantic States Fisheries Management Council</td>
<td>Concern</td>
<td>Spot Intergovernment FMP.</td>
<td>0.81</td>
<td>Limited Information</td>
</tr>
<tr>
<td>Squid</td>
<td>Mid-Atlantic Fisheries Management Council &amp; New England Fisheries Management Council</td>
<td>Unknown</td>
<td>Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. Trip limits, gear restrictions.</td>
<td>0.84</td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Alternative</td>
</tr>
<tr>
<td>Stingray</td>
<td>N/A</td>
<td>Unknown</td>
<td>Unknown</td>
<td>N/A</td>
<td>Limited Information</td>
</tr>
<tr>
<td>Striped Mullet</td>
<td>North Carolina Division of Marine Fisheries</td>
<td>Viable</td>
<td>North Carolina Fishery Management Plan, Jumping Mullet. Bag limits.</td>
<td>0.61</td>
<td>Best Choice</td>
</tr>
<tr>
<td>White Perch</td>
<td>North Carolina Division of Marine Fisheries</td>
<td>Unknown</td>
<td>Not managed.</td>
<td>0.86</td>
<td>Limited Information</td>
</tr>
</tbody>
</table>
Figure 9. Average Annual Ex-Vessel Prices for Identified Species – 2013 & 2014

Table 8. Landings (all bodies of water) for Selected Underutilized species

<table>
<thead>
<tr>
<th>Body of Water</th>
<th>Total Landings (lb) 2013</th>
<th>Total landings (lb)2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>North River/Back Sound</td>
<td>122</td>
<td></td>
</tr>
<tr>
<td>Masonboro Sound</td>
<td>1132.53</td>
<td>1093.79</td>
</tr>
<tr>
<td>Stump Sound</td>
<td>203.5</td>
<td>16</td>
</tr>
<tr>
<td>Pungo River</td>
<td>354.5</td>
<td>2300</td>
</tr>
<tr>
<td>Inland Waterway (Onslow)</td>
<td>524.7</td>
<td></td>
</tr>
<tr>
<td>White Oak River</td>
<td>473</td>
<td>3342</td>
</tr>
<tr>
<td>Shallotte River</td>
<td>729.65</td>
<td></td>
</tr>
<tr>
<td>Cape Fear River</td>
<td>2588.15</td>
<td>2039.51</td>
</tr>
<tr>
<td>Newport River</td>
<td>627.4</td>
<td>695.4</td>
</tr>
<tr>
<td>Perquimans River</td>
<td>5035</td>
<td></td>
</tr>
<tr>
<td>Inland Waterway (Brunswick)</td>
<td>1143.64</td>
<td>652.58</td>
</tr>
<tr>
<td>Topsail Sound</td>
<td>5236</td>
<td>1801.7</td>
</tr>
<tr>
<td>Croatan Sound</td>
<td>2177</td>
<td></td>
</tr>
<tr>
<td>Roanoke Sound</td>
<td>8820</td>
<td></td>
</tr>
<tr>
<td>Chowan River</td>
<td>5560</td>
<td>5003</td>
</tr>
<tr>
<td>Ocean 0-3 mi, S of Cape Hatteras</td>
<td>80796</td>
<td>149144.75</td>
</tr>
<tr>
<td>Bogue Sound</td>
<td>15079.15</td>
<td>12995.37</td>
</tr>
<tr>
<td>Ocean &gt;3 mi, S of Cape Hatteras</td>
<td>99646.86</td>
<td>182669.82</td>
</tr>
<tr>
<td>New River</td>
<td>25694.25</td>
<td>16189.9</td>
</tr>
<tr>
<td>Neuse River</td>
<td>229800.1</td>
<td>232463.05</td>
</tr>
<tr>
<td>Currituck Sound</td>
<td>61551</td>
<td>5412</td>
</tr>
<tr>
<td>Ocean 0-3 mi, N of Cape Hatteras</td>
<td>818918.5</td>
<td>189207</td>
</tr>
<tr>
<td>Pamlico River</td>
<td>104469.05</td>
<td>91507</td>
</tr>
<tr>
<td>Albemarle Sound</td>
<td>611613.3</td>
<td>564959</td>
</tr>
<tr>
<td>Core Sound</td>
<td>113921.36</td>
<td>82096.5</td>
</tr>
<tr>
<td>Pamlico Sound</td>
<td>1161937</td>
<td>945620.85</td>
</tr>
<tr>
<td>Bay River</td>
<td>69793.5</td>
<td>131804.5</td>
</tr>
<tr>
<td>Ocean &gt;3 mi, N of Cape Hatteras</td>
<td>691282</td>
<td>1683454</td>
</tr>
</tbody>
</table>
Table 9. Total lbs. of all underutilized fish landed in 2013 and 2014.

<table>
<thead>
<tr>
<th>Species</th>
<th>2013 total landings (lb)</th>
<th>2014 total landings (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squid, Loligo</td>
<td>2107.8</td>
<td>868.94</td>
</tr>
<tr>
<td>Banded Rudderfish</td>
<td>3893.76</td>
<td>3059.472</td>
</tr>
<tr>
<td>Carp</td>
<td>6381</td>
<td>7420</td>
</tr>
<tr>
<td>Amberjacks</td>
<td>37932.156</td>
<td>5327.92</td>
</tr>
<tr>
<td>Almaco Jack</td>
<td>19122.272</td>
<td>47925.28</td>
</tr>
<tr>
<td>Hogfish</td>
<td>54134.41</td>
<td>35266.37</td>
</tr>
<tr>
<td>Drum, Black</td>
<td>70073.26</td>
<td>24466</td>
</tr>
<tr>
<td>Greater Amberjack</td>
<td>18937.672</td>
<td>99965.152</td>
</tr>
<tr>
<td>Hickory Shad (Jack)</td>
<td>53171.5</td>
<td>76868.5</td>
</tr>
<tr>
<td>Scups</td>
<td>13146</td>
<td>149861</td>
</tr>
<tr>
<td>Sea Mullet</td>
<td>142123</td>
<td>101878.5</td>
</tr>
<tr>
<td>Shad</td>
<td>129585</td>
<td>125366.55</td>
</tr>
<tr>
<td>Catfish</td>
<td>173916.55</td>
<td>145462.5</td>
</tr>
<tr>
<td>White Perch</td>
<td>236334.25</td>
<td>130254</td>
</tr>
<tr>
<td>Spot</td>
<td>197148.1</td>
<td>173430</td>
</tr>
<tr>
<td>Trout, Speckled</td>
<td>238712.35</td>
<td>176393.85</td>
</tr>
<tr>
<td>Bluefish</td>
<td>512466.62</td>
<td>410752.44</td>
</tr>
<tr>
<td>Mullets, Jumping</td>
<td>585772.14</td>
<td>648277.5</td>
</tr>
<tr>
<td>Croaker</td>
<td>1623541.45</td>
<td>1942353.4</td>
</tr>
</tbody>
</table>
Spatial Distribution: Landings of Underutilized Species in North Carolina (2013 & 2014)

This map represents the total landings of certain underutilized species in North Carolina. This map provides spatial reference for sourcing of local underutilized species.

Data Source: NC-DMF Fishery Landings Data, NC Center for Geographic Information and Analysis County and Maier Hydrology Data

Figure 10. Total (logarithmic) lbs. of all underutilized fish landed in 2013 and 2014 in certain bodies of water.
Figure 11. Total lbs. and average prices of all underutilized fish landed in 2013 in the Albemarle Sound.
Figure 12. Total lbs. and average prices of all underutilized fish landed in 2014 in the Albemarle Sound.
Figure 13. Total lbs. and average prices of all underutilized fish landed in 2013 in the Neuse River.
Figure 14. Total lbs. and average prices of all underutilized fish landed in 2014 in the Neuse River.
Figure 15. Total lbs. and average prices of all underutilized fish landed in 2013 in the Pamlico River and Sound.
Figure 16. Total lbs. and average prices of all underutilized fish landed in 2014 in the Pamlico River and Sound.
Exhibit 5. Focus Group Script

Thank you for coming and agreeing to participate in this discussion. What we are doing here is called a focus group. My name is Rachel, and I will be moderating the discussion. I am a student at Duke University and I am interested in bringing more local seafood to counties in North Carolina. I want you to understand that I have nothing to sell you, I am only interested in hearing what you have to say. I also want you to understand that I cannot promise you that anything I do will impact or benefit your community, for now we are only collecting information on what folks in Garysburg think about seafood and fish. We are working with a local non-profit, NC Catch, to determine if there is a feasible way to build supply chains for local seafood into more communities in North Carolina. In this discussion, we are going to be talking about fish and seafood and we have provided you with some samples that we will try together and talk about.

First, we need to take care of some housekeeping details. I handed you a consent form when you came in. If you have read the form and signed it, please hand it to me. If you need an additional copy of the form, I can give you one. Does anyone have any questions about the information on the consent form?

As I mentioned in the form, with your permission our discussion tonight is being recorded and we will be taking notes. This helps me so that I can talk to you and listen without having to write down everything that you are saying. Your names will not be used in our report, and I can assure you that no one outside of this room will ever hear our conversation. Our findings will be used in our final paper, but we will not use any information that identifies or singles anyone out. You are also welcome to leave at any point.

Now, there is an important thing I want you to know about focus groups. There are only right answers. There is no specific answer I am looking for in any of the things we will discuss tonight.

You all have had different experiences and have different opinions, and all opinions are truly important. We are looking for different opinions, so please do not be swayed by others in the group if you might feel differently about something we are discussing.

I ask that you please talk one at a time so that everyone gets a chance to share their opinions and that we do not miss anything.

Also, please speak up so that we can all hear what you have to say and so we get it on tape. Feel free to address others, you do not need to address all of your comments to me, but please avoid side conversations while others are talking. I may interrupt the discussion from time to time. Please forgive me if I do this. I'm not being rude, it's just that I have a lot that I'm trying to cover with you and I want to get you out of here on time. Lastly, I really encourage everyone to participate equally; I'm very interested to hear what each one of you has to say so please don't be shy!

We'll be here for 30-45 minutes. We'll spend the first 10 or so minutes talking about your current relationship with seafood and then we'll sample together and talk about that.

I want to tell you a little bit about the seafood we've provided. The fish were all caught and landed here in North Carolina and sold to us fresh. They are bluefish, whiting and trout. Using recipes developed by a seafood chef, 15 volunteers got together on Tuesday night and put together these samples. The recipes are meant to be simple and affordable, and I am happy to share them with you. The samples are fairly diverse, and you may like some more than others. Some are chewy and fishy, others are flaky, some have bones and some do not. I want to know what you did like and what you didn’t like so please feel free to share, I won’t be offended!
So, let’s begin our discussion. First, I know that some of you know each other, but I’d like everyone to introduce themselves to the group. Why don’t you tell us your first name and how long you have lived in Garysburg?

Issue Area #1– General information about seafood consumption

1. First we’ll just talk about food. What are some of your favorite foods?

2. Can you remember if you have purchased or eaten seafood in the last month? Examples include fish, oysters, crab meat, and shrimp.

3. Can you comment on why you have or why you have not purchased or eaten seafood in the past month?

4. Do you prepare food regularly in your home?

5. What are some ideas or thoughts your currently have about seafood? Its smell, taste? Whether or not it’s good for you? Do you currently like or dislike seafood?

Now we are going to sample the seafood together. You may notice that you have three samples of fish with different colored stickers on them. We are going to first unwrap and eat the sample with the purple sticker. This is bluefish. Please take your time eating it and raise your hand when you are finished.

Now that everyone has finished, let’s talk a little bit about this fish. What did you like or dislike about the fish?

Now we are going to sample the second item together. Please unwrap and eat the sample with the pink sticker. This is trout. Please take your time eating it and raise your hand when you are finished.

Now that everyone has finished, let’s talk a little bit about this fish. What did you like or dislike about the fish?

Now we are going to sample the third item together. Please unwrap and eat the sample with the red sticker. This is whiting. Please take your time eating it and raise your hand when you are finished.

Now that everyone has finished, let’s talk a little bit about this fish. What did you like or dislike about the fish?

Issue Area # 2 - Post-seafood sampling thoughts

1. What were your overall thoughts on the fish you tried?

2. Please comment on some of the aspects of the fish if you haven’t already - the smell, the taste, the texture, and the bones.

3. Can I get a show of hands - were you nervous to try the seafood? (PAUSE) Did you trust me as someone who could provide you with good food?

4. If those samples were sold at the place where you normally buy food, would you think about buying them?

5. Have your thoughts on seafood changed?
6. Before we end, does anyone have any other comments about what we have been discussing or questions about this group?

Well, we are out of time. Thank you all so much for coming. I have some documents here with more information about our project, seafood recipes and the organization that we are working for, North Carolina Catch. These sheets have our contact information so if you have anything you want to say or if you want to have a one-on-one conversation about our project, feel free to contact us.
DO THIS PAGE BEFORE EATING (Pre-Survey)

1. What are some of your favorite foods?

2. In the month have you bought seafood (examples are fish, shrimp, squid, crab)?
   □ Yes      □ No      □ I don’t know

3. Check all of the boxes below that are true for you
   □ I don’t like the taste of seafood
   □ I don’t have the time to make seafood
   □ I think seafood smells bad
   □ Seafood costs a lot of money
   □ I cannot buy seafood in my community
   □ I have health concerns about seafood
   □ I like the way seafood tastes
   □ I think seafood is good for my health
   □ I do eat seafood in my home sometimes
   □ I like the way seafood smells
   □ I think eating seafood is good for the environment
   □ Other:

4. In the past week, you have eaten (check all that apply):
   □ Seafood
   □ Vegetables or fruit
   □ Chicken
   □ Beef
   □ Pork

5. Do you know how to prepare raw/uncooked seafood?
   □ Yes      □ No      □ I’m not sure

6. Do you cook in your home?
   □ Yes      □ No      □ I don’t know
7. Do you purchase prepared food from a store restaurant?
   - [ ] Yes  - [ ] No  - [ ] I don’t know

8. Would you generally say you are interested in trying new foods?
   - [ ] Yes  - [ ] No  - [ ] I don’t know

9. How long have you lived in Craven County?
   

10. Do you have any other comments?


DO THIS PAGE AFTER EATING (Post-Survey)

1. Did you like the sample with purple tape?
   - [ ] Yes  - [ ] No  - [ ] I don’t know
   Please check all reasons below for that answer:
   - [ ] I don’t like the taste
   - [ ] I don’t like the texture
   - [ ] It smells bad
   - [ ] I don’t like new food
   - [ ] I don’t trust the server
   - [ ] I don’t like the bones
   - [ ] I like the taste
   - [ ] I like the texture
   - [ ] I like trying new food
   - [ ] Other:

2. Did you like the sample with pink tape?
   - [ ] Yes  - [ ] No  - [ ] I don’t know
   Please check all reasons below for that answer:
   - [ ] I don’t like the taste
   - [ ] I don’t like the texture
   - [ ] It smells bad
   - [ ] I don’t like new food
I don’t trust the server

I don’t trust the server

I don’t like the bones

I like the taste

I like the texture

I like trying new food

Other:

3. Did you like the sample with red tape?
   ☐ Yes ☐ No ☐ I don’t know

   Please check all reasons below for that answer:
   ☐ I don’t like the taste
   ☐ I don’t like the texture
   ☐ It smells bad
   ☐ I don’t like new food
   ☐ I don’t trust the server
   ☐ I don’t like the bones

   ☐ I like the taste
   ☐ I like the texture
   ☐ I like trying new food
   ☐ Other:

4. Were you nervous to try the seafood sample(s)?
   ☐ Yes ☐ No ☐ I don’t know

5. If the samples you tried were sold at a store near you, would you think about buying them?
   ☐ Yes ☐ No ☐ I don’t know

6. Would you be interested in trying other seafood products?
   ☐ Yes ☐ No ☐ I don’t know

7. Any other comments?
Exhibit 7. Maps demonstrating distribution routes between fish houses and pilot communities.

Figure 17. Road Routes between Fish Houses and Garysburg

Legend
- Fish Houses/Markets
- Garysburg Farmers Market
- All Routes
- Perry-Winne, 55.26 Miles

Sources: ESRI, HERE, DeLorme, USGS, Intermap, Exodeme P Corp, AIP CAN, BD Japan; MET, ET, China Hong Kong; ESRI (The Natural Maplandia, © OpenStreetMap contributors, and the A93 User Community)
Figure 18. Road Routes between Fish Houses and New Bern, NC
Exhibit 8. Opportunities and Obstacles for Piloting Seafood Access Project

<table>
<thead>
<tr>
<th>Perceived Opportunities</th>
<th>Perceived Obstacles</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Considerable interest in food space to incorporate seafood in North Carolina</td>
<td>● Technology to operate and accept SNAP and other government welfare programs</td>
</tr>
<tr>
<td>● Many food hubs, farmers markets etc. already exist</td>
<td>● Identifying processors who can do value-added seafood products at affordable cost</td>
</tr>
<tr>
<td>● No need to reinvent the wheel: history of food access projects</td>
<td></td>
</tr>
</tbody>
</table>

List of grants/social venture firms of relevance:
- Fisheries Innovation Fund
- Jamie Kirk Hahn Foundation
- Kate B. Reynolds Charitable Trust
- USDA Grants
- Angel Food Network
- Sustainable Local Food Investment Groups
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