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FARMED AND WILD-CAUGHT SHRIMP IN KENTUCKY AND SOUTH CAROLINA: CONSUMER PREFERENCE FOR HOMEGROWN BY HEROES, COMMUNITY SUPPORTED FISHERY, AND OTHER QUALITY ATTRIBUTES

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THESIS

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Agricultural Economics in the College of Agriculture, Food and Environment at the University of Kentucky

By

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ABSTRACT OF THESIS

FARMED AND WILD-CAUGHT SHRIMP IN KENTUCKY AND SOUTH CAROLINA: CONSUMER PREFERENCE FOR HOMEGROWN BY HEROES, COMMUNITY SUPPORTED FISHERY, AND OTHER QUALITY ATTRIBUTES

As information regarding origin, production method, and environmental certifications characterize a progressing seafood market, scare analysis has been made to understand market responses. This study focuses on consumer preference for wild-caught and farm-raised shrimp with several attributes. These include the Homegrown By Heroes label and Best Aquaculture Practices certification, as well as other existing attributes including the Marine Stewardship Council and each state's local label. Also considered are hypothetical labels including Community Supported Fishery (CSF) and National Oceanic & Atmospheric Administration (NOAA). This study surveys consumers in Kentucky and South Carolina while utilizing a choice experiment to elicit willingness-to-pay measures for these various product attributes.

Both wild-caught and farm-raised shrimp are considered since these species have significant market potential. Like previous studies, a strong preference for fresh as well as local shrimp was found. Furthermore, preference for Homegrown By Heroes was found to be highly valued by consumers, as well as the NOAA label signifying a federally operated ecolabel. Consumers were also found to value BAP and MSC certifications, two third-party agencies currently existent in the seafood market. Marketing and policy recommendations are given based on consumer willingness to pay estimates for these various seafood attributes in both states.

KEYWORDS: Choice Experiment, Willingness to Pay for Seafood, Homegrown By Heroes, Ecolabels

Graham Soley

April 14, 2016

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CHAPTER 1: INTRODUCTION

The turn of the century has expanded consumers' access to information, with increasing product attributes ranging from environmental certifications to origin labeling in the seafood market (Fonner 2015). Regulations are somewhat accountable for this trend, with both Country of Origin Labeling (COOL) and "Previously Frozen" required for seafood sold in the U.S. (Thompson et al., 2005). As consumers are introduced to this information, producers and processors are striving to understand how to compete in an increasingly global marketplace (Asche et al., 2015). Understanding how to differentiate food products in a global marketplace could be challenging. Therefore, a new era has ushered innovative labels for fish and shellfish products.

Providing useful and relevant information at the point of sale will potentially benefit all stakeholders in the seafood supply chain, especially certifications representing responsible or sustainable production (Future of Fish 2014). Providing consumers credible and transparent info is needed to make informed and responsible purchasing decisions, as well as rewarding producers and processors for responsible production practices (Roheim 2009). This progressive setting of increased access is providing researchers and marketers an opportunity to understand the seafood market from a consumers' perspective. Thus, one must assess the magnitude of particular attributes, as this study analyzes both wild-caught and farm-raised shrimp in Kentucky and South Carolina. Both Southeastern states have ties to the production of fish and shellfish products, with Kentucky's substantial acreage of freshwater and South Carolina's ties to the seacoast.

Impact of attributes depends on consumers' acceptance, perceptions, and willingness-to-pay for what the labels are attempting to establish, hence providing the opportunity to empirically evaluate their magnitude (e.g. Caswell and Mojduszka 1996). Evidence of robust consumer acceptance in certain labeling schemes could be pivotal in increasing producers' viability, as well as participation in responsible fishing practices (Roheim 2008). By evaluating attributes in the presence of multiple labels and surveying a diverse sample of participants, this study hopes to contribute to the literature. Stakeholders (e.g retail outlets, processors, seafood producers) can utilize results to determine the significance of certain labels, therefore suggesting whether to invest in certain programs.

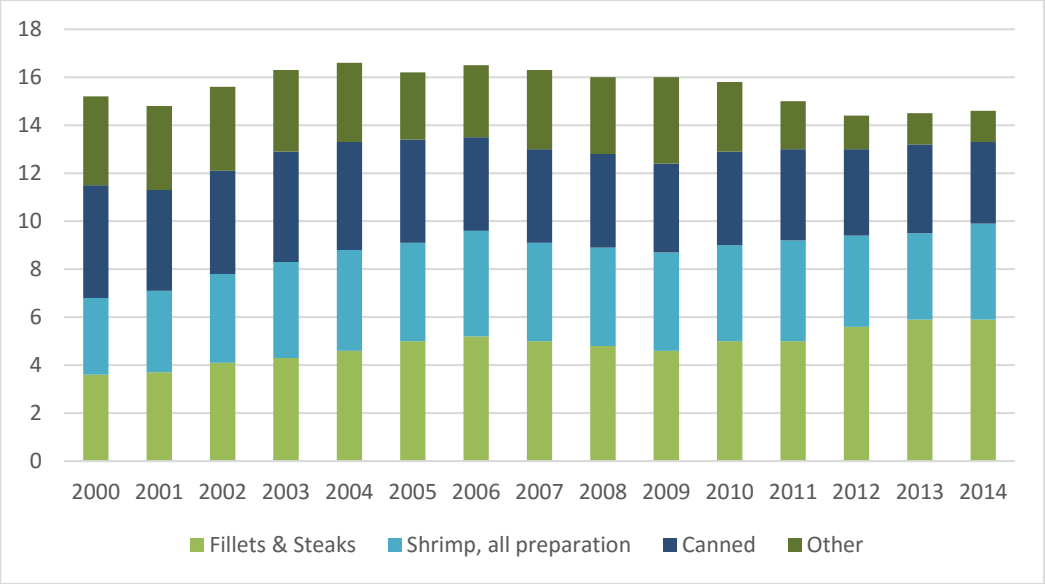
Background information pertaining to the specifics of the seafood industry ensues in Chapter 2 of the thesis. Chapter 3 presents a literature review pertaining to relevant topics discussed within the preceding chapter, as sections on relevant topics are discussed. Chapter 4 presents the theory and empirical model, allowing readers to understand how the research will be evaluated and estimated. The survey design and product attributes characterize Chapter 5, as readers are given specifics on how the project was formulated and distributed. Econometric results characterize Chapter 6, as readers are presented with the empirical groundwork that is the forefront of the study. Lastly, Chapter 7 discusses these findings and suggests potential implications as well as limitations and suggestions for future research. References ensue afterward.

CHAPTER 2: THESIS BACKGROUND

2.1 U.S. PRODUCTION & DEMAND

Figure 2.1 depicts U.S. seafood consumption from the turn of the century, outlining how different categories and species constitute per capita consumption on an annual basis. The National Marine Fisheries Service (NMFS) Report of 2014 estimated U.S. consumption at 14.6 pounds in 2014, as consumer expenditures totaled $91.7 billion for fishery products (NMFS 2015). Of the $91.7 billion consumers spent in 2014, 67% was devoted to expenditures at food service establishments (restaurants, carry-outs, caterers, etc.) and 33% in retail sales for home consumption (NMFS 2015).

Figure 2.1 U.S. Annual Per Capita Consumption of Commercial Fish and Shellfish



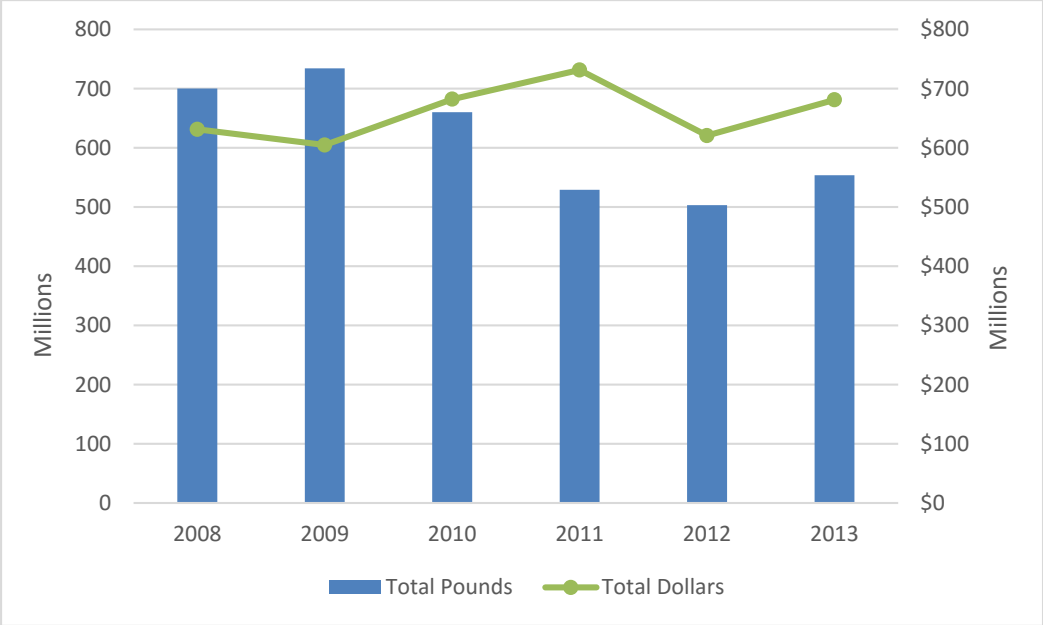
Source: National Marine Fisheries Statistics 2015

Assessing demand for aquaculture and wild-caught products furthermore provides a better perspective of trends in consumption. Figure 2.1 also outlines the large portion

shrimp products have accounted for the past 14 years (27% in 2014), suggesting shrimp's importance to the industry. For this study, shrimp was the only category of seafood selected in evaluating consumers' preferences for various product bundles. Not only does shrimp constitute a significant portion of annual consumption by U.S. consumers, but is also noteworthy in terms of production for the participating states.

Most recent data on U.S. aquaculture shows production was 662 million pounds in 2013 with a value of $1.37 billion, an increase of around 11% in both volume and value from 2012 (NMFS 2015). Freshwater aquaculture produced over $681 million alone in 2013. Observing Figure 2.2 demonstrates that although freshwater production (e.g. catfish, tilapia, crawfish, shrimp/prawn, etc.) has been declining since 2009, 2013 production increased around ten percent over 2012. Freshwater aquaculture has significance in Kentucky, as 2012 data showed the state having the most freshwater shrimp farms in the U.S. (NASS 2013).

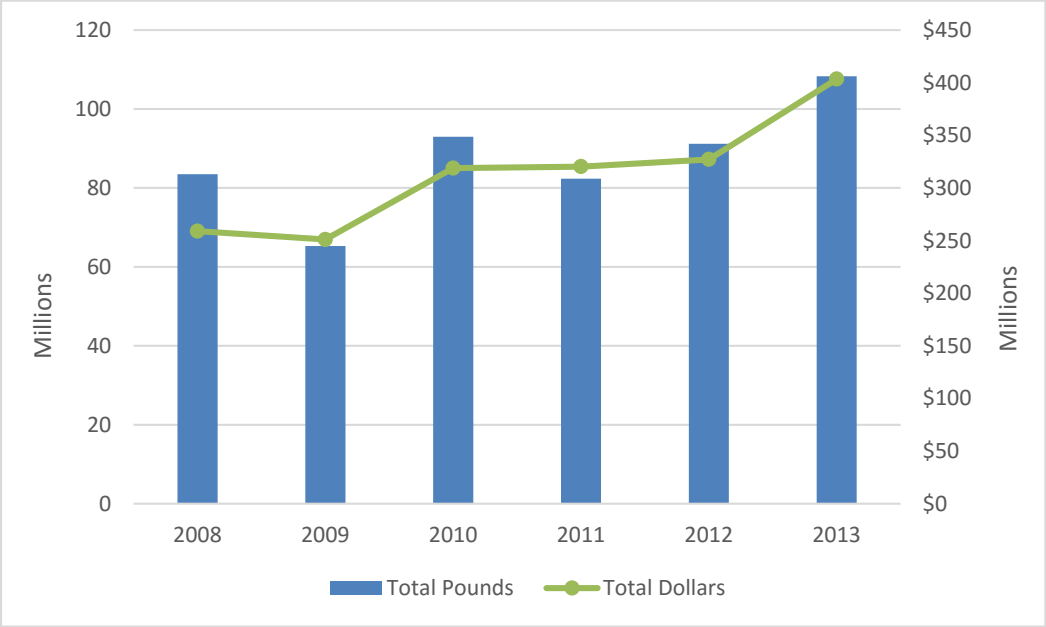
Figure 2.2 U.S. Annual Freshwater Aquaculture Production & Value (Millions)



Source: National Marine Fisheries Statistics 2015

Though not as significant as freshwater aquaculture in production, Figure 2.3 depicts how total pounds and value in the marine aquaculture sector (e.g. salmon, tilapia, oysters, mussels, saltwater shrimp, etc.) have steadily increased over the past 5 years. Figure 2.3 also depicts how total value increased around 23% from 2012 to 2013 and generated over 403 million in 2013. Though not relevant to Kentucky, South Carolina has a notable number of participants in marine aquaculture, where an array of shellfish farms characterize the state's production (NASS 2013).

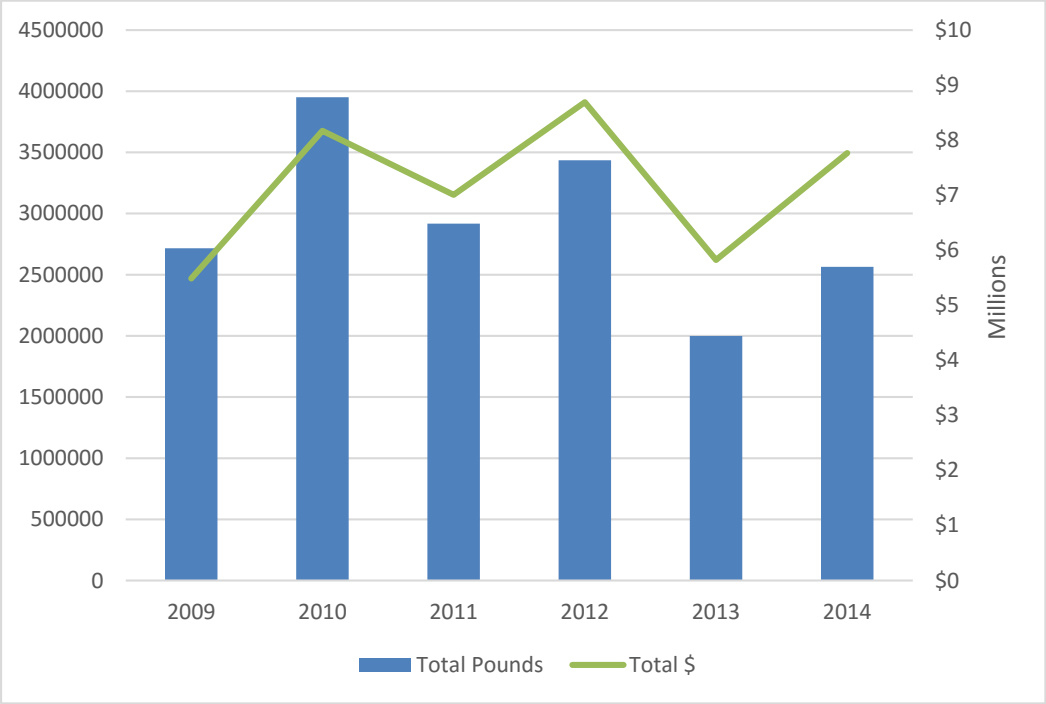
Figure 2.3 U.S. Annual Marine Aquaculture Production & Value (Millions)



Source: National Marine Fisheries Statistics 2015

When considering all varieties of fishery products for domestic and foreign markets, the commercial marine fishing industry contributed around $43.5 billion (in value added) to the U.S. Gross National Product in 2014 (NMFS 2015). Commercial landings were 9.5 billion pounds valued at $5.4 billion, where finfish accounted for 87% of total pounds but only 44% of value (NMFS 2015). Specifically, wild-caught shrimp was of interest for this study due to its significance in the seafood sector for South Carolina, as Figure 2.4 outlines total pounds and value from 2009 to 2014. One cannot observe a particular trend for this state's shrimp industry just through the figure, where data show that capture and value are fairly inconsistent from year to year. The industry is significant to the state nonetheless, resulting in over 7 million dollars for 2014.

Figure 2.4 South Carolina Wild-caught Shrimp Production & Value (Millions)



Source: National Marine Fisheries Statistics 2015

2.2 TRADE AND ENVIRONMENTAL ISSUES IN THE GLOBAL SEAFOOD MARKET

From a global perspective, both commercial fisheries and aquaculture have progressed in terms of productivity, market growth, and product development thereby becoming the world's fastest growing animal-based food sector (FAO 2006). Global per capita consumption of fish and shellfish has doubled over the past five decades, with fisheries and aquaculture directly employing over 43.5 million people (FAO 2006). This particular food commodity is the most widely traded with half of consumption in most developed countries supplied from developing nations (Asche et al., 2015, Jacquet et al., 2010). Total U.S. import values of fishery products were $35.9 billion in 2014, an increase of eight percent over the previous year (NMFS 2015).

With the profitability of shrimp farming in developing countries such as Thailand having been estimated to be thirty times that of profits associated with rice, one can see how seafood has become an export-oriented market for developing countries (Primavera, 1997). These estimates encourage developing states to adopt export-driven protein products to meet increasing demand from developed states and attract foreign investment (Environmental Justice Foundation, 2003). The desire to export is also due to seafood having the highest value in trade over any food commodity (Smith et al., 2010). Anderson et al. (2010) explain that high volume of trade is due to progress in transportation technologies like freezing, as well as the adoption of aquaculture around the world.

Increasing volume of trade has encouraged the U.S. implementation of country-of- origin labeling (COOL), as 2005 witnessed the mandatory labeling of wild and farm-raised seafood (United States Department of Agriculture (USDA)-Agricultural Marketing Service (AMS), 2009). The AMS branch of the United States Department of Agriculture (USDA) justified COOL by suggesting consumers deserve access to additional and accurate market information to assist with purchasing decisions (USDA-Agricultural Marketing Service (AMS), 2009). Studies have shown that consumers are willing to pay high premiums for COOL, stating concerns with imports and source verification (Loureiro and Umberger 2003).

An additional motivation behind origin labeling is the effort to signal environmentally and sustainably sourced food products from certain countries or regions, especially those who wish to promote their positive reputations with environmental issues or being required to do so if they have negative reputations (Golan 2001). One

environmental concern surrounding the fishing industry is the unintentional catch of other species, also referred to as “by-catch.” A publicized form of “by-catch” is the event to which shrimp trawlers catch sea turtles in trawler nets thus causing fatality (FAO 1997). Therefore U.S. shrimp trawlers are required to use turtle excluder devices (TEDs), as several World Trade Organization (WTO) disputes have involved the United States banning imported wild-caught shrimp without the use of these devices (World Trade Organization 1998).

Environmental issues have incentivized the FAO (Food & Agriculture Organization) to call for a systematic and broad-based approach in addressing the management of fish stocks, stating 90% are fully or overexploited (FAO 2014). With environmental issues plaguing the fishing sector, the term sustainable can have multiple meanings and potential to cover many metrics (Roheim 2009). Sustainable seafood may be described as a product having high stock abundance, low levels of fishing pressure, nominal by-catch levels, minimal adverse gear effects, negligible habitat damage, and/or effective management (Roheim 2009).

2.3 ECOLABELS & ENVIRONMENTAL CERTIFICATIONS

Consumer preference for sustainable seafood has garnered attention among researchers. Ecolabels are certification programs having been established as a market-based solution to environmental issues (Gudmundsson and Wessells 2000). Success depends on the extent to which consumers are willing to pay a premium for certified products, as certification requires fishermen to follow a collection of strict standards (Gudmundsson and Wessells 2000). Certified products also incentivize retail outlets to

increase profits while improving corporate social responsibility, as certified fishermen can also potentially earn greater revenues (Roheim 2008).

A popular third-party agency establishing its own ecolabel and reviewed within the literature is the Marine Stewardship Council (MSC). The non-profit organization was founded in London, England in 1996 and established as an incentive for fisheries to positively sustain and progress marine environments (MSC 2016). MSC standards seeks to utilize a market mechanism that increases the availability of certified sustainable wild-caught seafood (MSC 2016). The blue ecolabel signals to consumers that the product maintains the standards for sustainable fishing and traceability. The agency's main goal is to make the global market more sustainable (MSC 2106).

Standards were developed through consultation with the fishing industry, scientists, conservation groups, experts, and stakeholders (MSC 2016). From 2014-2015, 608,000 tons of MSC labelled seafood was bought, up from 538,000 tons for 2013-2014 (MSC 2015). In 2015 alone, over 108 species were available in over 97 countries, as well as an estimated $4.5 billion spent by consumers (MSC 2015). The MSC's certification system is popular among U.S. retailers, being used for assessing sustainable seafood by Wal-Mart, Whole Foods, and McDonald's (MSC 2016).

Relevant to this particular study, the first shrimp fishery to be certified by the MSC was an Oregon pink shrimp fishery in 2007 (MSC 2015). This statistic owes to the infancy of the certification program, especially when referencing to the certification of wild-caught shrimp. Viability of such an organization is somewhat reliant on popularity among retailers and consumers. Consumer acceptance and purchasing behavior toward ecolabels like the MSC influence the organization's existence and progress, such that the

revenue- generating capacity may or may not provide sufficient funds supporting monitoring measures (McHale 1997).

With public institutions managing marine ecosystems/fish stocks and using science-based metrics, agencies such as NOAA have explored the idea of establishing domestic certification systems for sustainability. NOAA is the U.S. agency responsible for science-based management of domestic fish stocks and other environmental issues relevant to marine ecosystems, and has proposed its own certification for sustainable, domestic fishery products (NOAA Fisheries 2013). NOAA has already created a website entitled FishWatch, intended to provide information on whether the seafood is a "smart" choice. An example from the website states, "U.S. wild-caught white shrimp is a smart seafood choice because it is sustainably managed and responsibly harvested under U.S. regulations" (NOAA Fishwatch 2016). Non-profits like the Monterrey Bay Aquarium (MBA) use NOAA's technical data and Fishwatch to produce grades for its Seafood Watch Program. As a result, institutions seeking to source sustainable fish products (restaurants, wholesale distributors, processors, etc.) use the MBA's program as a reliable source for providing sustainability information for fish and shellfish products (MBA 2016).

With the release of the NOAA Aquaculture Policy in June, 2011, sustainable aquaculture production is being advocated as well (ASC 2016). Best Aquaculture Practices (BAP) is an international, third-party certification system outlining the elements of responsible aquaculture by certifying finfish, crustaceans, and mussels. The blue & white ecolabel appears on packaging for frozen and prepared seafood. Certification standards for farm-raised seafood were formulated by the Global Aquaculture Alliance

(GAA), an international non-profit devoted to promoting sustainable aquaculture (GAA 2016). Keeping in mind that aquaculture is pivotal to increasing seafood supply for food security, the alliance advocates responsible and sustainable aquaculture by working with NGOs, industry, governments, and academia to meet these challenges (GAA 2016).

BAP certification defines the following elements as most important to responsible aquaculture: environmental responsibility, social responsibility, food safety, animal health and welfare, and traceability (BAP 2016). BAP-certified farms, feed mills, hatcheries and processing plants apply the above standards to minimize environmental impacts, respect workers' rights, and produce credible and healthy seafood products (BAP 2016). The BAP collaborates with aquaculture producers, processors, retail and foodservice companies, scientists, conservation groups, and consumers to certify and establish a labelling program for responsibly farmed seafood (BAP 2016). As of 2016, BAP certified 40 operations in the U.S., as to which 12 of these process shrimp products (BAP 2016). All 12 of these do not operate as farm-raised operations but rather as processing or repackaging product, suggesting more certifications are given to the processing stage. Currently, no shrimp processing facilities in Kentucky or South Carolina are certified by the BAP.

2.4 TRACEABILTIY ISSUES AND MISLABELING OF SEAFOOD PRODUCTS

With increasing attention given to trade and environmental issues, traceability and credibility of products have also become important issues in the seafood market. A 1997 press release by the United States National Seafood Inspection Laboratory (NSIL) reported that 37% of fish and 13% of other seafood products tested were mislabeled with

respect to species (Tennyson, Winters, and Powell 1997). This was the last such test performed by the NSIL. With recent reports suggesting a similar story, fraudulent mislabeling of species could still be an issue. By referring to Food and Drug Administration guidelines, a 2013 study by Oceana discovered 33% of more than 1200 fish samples tested were mislabeled (Warner et al., 2013). This potential market failure could complicate consumers' intentions in purchasing with regards to the credibility of labels representing specific attributes and species.

A similar Oceana study in 2014 assessed shrimp in retail outlets and restaurants, seeking to outline specific characteristics of the settings to which consumers obtain information on products and the actual products received. The organization collected shrimp samples for genetic species identification in four different regions of the United States, concluding that 41 percent of retail outlets sold misrepresented shrimp (Warner et al., 2014). It's important to note that the study only found 30% of shrimp products indicating country of origin, 29% indicating farmed or wild-caught, and 20% provided neither (Warner et al., 2014).

The issue of mislabeling and seafood fraud had resulted in President Barack Obama's issuing of a Presidential Memorandum in 2014 to quote, "establish a framework for combating illegal, unreported, and unregulated fishing and seafood fraud" (Obama 2014). Obama suggests the U.S. as a global leader in sustainable seafood, stating that the U.S. has ended overfishing, rehabilitated a record number of stocks, and all the while supported record highs in landings and revenue (Obama 2014). The report also advocates that illegal, unreported, and unregulated (IUU) fishing damages the economic and environmental sustainability of fisheries in the U.S., with losses estimated to be $10-23

billion annually (Obama 2014). Perhaps mislabeling and seafood fraud are pertinent issues, and thus increase the incentive for stakeholders in the seafood supply-chain to improve upon traceability standards (e.g. Jacquet and Pauly. 2008; Future of Fish 2014).

2.5 LOCAL SEAFOOD & COMMUNITY SUPPORTED FISHERY

Food safety is important when considering both wild-caught (e.g. mercury levels) and farm-raised (e.g. antibiotic and chemical use) products, especially with the use of antibiotics, algaecides, disinfectants, detergents, and soil treatments in aquaculture (Graslund and Bengtsson, 2001). Within cultured shrimp production, chemicals are used to inhibit the growth of viral, bacterial, fungal, and other pathogens, hence a potential concern for consumers (Primevera et al., 1993). Consumers' risk perception factor into purchasing behavior and willingness to pay, as products perceived to be hazardous can change behavior (McIntosh et al., 1994). Origin could also play a role in consumers' perception of safety when evaluating the original source (Golan 2001).

Preference for origin labeling has made strides with the implementation of COOL and recent trend of "local" food systems focused on direct marketing (e.g. Farmers' Markets, Community Supported Agriculture (CSAs)) as well as state agriculture departments promoting producers' products (e.g. Kentucky State Proud/Certified, South Carolina Seafood, etc.) (Low et al. 2015). Therefore, information regarding origin is important with "local" food products representing transparent provenance, traceability, and short supply chains (Marsden et al 2004). Due to the lack of extensive research in local seafood, the definition and study of this particular topic is less defined and different

than that for other food products (Smith and MacKinnon 2007; Adams and Adams 2008; Fonner 2015).

"Local" could be flexible from a marketing perspective for fish and shellfish, as consumers may define local by port, region, seafood traveling 175 miles inland, or even country (Brinson, Lee, Rountree 2011). An example is the Port Clyde Community Supported Fishery in Maine, shipping product to New York City and marketing itself as "local" (Brinson, Lee, Rountree 2011). This particular study utilizes the "Kentucky State Proud" and "Certified South Carolina Seafood" labels to define local as product sourced from the participants' state of residence. This helps give the loose term a more precise definition, as well as examine how consumers value seafood products sourced from state of residence.

A popular marketing model placing emphasis on origin and traceability is Community Supported Fishery (CSF), where programs are modeled off CSAs and have started to emerge across the U.S. (Andreatta et al. 2011). CSAs engage consumers by establishing close relations with farmers, as well as providing a seasonal "basket" of local and fresh agricultural products characterized by sustainable farming practices (Brown and Miller 2008). CSFs are similar with arrangements between fishermen and consumers where consumers provide upfront payments to fishermen in exchange for scheduled seafood deliveries, and both consumers and producers share risk of production (Brinson et al., 2011). Quantity is usually marketed as a specific weight of seafood distributed weekly for consumers, where members are more prone to timing risk (disruptions in scheduled delivery due to weather, regulatory pressures, etc.) instead of production risk shared by CSA members (Brinson et al., 2011). When considering species marketed,

CSFs are diversified with some selling a variety of seafood products and others specializing in specific species (Brinson et al., 2011).

Brinson et al., (2011) explains how two main goals of the CSF model are to increase profits for local fishermen and provide high-quality seafood to consumers. For this particular project, a "Product of CSF" label is used with the intention that the fishery diversifies operations by selling excess product to other market channels. Direct marketing may not be the only method to which CSFs market products, but used as a supplement to operations (Brinson et al., 2011). Seafood is required by law to be sold by registered dealers, so one must attain a dealer's licenses to sell product to consumers. As an alternate form to obtaining a license or direct marketing, CSFs could operate as a cooperative selling to an array of market outlets. CSFs may have the ability to shorten the seafood supply-chain process by selling to Food-Coops and other grocery outlets. Operating only a direct market may be challenging, as a CSF may not attain enough customers to achieve a viable income (Brinson et al., 2011). The Yankee Fishermen's Cooperative in Seabrook, NH, operated a shrimp CSF and only a small fraction of total landings were channeled to the CSF (Brinson et al., 2011). Situations such as this may allow the opportunity to diversify and expand operations, as well as decrease market risk by not operating solely through a direct market.

2.6 HOMEGROWN BY HEROES

A food label not having been studied in the literature and possessing potential implications is Homegrown By Heroes (HBHs). Kentucky's former Commissioner of Agriculture, James Comer, launched the HGHs program in January of 2013. The labeling

scheme was founded by the Kentucky Department of Agriculture (KDA) and distributed nationally by the Farmer Veteran Coalition (KDA 2015). The program now includes over 250 members in 43 states, as the label serves to inform consumers that participating products were produced by military veterans and available to farmers, ranchers, fishermen, and value-added producers of all branches and eras of military service (FVC 2015).

Commissioner Comer elaborated on how agriculture is a growth industry in the state and how agriculture fits well as an occupation for veterans, and the KDA was determined to establish a program to add value to veterans' products (KDA 2015). Within the same press release, Commissioner Comer explained how unemployment rates of veterans and reservists is higher than the statewide average, and thus the label uses the popularity of the Kentucky Proud program to help veterans make a living in agriculture (KDA 2015). South Carolina Agriculture Commissioner Hugh Weathers has also endorsed the program by promoting HBHs in an interview with Southern Farm Network. When it was suggested that veterans come back from deployment overseas and don't have sold job prospects, Weathers explained how veterans can be mentored on farms for a number of years as beginning farmers (SCDA 2015). This allows the opportunity to learn the trade and start a sole operation qualifying for HBHs, as the commissioner concludes on the point that the program is established to help veterans transition to agriculture and show the countries' appreciation for their service. (SCDA 2015).

Since 2009, the USDA has distributed $466.8 million in farm loans to 6,868 veterans to purchase farmland, buy equipment and make repairs and upgrades (USDA 2016). The Agricultural Act of 2014 designated veterans eligible for special preferences,

priorities, and incentives in promoting opportunities to access resources needed to start an agricultural operation (USDA 2015). Capital such as land and equipment are essential for producers aiming to start an operation, as the USDA states the agency is committed to assisting veterans with the transition back home and finding meaningful work in agriculture (USDA 2015).

The USDA has also established a Military Veterans Agricultural (MVA) Liasion in the 2014 Farm Bill to quote, "coordinate USDA leadership across the Department to provide information, resources, and support for active duty military and veterans interested in agriculture" (USDA 2014). The first MVA Liasion, Karis Gutter, explained that as a Marine she knows veterans and active personnel have unique skills, training, and perspective to succeed in starting or continuing an agricultural operation (USDA 2014). The MVA Liaison's duty also includes facilitating relations between the USDA and other government agencies and non-profits to expand upon opportunities for veteran employment. A recent example of this is the joint agreement between the USDA and U.S. Chamber of Commerce Foundation. The agreement is intended to establish a partnership between the USDA and Hiring Our Heroes (program helping veterans) that assists with training and opportunities for employment (USDA 2016).

Thus far, the label has been applied to a diverse variety of agricultural products, reiterating the program's application for many food products. As an example, the label has been applied to a processor of sea salt in South Carolina and a sorghum farmer selling processed syrup to beer producers in Kentucky (FVC 2014). The label is not only applicable to market channels to which the sorghum farmer sells to, but is also implemented on the beer cans as well. The HGHs label was of interest to researchers in

exploring the idea of the label attached particularly to farm-raised seafood products. Having been developed and started in Kentucky as well as promoted in South Carolina, there has been no study examining the impact of this program on the market in terms of how consumers may react to it.

CHAPTER 3: LITERATURE REVIEW

3.1 CONSUMER PREFERENCES

Though research is not as extensive as other meat products, literature devoted to the perceptions and attitudes towards fish and shellfish products has progressed in the last 25 years (e.g. Anderson and Bettencourt,1993; Hanson et al., 1995; Wessells et al., 1996; Holland and Wessells, 1998; Charles and Boude 2001; Johnston et al., 2001; Jaffry et al., 2004; O'Dierno et al., 2006; Quagrainie, 2008; Whitmarsh and Palmieri, 2009; Rudd et al., 2011; Davidson et al., 2012; Roheim et al., 2012). When considering other meat-based proteins, seafood is not as popular in the U.S., with the protein category behaving as a normal good with demand income elastic (Asche et al., 2007). A significant difference separating seafood from other meat products is that other proteins are not characterized by differences between cultured and wild-capture.

This unique situation has spawned several studies devoted to differences in this attribute (Gempesaw et al., 1995; Hanson et al., 1995; Whitmarsh & Palmieri, 2009). Roheim, Sudhakaran, and Durham (2012) reiterate the importance of wild-caught vs. farmed seafood with results showing consumers more often select wild-caught over farm-raised products with environmentally certification. Studies have also assessed wild-caught versus farm-raised as a signal of product quality in choice experiments (Davidson et al. 2012; Roheim, Sudhakaran, and Durham 2012).

Quality can be challenging to evaluate in a direct sense with seafood, as the term is multidimensional and dependent on food safety, fresh vs. previously frozen, appearance, and taste (Anderson 1991). Jaffry et al. (2004) found significant evidence for preference towards products certified as "high quality," implying that without certification consumers are challenged in judging quality. Verbeke et al. (2007) had similar results with preference for quality labels highest among consumers unsure in evaluating quality. Kole et al. (2009) discovered Dutch consumers' judged quality based on the perception of the suppliers, suggesting credibility and consistency at the point of sale could be more important than labels.

A variable mentioned above in assessing quality was food safety risks, having found to be solely significant as Lin et al (1991, 1993) mention how health hazards in seafood have been publicized (e.g. mercury levels) and affect preference. Brécard et al. (2009) has shown significant results in safety assurance labeling, and Brécard et al. (2012) discovered that labels assuring safety are most important among women with children. When asking respondents to rank salmon profiles, Holland and Wessel (1998) show that safety inspection, certifying agency, and price are significant with the strongest preferences for safety inspection. Wessells and Anderson (1995) assessed the value of safety certifications and results showed the attribute with a premium. Though many attributes are emerging in the seafood market, one cannot ignore the importance of basic food safety and quality factoring into purchasing decisions.

3.2 ECOLABELS

Considering one of the more popular attributes of the 21st century, ecolabels have been given the most attention in research with the likes of Johnston (2008) providing an extensive literature review. Johnston et al. (2001) and Wessells et al. (1999) were among the first researchers analyzing consumers' likelihood of selecting ecolabled seafood products, finding significance in certified over non-certified. With regards to magnitude, Jaffry et al. (2004) found ecolabels having the greatest effect on product choice when considering other seafood attributes. Roheim et al. (2011) found similar results with scanner data in the United Kingdom (U.K.) by using a hedonic price model and showing a premium of 14%. Teisl et al. (2002) examined market data as well, showing the implementation of a dolphin-safe label (canned tuna) induced purchases and increased market share verses substitute meats. Olesen et al. (2010) found significant premiums as well, but results showed an increase in price premium having adverse effects on probability of selection.

Johnston and Roheim (2006) estimated tradeoffs amongst ecolabels and species preference, showing consumers pay significant sums for certification. This was not the case if respondents substituted a favorite species to attain a less-favored with an ecolabel, suggesting consumers are not willing to substitute among species. Thus, the label's effect could only be relevant when choosing between two different products of the same species. Fonner and Sylvia (2015) estimated WTP for ecolabels, finding estimates to have a large range as well as having the largest number of negative estimates. The study also established a relationship between ecolabel preference and demographic characteristics, where respondents who preferred ecolabels were shoppers at natural food stores and

college educated. Brécard et al. (2012) and Salladarre et al. (2010) found European supporters of ecolabels as young and well-educated, living in non-coastal areas and concerned with environmental circumstances surrounding seafood.

Species and the certifying institution of the ecolabel are deemed to factor into consumer decisions as well. Consumer opinion of certifying institution is of interest to researchers, with studies citing reputation and credibility of certifying agency critical to success. Wessells et al. (1999) cited consumers' trust in the organization's vision and competence as a major feature in WTP for sustainability certification. When respondents were asked whether the World Wildlife Fund (WWF), MSC, or NMFS would be most credible in certification, NMFS garnered the highest trust ratings among U.S. participants at 49%. This is surprising considering NMFS does not operate a certification program for retail products, while only 5% selected the MSC (an existing agency with a label) who currently has certified products in Wal-mart and Whole Foods.

3.3 ORIGIN MARKETING

COOL was proposed to support domestic agricultural producers, as stakeholders in the beef and horticultural industries became strong advocates for implementation (Krissoff et al., 2004). Though research proves consumers will pay premiums for U.S. meat products (e.g., Umberger et al., 2003), this has not always been the case for seafood where 80% of consumption is imported (NMFS 2015). Even though Jaffry et al. (2004) found consumers prefer domestically caught to imported, Kuchler et al. (2010) examined national household data in the U.S. finding no impact of COOL on household seafood consumption.

Considering the emergence of ecolabels and legal requirements for COOL and "previously-frozen," it is important to note seafood preference with multiple information labels. Barreiro-Hurle et al. (2008) found products containing multiple labels with similar information could decrease preference, but no results showed multi-labels reducing preference for the "local" attribute. Literature pertaining to local foods finds purchasing motivations are characterized by consistent preference for nutritious, fresh, chemical-free, sustainable/environmental-friendly, and overall support for local producers (Zepeda and Nie 2012). Local labels are hence an important signal to consumers for many underlying features. As far as preference for local seafood products, Roheim et al. (2012) found 74% of participants preferring wild-caught local fish to farmed fish from other states. Davidson et al. (2012) found consumers in Hawaii preferring locally grown aquaculture products over imported., with both studies inferring the attribute's significance for further research.

Research is emerging but not largely abundant due in part to the absence of truly "local" seafood across the United States, but labeling programs have been implemented at the county level (e.g. Andreatta et al., 2011). Fonner and Sylvia (2015) found significant evidence in support of local seafood labels among niche consumers in Oregon with the "local" parameter yielding the largest estimates of mean WTP (willingness to pay). A survey by Quagrainie et al. (2008) had similar results suggesting most participants were interested in local aquaculture products, but results revealed consumers were not willing to pay premiums. Rudd et al. (2011) showed the local attribute yielding larger mean WTP estimates than "high omega-3 content" and "decreased environmental

impact;" with a small segment of consumers always purchasing local regardless of other attribute levels.

CHAPTER 4: CONSUMER THEORY & ECONOMETRIC MODEL

4.1 CONSUMER THEORY

The theory of consumers guiding this current research stems its foundation from Lancaster's (1966) formative paper, generating a framework for evaluating utility from consuming products with an array of attributes. By recognizing that a collection of traits is significant, Lancaster (1971) proposed the theory of demand for products having one or more attributes. By showcasing that consumers derive utility on products' embedded attributes, utility is not assumed to be ordered by a sole characteristic. The concept suggests that utilities generated from consuming the same product differ on impending attributes and various levels. On the demand side of the market, Lancaster's work has been the underlying theory used for research evaluating consumers' preferences for food attributes.

When considering a number of n-choice situations and evaluating consumer i's selection of a product, McFadden's (1974) random utility theory can be applied. Consumer i's indirect utility (Uijn) from selecting the j-th product in a group of J products in the n- choice condition (n=1, 2, 3…) is described as a linear function of product attributes (Xijn) by the equation below:

$$(4.1)\ U_{ijn} = X_{ijn}\,\boldsymbol{\beta} + \varepsilon_{ijn,}$$

where $\boldsymbol{\beta}$ symbolizes a vector of indefinite marginal utilities from product attributes Xi j n of the alternate j in choice situation n, as εijn denotes the random error term of the

computed utilities. Assuming consumers act rationally, utility is maximized through selecting alternatives j in the n-choice framework (McFadden 1974).

4.2 PREFERENCE AND WTP ELICITATION FRAMEWORK

Both stated and revealed preference are extensively applied in food literature, where these methods develop a framework for which a choice model can measure consumer preferences. Revealed preference refers to a collection of data that discloses decisions in reality, whereas stated preference data "states" decisions that consumers would do in a hypothetical situation. Utilized in this study, stated preference data was collected through controlled choice experiments where consumers' stated decisions were used instead of observed data. Since the research project encompassed emerging and scarce concepts in the marketplace, existing data on consumer preferences and WTP do not exist. New and emerging product attributes that characterize this project are difficult to measure with revealed preference information such as actual scanner data, as revealed preference is also expensive and time-consuming to obtain. As a result, we concluded that stated preference was the better direction.

Common stated preference methods consist of two types of analysis, contingency valuation and discrete choice experiment. Contingency valuation inquires participants to gauge attributes directly, whereas discrete choice experiments provide a more multifaceted and indirect technique of evaluating consumers' preference. This technique has its foundations in Lancaster's (1966) notion of utility maximization and McFadden's (1974) random utility theory (Louviere, Hensher and Swait 2000). Discrete choice experiments intrigue scholars in the method's ability to evaluate attributes when products

are described by price and additional characteristics. Indirectly presenting attributes in the manner of "choice cards" helps reveal the magnitude to which consumers' trade-off between various traits, but this technique is not viewed as flawless.

What concerns researchers using stated preference surveys are whether consumers' choices in these hypothetical situations replicate actual consumption behaviors. When revealed preference data does not exist, one must address this issue known as hypothetical bias. Even discrete choice experiments is generally viewed as a reliable tool, one must apply this technique careful to minimize the impact of hypothetical bias. Lusk and Fox 2003 showed hypothetical bias can be eased by controlling for unengaged bidders, and that elicitation context (hypothetical versus non-hypothetical) has a larger influence than environment (store versus lab) on results (Lusk and Fox 2003).

4.3 ECONOMETRIC MODELS

Owing to the extensive application of the Conditional logit (CL) choice model for inference in discrete choice experiments, this econometric technique is applied as a baseline model in this research as well. By accepting the independently and identically distribution (iid) of the error term (εijn) in (4.1) and Independence of Irrelevant Alternatives (IIA) assumptions holds, the probability of the j-th option being selected can be modeled as:

$$(4.2) \quad P(Y_{in} = j) = \frac{\exp(Xijn\beta)}{\sum_{j=1}^{J} \exp(Xijn\beta)} \quad \text{For j} = 1,2,\ldots,J,$$

where Yin is an indicator variable representing the selection by consumer i in the n-choice situation. Considering a closed-form probability function, the CL method can be assessed using Maximum Likelihood estimation (McFadden 1974). Though straightforward to estimate, the conditional logit model is thought to suffer from its IIA assumption. Striving for an alternative, Train (1998) developed what is known as the mixed logit model. The mixed logit offers greater flexibility by relaxing the IIA assumption. This is important in examining data from discrete choice experiments to which the resulting IIA assumption may be too limiting. Both the mixed and conditional logit will be applied in the study, as the resulting McFadden pseudo R2 will help researchers indicate which model has a superior fit (higher statistic) to the data (Louviere, Hensher and Swait 2000).

Incorporating preference heterogeneity as well as accounting for correlations between multiple choice observations (within each respondent) provides the mixed logit model with additional advantages (Bliemer and Rose 2010). This is also referred to as accounting for correlation in unobserved utility over repeated choices made by each respondent, or that the parameter estimates of the marginal utilities vary across respondents. The choice probability identified by the mixed logit is modeled as:

$$(4.3) \quad P(Y_{in} = j) = \int \frac{\exp(Xijn\boldsymbol{\beta})}{\sum_{j=1}^{J} \exp(Xijn\boldsymbol{\beta})} f(\boldsymbol{\beta}) d\boldsymbol{\beta}$$

where the coefficients in vector β are defined as random variables following density function f as:

$$(4.4) \quad \beta_i \sim f(\beta_o, G)$$

with βo as the means of βi and G as the variance matrix. With the probability evaluated over a range of possible values of βi and the absence of a closed-form solution, the approach of approximating the likelihood function with simulated maximum likelihood is applied to the model (Train 2009).

4.4 MARGINAL WILLINGNESS TO PAY

Following the estimation of β in either the conditional or mixed logit model, marginal Willingness to Pay (WTP) measures for an attribute k is approximated as the part-worth utility estimate for the attribute divided by the negative marginal utility of price (Louviere, Hensher and Swait 2000):

$$(4.5)\ WTP_k = -\frac{\beta_k}{\beta_{price}}$$

Thus, WTP measure the change in price associated with a unit increase in the respective attribute and approximate the monetary values of product attributes. Noteworthy interest is the inference on the WTP measures, as those generated from past studies have been found to be reliable and comparable to results from using other methods. Past studies suggestes that marginal WTP measures calculated in discrete choice experiments (DCEs) were close to those estimated from actual field using real choice data (List, Sinha and Taylor 2006).

CHAPTER 5: SURVEY DESIGN & DATA

5.1 SURVEY DESIGN

Consumer response to certain seafood attributes stands as a focal objective of the project, as a survey was designed and implemented for assessment. The first section consists of questions asking consumers about general seafood awareness, as well as a variety of shopping behaviors. The survey proceeds with a DCE to elicit consumer preferences for product attributes of both (a) farm-raised shrimp and (b) wild-caught shrimp that are differentiated by various product attributes including price. Choice experiments (CE) have been shown to perform well in comparison to contingent valuation method (CVM), with CE having several advantages over CVM (Adamowicz et al. 1998). Specifically, CE allowed the examination of specific attributes and nonlinear differences in comparison to revealed preference data, responses in DCE have been shown to be similar (Adamowicz et al. 1997).

Questions regarding socio-demographic information, including gender, age, household size, education and annual household income level before tax conclude the questionnaire. Qualtrics was the online platform utilized for distribution, as primary grocery shoppers in the states of Kentucky and South Carolina were the principal targets.

5.2 PRODUCT ATTRIBUTES AND CHOICE EXPERIMENT DEISGN

Emerging attributes entice researchers to evaluate consumer preference and establish an accurate depiction of credence attributes in the seafood market. Including multiple attributes for sole products is necessary for consumer evaluation, as decisions are based

on combined information with multiple product attributes (Green and Srinivasan 1978). A DCE was used for each type of shrimp, respectively. For the farm-raised shrimp, the products could vary according to the following six characteristics: (a) Product form (b) Price (c) Homegrown by Heroes (d) BAP (e) Product of CSF and (f) State sourced. Choice card designs for the wild-caught shrimp were subject to the following four characteristics: (a) Product form (b) price (c) MSC or NOAA certification (d) Product of CSF. Table 5.1 presents the attributes and their levels for both shrimp products, as well as a brief depiction of the particular levels.

Table 5.1 Product Attributes Used in DCE

Shrimp Type	Attribute	Level	Description
Farm-raised	Product Form	2	Previously frozen Fresh (never frozen)
	Homegrown by Heroes	2	Yes No
	BAP Certified	2	Yes No
	Product of CSF	2	Yes No
	State sourced	2	Yes No
	Price/lb[1]	4	9.99 12.99 15.99 18.99
Wild-caught	Product Form	2	Previously frozen Fresh (never frozen)
	MSC or NOAA	2	Yes No
	Product of CSF	2	Yes No
	Price/lb[1]	4	9.99 12.99 15.99 18.99

[1]Based on observed retail prices

Observed retail prices for both wild-caught and farm-raised shrimp resulted in a range between [$9.99, $18.99] per pound. The price range attempts to replicate the low and high prices of differentiated shrimp products witnessed in U.S. retail outlets at the time of the survey. All choice situations had a product form ("Fresh (Never Frozen)" or "Previously Frozen") and price ($/pound).

Amid the increasing access to information, some attributes are somewhat new to the seafood marketplace. The Product of CSF is a hypothetical label attempting to capture consumers' preference and perceptions of products derived from a model attempting to support higher prices for fishermen and quality for consumers. The label is accordingly attached to both the farm-raised and wild-caught situations, as it is feasible for fresh and marine aquaculture to market a CSF product. It was thought producers could market excess product to additional outlets or the capacity to produce/catch additional products for other markets (example could be when CSAs sell at farmers' markets). Both the Kentucky Proud and Certified South Carolina labels are included to assess consumers' value of state origin.

With the importance of ecolabels in the seafood literature, it is practical to combine such criterion to the set of additional attributes, especially considering how consumers make tradeoffs with origin, product form, and price. The BAP Certified label is considered for the farm-raised situations, a signal capturing preference for environmentally conscious production in aquaculture. The MSC label is included in the wild-caught situations to represent a seafood product that maintains standards of sustainable fishing and traceability. A hypothetical NOAA label is included as a substitute for the MSC. Lastly, the Homegrown By Heroes label was included on farm-

raised shrimp to examine how consumers' value products sourced from veterans of the armed forces.

Given the attributes and their corresponding levels, we conducted a fractional orthogonal design, generating 8 choice situations for farm-raised shrimp. As previously stated, each choice situation (choice card) contains 2 products side by side and a third option of not choosing either of the first two products, thus making the choice situation as realistic as possible in that consumers are not forced to choose the products offered. Similarly, a fractional orthogonal design generated 6 choice situations for the wild-caught shrimp.

In each DCE, several choice cards were designed to describe various products. In each choice card, two products are presented side by side. Four versions of the choice survey were developed, with two versions implemented for each state. The reasoning behind two versions was the ecolabel attribute (e.g. MSC or NOAA label) for wild-caught shrimp. It was of interest to researchers to analyze whether preferences differed between the presence of a MSC or NOAA label. It was not feasible for a wild-caught product to receive a sustainable certification by both agencies. It is also not advisable to let consumers see that both types of labels may appear on a product even when these two labels do not appear simultaneously since consumers may question the validity of the survey when either one of the two similar federally-regulated labels may be used on a product. As a result, for each state, respondents were randomly assigned to one of the two versions in that state. The two versions are identical in all aspects except the DCE for the wild-caught shrimp has one version showing the NOAA label and the other showing the MSC label.

Considering the product profile for both farm-raised and wild-caught shrimp, farm-raised had eight choice situations (16 choice options) and wild-caught resulted with six (12 choice options). Thus, each survey participant chose between 2 choice options in 14 situations. The justification behind eight situations for the farm-raised product was the greater number of product attributes. Two choice options were paired in each situation that consisted of an array of seafood attributes, and each was equally weighed at a price per pound. Louviere et al. (2000) suggests a "I choose not to purchase either option" choice with the other two choice profiles, hence included to evade a conditional situation and approximate a more "true" demand model. To make certain that the choice data was consistent, the sequence of choice options was randomized to reduce ordering bias (Carson et al. 1994).

A depiction of the choice card for the farm-raised shrimp is presented in Figure 5.1, as wild-caught shrimp is presented in Figure 5.2. Information regarding the product attributes was accessible before participants proceeded with the DCE, along with how to proceed with each situation and to choose one of the three options provided. There were also instructions informing respondents that other than the attributes explicitly presented, all other product characteristics were identical for each situation and not to compare across situations. Consumers were then asked to make a sequence of choices between various choice profiles as if they were grocery shopping.

Figure 5.1 Sample Choice Card in the Choice Experiment (Farm-raised shrimp)

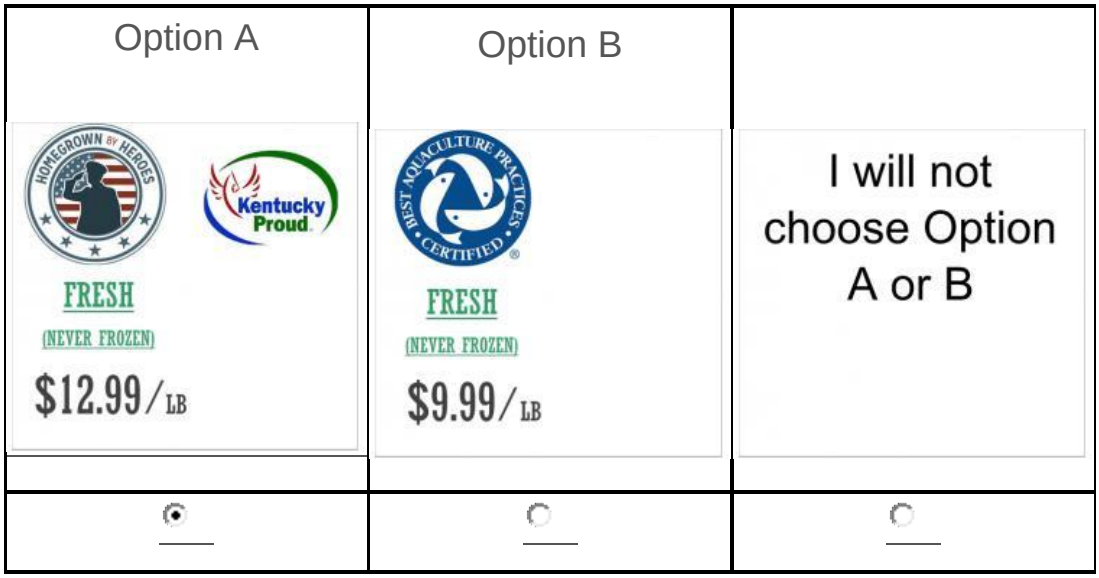


Figure 5.2 Sample Choice Card in the Choice Experiment (Wild-caught Shrimp)

5.3 DATA

The survey design and implementation was administered through Qualtrics and was open to only residents in Kentucky and South Carolina, respectively. By fielding the survey in both South Carolina and Kentucky, the sample's contrasting geographical

characteristics allow for researchers to analyze differences between the two states. This is important to fish and shellfish products, considering the importance of access to high quality seafood that coastal residents might be accustomed to in contrast to inland states with no marine fisheries.

For thoughts and suggestions on improving the survey, focus groups were conducted with staff at the Kentucky Department of Agriculture as well as with seafood industry experts. Before being administered online, preliminary surveys were designed and tested for practicality and efficiency with three focus groups (two at the University of Kentucky and one at Clemson). Adults 18 and over who were most likely the primary grocery shopper of the household were the target of the study. The finalized survey questionnaire was designed and distributed online using the platform Qualtrics in the month of February of 2016.

5.4 DESCRIPTIVE STATISTICS

Data was collected from a total of 1011 respondents, 505 from Kentucky and 509 from South Carolina as Table 5.2 provides populations statistics from the 2012 American Community Survey and Table 5.3 provide the sample demographics. One can observe how female respondents were the majority of results (around 69%), but this result makes intuitive sense when considering the female role in shopping behavior. For example, females resulted in 60% of the sample for Fonner & Sylvia (2015) in analyzing WTP for seafood attributes. Participants had to respond “yes” to whether they classified themselves as primary grocery shoppers to proceed with the survey. Most listed themselves between the ages of 35-54 (43%). Some college, technical school, or

associate’s degree was the majority of choice for both states when inquired about education (37%), and most earned $50,000 to $74,000 (17 %) annually.

Table 5.2 Population Socio-demographic Statistics

	Kentucky	South Carolina
Number	4,413,457	4,727,273
Sex (%)		
Female	50.8	51.4
Age (%)		
15 to 19 years	6.6	6.7
20 to 24 years	7	7.3
25 to 34 years	12.9	12.8
35 to 44 years	13	12.6
45 to 54 years	14.3	13.8
55 to 64 years	12.9	13
65 to 74 years	8.1	8.8
75 to 84 years	4.2	4.3
85 years and over	1.7	1.6
Educational attainment (%)*		
Not a high school graduate	16.5	15
High school graduate (includes equivalency)	33.7	30
Some college, no degree	20.7	21
Associate's degree	7.3	8.7
Bachelor's degree	12.9	16.2
Graduate or professional degree	8.9	9.2

Note: State population statistics are based on the 2012 American Community Survey 1-Year Estimates

*Population 25 years and over

Table 5.2 (Continued) Population Socio-demographic Statistics

	Kentucky	South Carolina
Household Income (%)**		
Below $14,999	16.9	15.5
$15,000 to $24,999	13	12.7
$25,000 to $49,999	26	26.4
$50,000 to $74,999	17.6	18
$75,000 to $99,999	10.9	11.2
$100,000 to $149,999	10.1	10.4
Above $150,000	5.3	6

Note: State population statistics are based on the 2012 American Community Survey 1-Year Estimates
** In 2014 inflation-adjusted dollars

Table 5.3 Sample Socio-demographic Statistics

	Kentucky	South Carolina
Number	505	506
Sex (%)		
Female	66.5	71.1
Age (%)		
18-25	13.9	16.2
26-34	25.7	22.1
35-54	44.0	41.7
55-64	11.3	12.3
65 or over	5.1	7.7
Educational attainment (%)		
8th grade or less	0.8	0.8
some high school	5.1	4.3
high school graduate or equivalent	31.5	21.1
some college-technical school or associate's	36.6	37.5
bachelor's or 4 year degree	16.2	22.3
graduate professional, or other advanced degree	8.3	13.6

Table 5.3 (Continued) Sample Socio-demographic Statistics

	Kentucky	South Carolina
Household Income (%)		
Less than $10,000	10.7	8.5
$10,000 to $14,999	7.3	7.9
$15,000 to $24,999	12.1	9.1
$25,000 to $34,999	13.7	11.1
$35,000 to $49,000	17.8	15.6
$50,000 to $74,900	17.2	17.0
$75,000-$99,900	8.3	13.0
$100,000-$149,900	6.3	7.1
$150,000-$199,900	1.6	4.0
$200,000 or more	0.6	1.4

CHAPTER 6: RESULTS

Considering separate choice sets for farm-raised and two versions implemented for wild-caught shrimp in each state (one version MSC label and other NOAA), a total of twelve models were presented using both the CL and ML model (4 farm-raised and 8 wild-caught). For all ML models, price was set as a fixed parameter and all other variables were assumed to be random and normally distributed. The rationale behind price the fixed parameter is to elude positive values from the normal distribution, as it is assumed all participants follow the theory of demand.

6.1 FARM-RAISED SHRIMP RESULTS

Both the CL and ML models for farm-raised shrimp resulted in 505 Kentucky (KY) and 509 South Carolina (SC) respondents. The estimated part-worth utilities coefficients of the two CL models are presented in Table 6.3. All coefficients resulted in expected signs and similar between the two states, with only the "Product of CSF" insignificant. The Pseudo R2's resulted in 0.178 and 0.194 for KY and SC, implying both models explained variation in consumers' choices fairly well (Louviere, Hensher and Swait 200).

Table 6.1 Utility Estimates for Farm-raised shrimp (Conditional Logit)

	Kentucky		South Carolina	
	Coef.	**S.E.**	**Coef.**	**S.E.**
Farm-raised shrimp				
Price	-0.116***	0.007	-0.121***	0.007
Buy Neither	-1.63***	0.044	-1.77***	0.121
Homegrown by Heroes	0.418***	0.044	0.390***	0.044
Product of CSF	0.003	0.047	-0.046	0.047
State Label [a]	0.450***	0.038	0.0424***	0.038
Fresh (Never Frozen)	0.795***	0.047	0.971***	0.048
BAP	0.337***	0.039	0.260***	0.039
Number of respondents	505		509	
Number of choice situations	4040		4072	
Log-likelihood function	-3646.83		-3604.99	
McFadden's Pseudo R^2	0.178		0.194	

Note: Asterisks *, **, and *** denote significance at 10%, 5%, and 1% level
[a] State Label is "Kentucky Product" for Kentucky respondents and "Certified South Carolina Seafood" for South Carolina respondents

ML models were also calculated to relax assumptions made by the conditional model and understand heterogeneity in preferences as evaluated by observing the standard deviation estimates. An approximate estimate specifying the proportion of participants who did not prefer the label can be computed based on the standard deviation estimates (Hensher, Rose and Greene 2005), indicating how valuation of the sample distributes around the estimated means (βi). Like the CL model, results were consistent between both states with "Fresh (Never Frozen)" garnering the highest coefficient and "Product of CSF" insignificant. Table 6.4 presents results with all other variables highly significant and Adjusted Pseudo

R^2's of 0.325 (KY) and 0.311 (SC). The coefficient of the fixed price variables were negative and significant for both states, implying consumers derived lower utility from products with higher prices.

Table 6.2 Utility Estimates for Farm-raised shrimp (Mixed Logit)

	Kentucky				South Carolina			
	Mean estimate		S.D. estimate		Mean estimate		S.D. estimate	
	Coef.	S.E	Coef.	S.E.	Coef.	S.E	Coef.	S.E.
Farm-raised shrimp								
Price	-0.162***	0.009			-0.169***	0.009		
Buy Neither	-4.095***	0.312	3.936***	0.311	-3.786***	0.258	3.401***	0.256
HBH	0.570***	0.059	0.534***	0.107	0.536***	0.578	0.466***	0.098
CSF	-0.056	0.055	0.114	0.114	-0.119**	0.055	0.076	0.120
State Label[a]	0.594***	0.062	0.909***	0.078	0.558***	0.056	0.701***	0.070
Fresh (Never Frozen)	1.095***	0.074	0.934***	0.095	1.317***	0.081	1.174***	0.099
BAP	0.459***	0.047	0.055	0.155	0.354***	0.046	0.032	0.127
Number of respondents	505				509			
Number of choice situations	4040				4072			
Log-likelihood function	-2987.11				-3072.953			
Adj. McFadden's Pseudo R^2	0.325				0.311			

Note: Asterisks *, **, and *** denote significance at 10%, 5%, and 1% level

[a] State Label is "Kentucky Product" for Kentucky respondents and "Certified South Carolina Seafood" for South Carolina respondents

Both 'Buy Neither' variables were included for consumers to 'op out' of either product choice, with the estimates significantly negative and the result implies most consumers chose to purchase the products available and experienced a decrease in utility with no purchase. The significant standard deviation estimates can be interpreted that a number of respondents valued purchasing farm-raised shrimp more than others.

When considering the ‘Homegrown by Hero’ label, significant positive coefficients and similar magnitude resulted for both states, indicating all participants derived higher utility from farm-raised shrimp produced by veterans. Preference was not homogenous across all respondents with significant standard deviation estimates. As a result, around 14% of KY and 12% SC participants did not value the label.

The only insignificant variable in both models was the ‘Product of CSF’ for KY residents, indicating products derived from a Community Supported Fishery did not affect consumers’ purchasing decisions. The negative and significant coefficient for SC residents indicates consumers derived lower utility from the presence of the label, as the mean estimate was homogenous among preference with no significance in the standard deviation estimates.

The ‘State Labels’ for both models were positive and significant, implying consumers derive higher utility with the presence of their state’s label indicating shrimp produced within the state. Kentucky’s was represented with the ‘Kentucky Proud’ label and South Carolina the ‘Certified South Carolina Seafood,’ both of which currently exist in the marketplace Preference among all respondents was not homogenous, as approximately 26% of KY and 21% of SC residents did not value products sourced from the participating state.

‘Fresh (Never Frozen)’ was significant and yielded the highest parameter among all positive coefficients in both models. This indicates consumers valued a fresh product highest among all attributes and thus generated the greatest utility. Preference was not homogenous in both states, with approximately 12% of KY and 13% of SC residents not valuing the fresh product form.

With the BAP label representing the value put on sustainable certification, results were significant and positive for both models, indicating participants attained higher utility with sustainably certified products. Insignificant results showed preference was homogenous among both states.

6.2 WILD-CAUGHT SHRIMP RESULTS

Considering two survey versions for each state, wild-caught shrimp resulted in four different CL and ML models for each state. The version with the NOAA label generated 250 and 256 respondents for KY and SC. The estimated part-worth utilities coefficients of the two CL models are presented for both states in Table 6.5. All coefficients resulted in expected signs and similar between the two states. SC participants placed the greatest value on ‘Fresh (Never Frozen)’, whereas KY residents considered the NOAA label most important among all positive coefficients. The Pseudo R2’s resulted in 0.126 (KY) and 0.207 (SC), implying both models explained variation in consumers’ choices.

Table 6.3 Utility Estimates for Wild-caught shrimp with NOAA label (Conditional Logit)

	Kentucky		South Carolina	
	Coef.	**S.E.**	**Coef.**	**S.E.**
Wild-caught shrimp				
Price	-0.130***	0.136	-0.168***	0.014
Buy Neither	-1.769***	0.211	-2.501***	0.213
Product of CSF	0.130*	0.069	0.284***	0.070
Fresh (Never Frozen)	0.525***	0.069	0.871***	0.072
NOAA	0.744***	0.065	0.676***	0.065
Number of respondents	250		256	
Number of choice situations	1500		1536	
Log-likelihood function	-1440.083		-1338.992	
McFadden's Pseudo R2	0.126		0.207	

Note: Asterisks *, **, and *** denote significance at 10%, 5%, and 1% level

Table 6.6 presents ML results with all variables significant except ‘Product of CSF’ for KY and Adjusted Pseudo R2’s of 0.334 (KY) and 0.359 (SC). For both states, the coefficient of the fixed price variable was similar in magnitude as well as negative and highly significant. Both ‘Buy Neither’ variables were significant and negative for both KY and SC consumers, signifying less utility from no purchase. The large magnitude for both states suggests most consumers chose to purchase the products available. The significant standard deviation estimates can be interpreted that a number of respondents valued purchasing wild-caught shrimp more so than others.

Table 6.4 Utility Estimates for Wild-caught shrimp with NOAA label (Mixed Logit)

	Kentucky				South Carolina			
	Mean estimate		S.D. estimate		Mean estimate		S.D. estimate	
	Coef.	S.E	Coef.	S.E.	Coef.	S.E	Coef.	S.E.
Wild-caught shrimp								
Price	-0.201***	0.019			-0.248***	0.019		
Buy Neither	-5.131***	0.312	4.652***	0.571	-5.841***	0.548	3.401***	0.256
Product of CSF	0.177	0.084	0.060	0.136	0.399**	0.085	0.029	0.196
Fresh (Never Frozen)	0.739***	0.125	1.369***	0.147	1.233***	0.142	1.539***	0.147
NOAA	1.041***	0.098	0.681	0.157	0.958***	0.087	0.267	0.201
Number of respondents	250				256			
Number of choice situations	1500				1536			
Log-likelihood function	-1092.861				-1076.109			
Adj. McFadden's Pseudo R^2	0.334				0.359			

Note: Asterisks *, **, and *** denote significance at 10%, 5%, and 1% level

The only insignificant variable in both models was the 'Product of CSF' for KY residents, indicating products derived from a Community Supported Fishery did not affect consumers' purchasing decisions. In contrast, the positive and significant coefficient for SC residents indicates consumers derived higher utility from the presence of the label. The mean estimate was homogenous among preference with no significance in the standard deviation estimates, results consistent with farm-raised shrimp when assessing SC residents.

'Fresh (Never Frozen)' was significant for both states and for SC participants the parameter yielded the highest magnitude among all positive coefficients. This indicates all consumers highly valued a fresh product form, results consistent with farm-raised shrimp.

Preference was not homogenous in both states with approximately 29% of KY and 21% of SC residents not valuing the fresh product form.

The value put on sustainable certification with the NOAA label was significant and positive for both models, indicating participants attain higher utility with sustainably certified products. Among all positive and significant parameters, the NOAA label generated the highest positive coefficient for KY participants and second highest for SC. Insignificant standard deviation estimates showed preference for the NOAA label was homogenous among both states.

The wild-caught shrimp survey with the MSC label generated 255 and 253 respondents for KY and SC. The estimated part-worth utilities coefficients of the two CL models are presented for both states in Table 6.7. All coefficients resulted in expected signs and like the previous CL model for wild-caught shrimp. Between the MSC and NOAA models, a notable difference was that all variables for MSC were significant at the 1%. Consistent with the NOAA CL, SC participants placed the greatest value on 'Fresh (Never Frozen)' and KY residents considered the sustainable certification label (MSC in this case) most important among all positive coefficients. The Pseudo R2's resulted in 0.120 (KY) and 0.164 (SC), implying both models explained variation in consumers' choices.

Table 6.5 Utility Estimates for Wild-caught shrimp with MSC label (Conditional Logit)

	Kentucky		South Carolina	
	Coef.	**S.E.**	**Coef.**	**S.E.**
Wild-caught shrimp				
Price	-0.168***	0.014	-0.159***	0.014
Buy Neither	-1.973***	0.211	-2.117***	0.216
Product of CSF	0.192***	0.072	0.194***	0.071
Fresh (Never Frozen)	0.618***	0.072	0.930***	0.072
MSC	0.730***	0.068	0.559***	0.066
Number of respondents	255		253	
Number of choice situations	1530		1518	
Log-likelihood function	-1479.257		-1394.329	
McFadden's Pseudo R2	0.120		0.164	

Note: Asterisks *, **, and *** denote significance at 10%, 5%, and 1% level

Table 6.8 presents ML results for the MSC version with all variables significant at the 1% level and Adjusted Pseudo R2's of 0.380 (KY) and 0.314 (SC). A noticeable difference between the two ML models is the highly significant CSF variable for both states. The 'Buy Neither' variables were again negative and highly significant, and significant standard deviation estimates showed a number of respondents valued purchasing wild-caught shrimp more so than others. The 'Product of CSF' produced a highly significant and positive coefficient for both states, indicating consumers' attained higher utility with products sourced from a Community Supported Fishery. Preferences were homogenous among all respondents, consistent with previous ML results.

Table 6.6 Utility Estimates for Wild-caught shrimp with MSC label (Mixed Logit)

	Kentucky				South Carolina			
	Mean estimate		S.D. estimate		Mean estimate		S.D. estimate	
	Coef.	S.E	Coef.	S.E.	Coef.	S.E	Coef.	S.E.
Wild-caught shrimp								
Price	-0.267***	0.021			-0.228***	0.019		
Buy Neither	-6.054***	0.606	6.543***	0.759	-4.607***	0.467	3.388***	0.333
Product of CSF	0.282***	0.089	0.027	0.184	0.265***	0.083	0.003	0.187
Fresh (Never Frozen)	0.904***	0.132	1.348***	0.145	1.206***	0.127	1.384***	0.153
MSC	1.043***	0.096	0.456**	0.181	0.766***	0.083	0.263	0.245
Number of respondents	255				253			
Number of choice situations	1530				1518			
Log-likelihood function	-1036.318				-1139.746			
Adj. McFadden's Pseudo R^2	0.380				0.314			

Note: Asterisks *, **, and *** denote significance at 10%, 5%, and 1% level

'Fresh (Never Frozen)' was significant for both states as SC participants continued to value the parameter highest among all positive coefficients. Preference was not homogenous in both states with approximately 25% of KY and 19% of SC residents not valuing the fresh product form. The alternate sustainable certification, MSC, had resulted in a positive and highly significant coefficient for both states. The MSC label generated the highest value among KY participants and second among SC, showing sustainable certification remained the most valuable attribute for KY. Resulting standard deviation estimates were insignificant showing preference was homogenous amongst both states.

6.3 WILLINGESS-TO-PAY

As a result of the explanatory power of heterogeneity in consumers' preferences and ability to relax restrictive theoretical assumptions, mean WTP estimates and further implications will reference the ML model. By evaluating the marginal change in price with a particular attribute, the WTP measures can be calculated. Table 6.9 shows the results derived from the resulting ML model. Using the Krinsky-Robb approach (1986), ninety-five percent confidence intervals for the WTP measures and respective standard errors were constructed with 10,000 iterations. An attractive property of a nonrandom price variable specification is the convenience in calculating WTP measures. Every WTP estimate's distribution is thus assumed to have the same distribution as the attribute variable it is computed from (Train 2009).

Estimates within Table 6.9 indicate that for farm-raised shrimp, KY and SC participants were willing to pay a similar amount for most attributes. For both states, consumers' WTP for the 'Fresh (Never Frozen)' product form was the highest with the average premium about $6.77/lb and $7.81/lb, respectively. KY residents were on average not willing to pay for the 'Product of CSF,' whereas SC residents generated a negative value of -0.71, indicating the unwillingness to pay a higher price discount for the resulting measure. The second highest WTP measure was each state's label, where KY residents were on average willing to pay a premium of $3.68/lb (Kentucky Proud) and SC residents at $3.31/lb (Certified SC Seafood). Next, the Homegrown by Hero label was not far behind by generating a premium of $3.52/lb (KY) and $3.18/lb (SC). Finally, the BAP generated an average of $2.84/lb (KY) and $2.10/lb (SC).

Table 6.7 Mean WTP Estimates ($/lb) for Farm-raised shrimp

	Kentucky			South Carolina		
Variable	WTP	S.E	95% C.I.	WTP	S.E	95% C.I.
Farm-raised shrimp						
Buy Neither	-25.34	1.96	(-29.26, -21.43)	-22.45	1.43	(-25.30,-19.60)
HBH	3.52	0.41	(2.70, 4.35)	3.18	0.38	(2.41, 3.95)
Product of CSF	0.00[a]	0.33	(-1.01,0.32)	-0.71	0.31	(-1.33, -0.08)
State Label[b]	3.68	0.39	(2.90, 4.45)	3.31	0.33	(2.65, 3.97)
Fresh (Never Frozen)	6.77	0.49	(5.80, 7.75)	7.81	0.51	(6.79, 8.83)
BAP	2.84	0.31	(2.23, 3.46)	2.10	0.29	(1.53, 2.67)

a The marginal utility estimate was not significantly different from zero
b State Label is "Kentucky Product" for Kentucky respondents and "Certified South Carolina Seafood" for South Carolina respondents

Estimates for the NOAA version of wild-caught shrimp within Table 6.10 indicate that KY and SC participants' mean WTP estimates were fairly similar with all estimates significant. SC consumers' WTP for the 'Fresh (Never Frozen)' product form was the highest with the average premium at $4.98/lb, and KY residents slightly lower at $3.67/lb. Contrast to the 'Fresh (Never Frozen),' KY residents' WTP estimates for the NOAA label was highest among all attributes at $5.17/lb, with SC results lower at $3.87/lb. For the 'Product of CSF' label, SC residents generated a high positive value of $1.61/lb in contrast to KY residents' lower value of $0.88/lb.

Table 6.7 Mean WTP Estimates ($/lb) for Wild-caught shrimp (NOAA)

	Kentucky			South Carolina		
Variable	WTP	S.E	95% C.I.	WTP	S.E	95% C.I.
Wild-caught shrimp						
Buy Neither	-25.47	2.69	(-30.84, -20.09)	-23.59	2.02	(-27.62,-19.56)
Product of CSF	0.00[a]	0.41	(0.06,1.69)	1.61	0.34	(0.94, 2.29)
Fresh (Never Frozen)	3.67	0.65	(2.37, 4.97)	4.98	0.58	(3.82, 6.14)
NOAA	5.17	0.57	(4.03, 6.31)	3.87	0.38	(3.12, 4.62)

a The marginal utility estimate was not significantly different from zero

Estimates for the MSC version of wild-caught shrimp are shown within Table 6.11, indicating KY and SC participants' mean WTP estimates were again similar in magnitude and all significant. Once more, SC consumers' WTP for the 'Fresh (Never Frozen)' product form was the highest estimate with the average premium at $5.29/lb, and KY lower at $3.38/lb. Contrast to the 'Fresh (Never Frozen),' KY residents' WTP estimates for the MSC label was highest at $3.91/lb and SC was second at $3.36/lb. For the 'Product of CSF' label, SC residents generated a value of $1.16/lb and KY residents at $1.06/lb.

Table 6.8 Mean WTP Estimates ($/lb) for Wild-caught shrimp (MSC)

	Kentucky			South Carolina		
Variable	WTP	S.E	95% C.I.	WTP	S.E	95% C.I.
Wild-caught shrimp						
Buy Neither	-22.67	2.06	(-26.78, -18.55)	-20.19	1.87	(-23.93,-16.46)
Product of CSF	1.06	0.32	(0.41,1.70)	1.16	0.36	(0.45, 1.88)
Fresh (Never Frozen)	3.38	0.49	(2.40, 4.37)	5.29	0.61	(4.07, 6.50)
MSC	3.91	0.38	(3.16, 4.66)	3.36	0.40	(2.56, 4.15)

CHAPTER 7: CONCLUSION

7.1 MARKETING IMPLICATIONS

By considering inland Kentucky and coastal South Carolina, a DCE was implemented to allow the valuation of consumers' preferences for shrimp with multiple seafood attributes. Those included were familiar, emerging, as well as hypothetical in the existing market, with all having potential implications for policy and further research. Resulting data were further analyzed and mean WTP estimates were generated for each attribute to draw conclusions on strength and significance. With a strong focus towards developing marketing strategies, results are discussed with different labeling schemes considered and emphasized with regards to attributes most important to consumers and those for producers and policymakers to adopt.

Farm-raised shrimp garnered results having implications for both developed and developing attribute for the shrimp market. Being legally required in order to sell seafood, the attribute providing information regarding 'Fresh (Never Frozen)' or 'Previously Frozen' produced the highest premium for both states. Criteria referring to product form may infer how customers evaluate quality such as taste, sight, and smell of the product, with results indicating a fresh form consisting of a higher quality verses a previously frozen product. Results showing SC residents paying higher premiums could suggest living in a coastal state with closer proximity and access to fresh products may generate greater preference for non-frozen products.

Concerning the popularity of the local food movement and support for producers operating within participants' state of residence, the 'State label' allowed for analysis on preference for local/regional seafood. Rarely has the evaluation within the literature precisely defined the local term with a practical and existing label. Both state labels generated the second highest premium behind product form, implying that support for shrimp soured from within the state is highly valued. Producers of both marine and land-based aquaculture systems could use results to justify labeling schemes indicating state origin, which ultimately may be more important than attributes such as environmental certification.

Consumer perception of product sourced from veterans has not been studied within the food literature, as this project attempted to evaluate whether significance results existed in how consumers' may prefer such a product. The label was shown to be significant and produce a premium for both states that was 5% (KY) and 4% (SC) less than state sourced labels. Such results are notable considering the recent emergence of Homegrown By Heroes (relative unawareness of the program) and scarce existence in today's food markets. Similar results between both states adds to the importance of marketing veteran source products. Results could encourage both policymakers and veterans to encourage employment and thus develop marketing programs for veterans in agriculture/aquaculture.

With the BAP label indicating environmental certification and sustainable practices, significant premiums resulted for the farm-raised product in both states, though not as strong as the attributes listed above. Considering the strength of results, consumers may not fully understand nor value environmental stewardship as strongly in the case of

aquaculture products. Issues do not include by-catch nor the status of certain fish and shellfish stocks as ocean capture does, so value of certification may be limited unless more apparent environmental concerns arise in the industry.

The only insignificant variable was ‘Product of CSF’ for KY residents, which was significant but negative for SC. Insignificance could be the result of not conveying a transparent signal towards characteristics tied to a CSF, especially existing as the only hypothetical attribute in the farm-raised situations. Though CSFs represent a particular business model embodying environmental stewardship and local origin, the presence of ‘BAP’ (environmental certification) and ‘State Label’ (representing specific local origin) may limit the label’s effect. Therefore, CSFs could specify origin of the aquaculture operation as wild-caught fisheries have done (e.g. Port Clyde Community Supported Fishery). Finally, the label did not generate value for a farm-raised product, which could allude to confusion consumers face in assessing the Community Supported Fishery definition.

Like the farm-raised situations, wild-caught shrimp experienced similar results with product form with ‘Fresh (Never Frozen)’ producing the highest premium for t both SC models and second highest for KY. As before, SC consumers valued fresh more so than KY, reiterating that proximity to coastal fisheries and access to fresher seafood may develop a culture with a stronger preference for fresh. Consistent results for both farm-raised and wild-caught in both states may imply that processing remains one of the most important criteria to selection.

A primary goal in the analysis of wild-caught shrimp was the evaluation of consumer preference on defined ecolabels, and the differences between the labels by

implementing two surveys for each state. Though MSC has been studied, the hypothetical NOAA label was implemented to assess how a federal agency may differ from an existing agency. Both MSC and NOAA garnered the highest premium for both KY models and second highest for SC. NOAA results showed SC and KY with similar valuations. MSC experienced more robust differences between the two states. Higher premiums for NOAA in SC could imply the familiarity with a federal agency working only in coastal states (e.g. employment and participation in communities along state's coast). Therefore, consumers' may prefer certification over an international agency, though MSC exists within SC outlets like Whole Foods, Wal-mart, and McDonalds. Stronger estimates in KY verses SC for both could infer a stronger preference for sustainably certified products in the presence of multiple attributes. The difference between MSC and NOAA was non-existent, suggesting the presence of certification could be most important.

With significant results in 3 out of the 4 models, the 'Product of CSF' label could have stronger implications in the wild-caught case for seafood products. This is somewhat intuitive considering consumers view a 'fishery' as that of which operates within the realm of the ocean, though the same can be argued for marine aquaculture. Thus, the significant and positive results may imply a stronger case for not only wild-caught products, but also those absent of a state or origin label. The absence of an origin label in the wild-caught case could imply consumers may perceive CSF with origin characteristics (e.g. support for local, regional, or national fishermen), which may add to the confusion such a label would convey. Both SC versions produced differences in the premium ($1.61 vs $1.16), though positive results are different than that of the farm-

raised case. Thus, the presence of fisheries along SC's coast may infer preference for supporting fisheries, even with origin not specified. The insignificance of one KY model might infer the unfamiliarity with a local or regional fishery, therefore less value within an inland state. Although, the one significant and positive result for KY could still imply consumers value the idea of supporting domestic fishermen.

7.2 LIMITATIONS & FUTURE RESEARCH

Limitations to the study will be mentioned to better understand how future research can progress. First, the study involves two states in the U.S. located in the Southeastern region where it is hard to justify national implications. Perhaps, future projects may survey a broader audience with greater sampling so results can be assessed from a national perspective and more robust conclusions. National scale is not the only targeted market for a study when considering the global nature of the seafood market. A study of multiple of consumers of multiple countries can aid the understanding of international trade as disputes considering the inflow of imported seafood products (e.g. shrimp) continue to impact domestic markets. An additional concern is the impact of wild-caught fisheries and environmental issues from a global scale, so consumer research in multiple countries could help understand preference in these areas.

Second, this study only focuses on the demand side of the market. Although it has been shown there are positive consumer support for many of the attributes considered, one must also understand the production and cost side to assess the feasibility of implementing the various hypothetical labels discussed in this study. With issues in mislabeling and transparency within the supply-chain, issues from processing and

distribution must be considered to understand how producers can successfully market these attributes to consumers. Future research may develop producer surveys to analyze whether participation in certain programs would occur and if participants deem production practices with success.

Third, the current analysis provides a snapshot of the seafood consumption focusing on farm-raised and wild-caught shrimp. Certain participants who do not prefer shrimp or assess seafood attributes for other seafood species in a different perspective may effect conclusions made on certain labels. Studying other popular forms of seafood (e.g. salmon, tuna, etc.) could make conclusions more robust. A broader understanding of the overall consumption and more important long-term consumption trends remains to be an interesting future research area. Though many attributes included are emerging within the marketplace and trending amongst consumers' preference, one must also assess how sustainable demand will be in the future.

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