Assessing Consumer Preferences for Seafood Labels

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ASSESSING CONSUMER PREFERENCES FOR SEAFOOD LABELS

By

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B.A. The College of the Holy Cross, 2015

A THESIS

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

(in Resource Economics and Policy)

The Graduate School

The University of Maine

August 2017

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Coastal communities are host to a suite of economic, cultural, and natural resources, and are often focused around a core such as tourism, beaches, fisheries, or processing. In nearly all cases, coastal communities survive based upon the resources in the surrounding coastal areas and water. As wild fisheries begin to stagnate, many traditional fishing communities are forced to look elsewhere for economic sustenance. While tourism or real estate may provide relief, residents often require a more stable, year-round income. Some coastal communities have begun to transition away from wild fisheries and towards marine aquaculture, or, the cultivation of marine animals and plants for food.

Although marine aquaculture is not a new phenomenon, much of it has been focused on the farming of finfish, such as salmon. Shellfish and seaweed farms, on the other hand, have only recently begun to emerge in coastal communities, often as small, family-owned businesses, employing local residents. Although the shellfish and seaweed sectors of the marine aquaculture industry are eager to expand, little research has been done on these two sectors. This analysis uses economic methods and data from choice experiments and a survey in order to assess consumer preferences for farm-raised and wild harvested shellfish and seaweed salad. The assessment explains consumer preferences and their potential impacts on harvesters, coastal communities, and natural resource use.
The first chapter investigates consumer preferences for shellfish and seaweed salad attributes including production process (farm raised, wild harvested), certification (organic, sustainably harvested, non-certified), and origin (home state, U.S., imported). Data from a nationwide coastal online survey and conjoint experiments for oysters, clams, mussels, scallops, and seaweed salad were used to determine consumer willingness to pay for these attributes. A random parameter mixed logit model shows that consumers are willing to pay more for products that are wild harvested, certified, or from their home state. This research can be used to improve marketing and to facilitate producer and policy decisions for the sustainable expansion of aquaculture.

The second chapter more closely analyzes the potential impacts the research could have on the aquaculture industry using both quantitative and qualitative data for farm-raised seafood. We explore seafood consumer purchasing habits and find that seafood labeling plays a large role in the purchasing process, and could thus benefit farmers by presenting them with a medium to highlight the origin and any certification of their products. Results suggest that this could be an extremely effective tool for receiving higher prices when products are sold within the state in which they are produced. The results of this work will be relayed directly to members of the seafood industry through future publication in an industry journal.

Understanding consumer preferences for shellfish and seaweed salad is crucial as many coastal communities are forced to shift away from their traditional economic dependence upon wild fisheries. This research has implication for the wild harvest industry, aquaculture industry, natural resource policy and management, and coastal communities. Improved knowledge of consumer preferences could allow for shellfish and seaweed harvesters and farmers to garner price premiums while maintaining sustainable ecological methods. This could potentially increase stable, year-round jobs in coastal communities in harvesting, processing, transportation, and more.
As many coastal communities face issues including a changing local economy and climate, this information will become increasingly more important, as it will allow for coastal community residents and policy makers to make better-informed decisions for the long-term success of these communities.
I would like to thank Dr. Caroline Noblet for being an outstanding advisor. She has offered me support and encouragement throughout this whole process, teaching me how to step out of my comfort zone and pursue my goals. She has served as a role model and has taught me countless lessons that I will be able to apply throughout my future career and life. I would also like to thank undergraduate research assistants Maryam Kashkooli, Angela Hallowell, and Allyson Eslin, along with my committee members, Dr. Keith Evans and Dr. Laura Rickard, for their input and assistance.

I am especially grateful for the kindness and willingness to help of the professors and the graduate student cohort in the University of Maine School of Economics. Their camaraderie, perspective, and encouragement have been immensely helpful in my academic and personal development.

Last, I would like to thank my friends and family for their constant support and positive attitudes.

This work was supported by the National Science Foundation award #1355457 to Maine EPSCoR at the University of Maine.
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PREFACE

The worldwide demand for seafood continues to climb, but wild fish stocks do not (NOAA, 2016). In order to meet this growing demand for seafood, marine aquaculture emerges as an opportunity to close the gap. This is especially true in the U.S., where almost 90% of seafood is imported (NOAA, 2016). While an increasing seafood trade deficit could displace American workers, the aquaculture industry shows potential for expansion and employment in the U.S. Much of the economic gain would impact fishing and coastal communities, along with the seafood processing sector. Its benefits are recognized by NOAA, who in its latest marine aquaculture strategic plan (2016), calls for “at least a 50% increase in responsible U.S. marine aquaculture production by the year 2020.”

In the Northeast, aquaculture production has already grown to become the third largest value of any seafood category landed in the region (NOAA, 2016). Although much of the growth has come from salmon farms in Maine, many other states in the Northeast and New England are reporting all-time highs for shellfish aquaculture production. Nationwide, the industry is currently being led in value by oyster production at $136 million per year, and clams at $99 million per year (NOAA, 2016).

The production of bivalve shellfish thus represents a substantial, yet still growing sector of the U.S. and global seafood industry (NOAA, 2016). Aquaculture-produced seaweed has also seen similar advancements (Watson, 2016). While the increase in production of bivalve shellfish and seaweed has been matched by heightened seafood demand, inconsistency and lack of clarity in these products’ labels have left consumers unsure about the options available.

Seafood labels play an important role in the communication of product characteristics from the producer to the consumer and vice versa. While ample studies have conducted research
on labelling for farmed finfish, especially salmon (Ankamah-Yeboah et al., 2016; Olesen et al., 2010; Roheim et al., 2012), few studies have delved into consumer preferences for farmed shellfish (Fonner & Sylvia, 2015). While salmon and clams may benefit from being relatively well known species, seaweed and other shellfish are less familiar to many consumers. Furthermore, research has found that most fish products aside from shellfish have a relatively inelastic demand; that is to say that wild fish can increase in price without worry of suffering from large decreases in demand (Guttormsen et al., 2011). The same is not true, however, for shellfish and seaweed (Hanson et al. 1995). Due to the rather elastic demand for shellfish and seaweed, it may take additional efforts in order for their markets to grow and stabilize. This is especially of concern for farmed shellfish and seaweed, as both markets are in their early stages and are not well-established in the U.S.

It is thus in the best interest of Maine and the Sustainable Ecological Aquaculture Network (SEANET) to continue market research upon shellfish and seaweed. Unlike finfish farming, shellfish and seaweed farms tend not to cause concerns of environmental degradation. Rather, shellfish farms are nutrient sinks and thus help to promote sustainable ecological aquaculture (Ferreira et al., 2007). Likewise, seaweed farms “use solar energy to turn nutrient-rich effluents into profitable resources. [The] Plants counteract the environmental effects of the heterotrophic fed fish and shrimp and restore water quality” (Neori et al., 2013). In addition, shellfish and seaweed aquaculture in New England is mostly composed of small, family-owned companies. Many business owners come from fishing families and communities that are looking to diversify from wild harvest fisheries (LaPointe, 2013). An expansion in aquaculture would not only help to create jobs for coastal communities, but it would also help to increase workforce and professional development in the area and the industry. In order to stay
afloat, many stakeholders feel that a coordinated product marketing program should be underway in order to strengthen the industry (Lapointe, 2013). In turn, individual businesses would thrive on the increased demand and profitability of their products.
CHAPTER 1

ASSESSING CONSUMER PREFERENCES FOR SEAFOOD LABELS: THE ROLE OF PRODUCTION PROCESS, CERTIFICATION, AND ORIGIN ON WILD HARVESTED AND AQUACULTURE SHELLFISH AND SEAWEED SALAD

1.1. Chapter Abstract

This study investigates consumer preferences for shellfish and seaweed salad attributes including production process (farm raised, wild harvested), certification (organic, sustainably harvested, non-certified), and origin (home state, U.S., imported). Data from a nationwide coastal online survey and conjoint experiments for oysters, clams, mussels, scallops, and seaweed salad were used to determine consumer willingness to pay for these attributes. A random parameter mixed logit model shows that consumers are willing to pay more for products that are wild harvested, certified, or from their home state. This research can be used improve marketing and to facilitate producer and policy decisions for the sustainable expansion of aquaculture.

1.2. Introduction

While human population increases have helped to increase overall seafood demand, much of the drive behind its consumption comes from it being promoted as a healthy food choice, full of lean proteins and good fats (Bliss, 2015). Such attributes, among others, have caused an increase in per capita seafood consumption both in the U.S. and worldwide (Food and Agriculture Organization of the United States [FAO], 2012). However, much of the demand for seafood has been placed on certain species whose populations often cannot replenish their rate of harvest, such as oysters (Grabowski and Peterson, 2007). The gap in demand has been partially filled by
aquaculture, which has expanded production from 5 million to 63 million tons worldwide during the last three decades, a 1160% increase (FAO, 2016).

However, concern exists regarding aquaculture production, mainly over issues of antibiotic and pesticide residue, disease, adverse impact on native stocks, and environmental degradation. Aquaculture siting can also be contentious due to its effects on local viewsheds, aesthetics, recreation, and other coastal activities (Katranidis et al., 2003). Although wild harvested products may not suffer from the same concerns, consumers are worried about wild stock sustainability and habitat destruction (Christian, Ainley, Bailey et al., 2013). On the other hand, aquaculture alleviates the strain put on wild stocks, which can help them to rebound. The aquaculture industry can also bring jobs and other related money to rural coastal areas. This complex relationship between aquaculture and commercial fisheries creates a set of difficult trade-offs for consumers to make at the point of purchase. Often, consumers look to guidelines or certification standards to help resolve their confusion. In terms of labeling, aquaculture shows two potential areas of growth. The first area is that of certified organic standing (Ankamah-Yeboah, 2016). Although wild harvested products cannot be labeled as organic, the quality control for aquaculture qualifies it to be considered for organic certification. Such considerations have allowed for organic aquaculture certification to expand across the globe, including in countries such as China, Ireland, Norway, Denmark, and Costa Rica (Willer & Lernoud, 2017). While this has not yet happened in the U.S., the USDA indicated that the release of standards for organic aquaculture is currently on “step eight out of nine” (Wright, 2016).

Aquaculture often takes place in coastal waters on farms that are owned and operated by local residents and, in many cases, could allow for it to be seen as a local good. Since the early
2000s, “local” has become a buzzword, gaining greater traction across a variety of realms, especially locally produced foods (Darby et al. 2008).

Organic foods have seen a steady increase in consumer interest as well (USDA, 2014). Both organic and local foods differentiate themselves by promoting their attributes through labeling, also known as ecolabeling. The idea of an ecolabel is to identify sustainable products and to highlight their sustainable attributes (Hanss & Bohm, 2012) in order to facilitate the purchasing process for the consumer (Thøgersen et al., 2012). Ecolabels, in tandem with organic and local foods, have become widespread. While there are not yet many aquaculture labels bearing organic certification, a small number of seaweeds are certified organic by organizations such as the Maine Organic Farmers and Gardeners Association in the U.S. or Agriculture Biologique in France (MOFGA, 2015; European Commission, 2013).

Organic certification aside, there remains a consumer driven emphasis on the geographic location of the product’s harvest or production. Consumers often associate certain desirable quality characteristics “due to a particular geographical environment with its inherent natural and human factors,” where “a specific quality, reputation or other characteristics [are] attributable to that geographical origin” (Barojolle & Sylvander 2000). For example, Pemaquid® oysters were trademarked in 2010, and have since become a recognizable name for farmed oysters that has been adopted by other shellfish growers in the Damariscotta river area of Maine. The reputation for Maine lobsters, in addition, precedes itself, and shows how preferences for origin labeled products can also be product of cultural tradition and socially constructed phenomena. Thus, explicit identification and imagery related to origin have become a popular tool used by marketers to appeal to consumers (Barham & Sylvander 2011).
While seafood harvested in a certain area may be considered “local” and can represent freshness, environmental stewardship, and support for regional maritime economies (Campbell et al. 2014), similar to the organic labeling of seafood, little clarity exists when it comes to the definition of local seafood. Some seafood harvesters, such as Port Clyde Fresh Catch in Maine, USA, and Carteret Catch in North Carolina, USA, have developed local branding strategies for wild harvested products that use the community supported fishery model to sell their locally, environmentally consciously harvested products. But, many others still struggle.

Research focused on consumer preferences for aquaculture labeled seafood is clearly needed (Mariojouls & Wessells 2002). While studies have looked at the preferences between wild harvested and farm raised finfish (Roheim et al., 2012; Vanhornecker et al., 2012), few have delved into the same preferences for shellfish and seaweed (Fonner & Sylvia, 2015). This could be due to the fact that these same consumers often have fewer choices for shellfish and seaweeds in comparison to the choices available for fish. Importantly, with national organic aquaculture certification standards on the brink of approval, more research must be done to determine the potential impact (Jalonick, 2015). The same is true when it comes to sustainably harvested seafood and its competition with organic aquaculture production. In spite of the rising local food movement, few previous studies have researched seafood labels that market themselves as local, such as Carteret Catch’s “Fresh Locally Caught Seafood.” This lack of research is even more pronounced for local-labeled products grown through aquaculture. With a greater understanding of consumer preferences, seafood harvesters and farmers become capable of marketing their product in a way that is most effective both locally and throughout the U.S.
This paper analyzes consumer preferences for seafood labels using data obtained online through choice experiments and a survey. The analysis focuses on consumer preferences involved with the production process (farm raised vs wild harvested), certification (certified vs non-certified), and origin (consumer’s home state vs U.S. vs. imported) of shellfish and seaweed salad.

1.3. Literature Review

1.3.1. Ecolabels and Consumer Preferences

The idea of an ecolabel is to present consumers with product information (Hanss & Bohm, 2012), minimize search costs (Payne et al., 1988), and ease the decision making process (Thogersen et al., 2012). They are intended to differentiate qualities between products, in this case, in the seafood sector. As a market-based method of altering consumer behavior, ecolabels aim to promote sustainable practices and increase product value (Teisl et al., 2002; Potts & Heward, 2005).

An example of ecolabels comes from the Marine Stewardship Council, whose goal is to promote sustainability and minimize environmental impact, and has helped to label over 24,000 MSC certified products in nearly 100 countries, including products sold by big box retailers (Marine Stewardship Council, 2015). Large-scale ecolabeling has also spread to aquaculture produced seafood. The Aquaculture Stewardship Council, which was founded in 2010, has approved 7,348 products in 58 countries to date (Aquaculture Stewardship Council, 2016).

The rise of ecolabels ties into the research done by Roheim (2008) and Washington and Ababouch (2011). Their research argues that competition is increasingly based on quality rather than prices, and thus highlights the expanding power of the ecolabel. However, there are many
additional qualities that factor into the consumer purchasing decisions. The demand for seafood and its influences have been studied in several papers (Wessels et al., 1999; Johnston et al., 2001; Jaffry et al., 2004; Johnston and Roheim, 2006; Roheim 2008; Brécard et al., 2009; Salladarré et al., 2010; Salladarré et al., 2016). To begin, Jaffry and colleagues (2004), Brécard and colleagues (2009), and Salladarré colleagues (2010) found that those who consume larger amounts of seafood products are more likely to choose eco-labeled products. Wessels and colleagues (1999), on the other hand, found that consumer preferences vary according to species. Johnston and Roheim (2006) then found that eco-labels are not always sufficient for attracting customers, at least in terms of less popular species. Preferences for ecolabels, however, increase with greater awareness of marine resource issues (Brécard et al., 2009; Salladarré et al., 2010), yet also, interestingly, are stronger for those who live in non-coastal areas and further away from the sea (Salladarré et al., 2016). Last, while consumers with higher levels of environmental concern tend to prefer ecolabeled products, the sociodemographic characteristics of environmentally-minded consumers vary across countries (Salladarré et al., 2016).

In terms of who cares most about ecolabels demographically, Fonner & Sylvia (2015) found that younger, more-educated people are more concerned about labels. Similarly, Brécard et al. (2009) and Koos (2011) found that being female, more educated, or of higher socioeconomic status increases the likelihood of purchasing eco-labeled products. Bamberg (2003), found that consumers with higher levels of environmental concern respond more favorably on a Likert scale to labels that discuss environmental impact.

A major issue arises with ecolabels focused on comparing aquaculture production and capture fisheries in that their usage of ecolabels is not the same. While capture fisheries’ ecolabels focus upon the sustainability of the species, the gear used, and the limitation of byproduct,
aquaculture ecolabels pertain to food safety, community, and animal welfare, along with environmental sustainability. Since ecolabels for the two types of production are not equivalent, consumers may not view the ecolabels as presenting comparison opportunities (Roheim et al., 2012).

Consumer preferences for seafood have been explored in many previous studies; covering various attributes including farmed versus wild (Gempesaw et al., 1995; Vanhonacker et al., 2012; Davidson et al., 2012; Fonner & Sylvia, 2015) and eco-labeling of wild harvested products (Wessells et al., 1999; Xu et al., 2012; Fonner & Sylvia 2015). Studies also examine seafood labeling in terms of organic (Olesen et al., 2010; Ankamah-Yeboah et al., 2016) and local attributes (Quagrainie et al., 2008; Fonner & Sylvia, 2015). However, the majority of the work conducted about seafood labeling focuses on consumer preferences from capture fisheries. Notably, there has been a significant amount of research into consumer preferences for certified sustainable seafood from capture fisheries (Wessels et al., 1999; Jaffry et al., 2004; Johnston & Roheim, 2006; Brécard et al., 2009; Salladeré et al., 2010), yet little has been conducted on consumers’ preferences for certified aquaculture production with the exception of Roheim and colleagues (2012).

1.3.2. Local Foods

The markets for local foods have steadily increased over the past two decades. Such a rise could be attributed to an expanded recognition of environmental impact, stronger marketing efforts, concern about local economies, heightened health consciousness, or perceptions of superior quality and freshness (King, 2007). Between 1994 and 2014, farmers’ markets, which are often a strong indication of support for local food, increased by nearly fourfold (USDA, 2014).
Capture fisheries in the U.S., under the direction of the USDA, have been required to indicate a “country-of-origin” on labels since 2002 (Thompson et al., 2005). Some labels additionally mention a specific gulf, bay, state, river, or port. Despite citing a more specific area, capture fisheries often involve trips that span multiple days and can sometimes only limit the scope of capture to an area of hundreds or thousands of miles. With marine aquaculture production, however, growers can point to a specific area of raising and harvesting. This idea of a specific locality has been thoroughly studied for terrestrial food and drink products. Skuras and Vakrou (2002), for example, showed that origin labelling for wine has a positive, significant impact on the willingness to pay for wine consumers. Yue and Tong (2009) similarly found that local labeled fresh produce receives a price premium. However, less research has been done on the local aspects of seafood products, especially aquaculture products, aside from Quagrainie and colleagues (2008) and Fonner & Sylvia (2015). While Fonner and Sylvia (2015) found a high willingness to pay for local labels in Oregon shellfish, Quagrainie and colleagues (2008) found that consumers may not be willing to pay higher premiums for local aquaculture products.

One issue that researchers must confront when studying local goods is how to define local. In the present study, we chose to attribute local to one’s home state, as state lines have long been used to market products as locally grown or produced. As early as 1980, state agricultural marketing programs began promoting home state products. Since 1980, all 50 states have come to adopt similar policies (Onken et al., 2011). Furthermore, the U.S. Farm Bill of 2008 mandates that products promoted as “locally or regionally produced agricultural food product” must be transported less than 400 miles from its origin or within the state in which they are produced (Food, Conservation, and Energy Act of 2008, P.L. 110-246, §6015). While these regulations
may only apply to the USDA business and industry loan program, they provide guidelines and show an acceptance of state borders as a proxy for local food (Meas et al., 2013).

A study done by Darby and colleagues (2008) found that consumers failed to differentiate between “produced nearby” and “produced in Ohio,” which implies that consumers also allow for state borders to serve as natural definitions of local. One year later, a study done in Ohio by Ernst and Darby (2009) bolstered this idea when they discovered that “Ohio Proud” could be a useful proxy for locally grown products and could also capture a price premium among Ohio residents. Meas et al., (2013) also found a significant positive willingness to pay for products both marketed for their sub-state region of production and state proud.

However, more research is needed in terms of consumer preferences for local production to clarify mixed results. For example, while Darby and colleagues (2008) and Ernst and Darby (2009) found that state boundaries form natural borders for local labels and Meas and colleagues (2013) found that sub-state regions and state proud labels produced a higher WTP, the results of Meas and colleagues (2013) showed that consumers did not particularly prefer products from their home region. Last, in contrast to Fonner and Sylvia (2015), Quagrainie and colleagues (2008) found that consumers were not willing to pay price premiums for local aquaculture products. At the specific urging of Darby et al. (2008) more research must be done to determine how local foods apply within small states such as those in New England. Research must address whether state size would affect a consumer’s preferences within their home state, and whether consumers identify products from more than one state as local. The above literature informed our two-part hypothesis.
**Hypothesis 1:**

A.) Participants will be willing to pay more for aquaculture products from their home state across all species rather than those from abroad or elsewhere in the U.S.

B.) Consumers will be willing to pay more for products from the U.S. in comparison to products from abroad.

### 1.3.3. Organic and Sustainable Foods

The markets for organic and local foods have steadily increased over the past two decades. From 2004 to 2014 alone, organic sales rose by 150% (USDA, 2014). Organic foods have seen a rather consistent increased willingness to pay. Yue and Tong (2009) found that products labeled as organic, along with local received a price premium slightly above $0.70 per pound for fresh produce. Batte and colleagues (2010), also found a significant preference for organic foods. In terms of seafood, Ankamah-Yeboah et al. (2016) and Olesen et al. (2010) both found that consumers are willing to pay about a 20% more for organic salmon. Similarly while Mauracher & Vecchiato (2013) found that consumers are WTP 11.6% more for organic sea bass, their results are bolstered by Defrancesco (2003), Diegna and colleagues (2009), and Stefani and colleagues (2011) who all found positive, significant WTP estimates for sea bass, trout, and sea bream, respectively. However, people are not unanimously willing to pay more for organic labels. The results of Strzok (2012) found that higher education and income up to ~$85,000 increases a consumer’s WTP for organic products, but it then decreased after that income threshold.

A strong literature exists on consumer preferences for sustainably harvested seafood from capture fisheries (Wessels et al., 1999; Jaffry et al., 2004; Johnston et al., 2001; Jaffry et al.,
2004; Johnston & Roheim, 2006; Brécard et al., 2009; Roheim et al., 2011; Salladarré et al., 2010; Salladarré et al., 2016). These studies have found that consumers are willing to pay a premium for wild capture fish that are labelled as certified sustainable. However, there has been no research, to our knowledge, applied to farm-raised shellfish and seaweed salad. One major issue is that there are not yet many labels bearing organic certification aside from a small number of seaweeds certified organic by organizations such the Maine Organic Farmers and Gardeners Association in the U.S. (Maine Organic Farmers and Gardeners Association, 2015). It has been difficult to determine certification standards in the U.S. due to concerns over acceptable water quality levels, what the species are fed, and how the species are raised. Canada and the European Union, however, have already established standards (Jalonick, 2015). With the USDA promising to unveil standards for organic aquaculture by 2017, it must be determined if consumers are willing to pay more for organic aquaculture in the U.S. so that producers can begin to prepare accordingly (Whittaker, 2015). The open question on consumer preferences for organic aquaculture products yields our second hypothesis.

**Hypothesis 2:**

A.) Consumers will be willing to pay more for products that are either certified organic or certified sustainably harvested compared to their non-certified counterparts.

**1.4. Methods**

**1.4.1. Subject Recruitment**

We sampled consumers from coastal states of the United States, including the Great Lakes, through Amazon’s Mechanical Turk (MTurk). Amazon’s MTurk is a marketplace
crowdsourcing platform where requesters post “Human Intelligence Tasks” (HITs) for workers to complete and receive monetary compensation. Typical HITs, for example, may include comparing images, copying image text into word processors, or taking surveys. In terms of the validity of recruiting human subjects through MTurk, Casler and colleagues (2013) compared MTurk participants to social media and in-lab participants and found that the MTurk participants can complete behavioral-type tasks that have typically taken place in lab testing. Furthermore, they confirmed that crowd-sourced participants, such as MTurk participants, can provide high quality data, and have greater diversity compared to their in-person counterparts. Buhrmester and colleagues (2011) also found that social science data obtained through MTurk are at least as reliable as those obtained through traditional methods, and include a more demographically diverse sample than in-person or internet samples. Smith and colleagues (2015) even found that MTurk participants are more attentive to instructions than collegiate samples.

The survey used in this study, which includes the choice experiment, was posted on Amazon’s MTurk under the title “Seafood Consumer Experiment” in July 2016. Participants were restricted to U.S. residents, and only participants who lived in coastal states, including the Great Lakes, were included in the results. In addition, Maine consumers were oversampled in order to compare the results from in-person and online samples in future work. The survey and choice experiment were designed using Qualtrics, an online survey platform. Participants were paid $1.00 for completing the survey. In total, 2,155 participants from across the country completed the survey. It was required that all participants be seafood consumers. Those who responded with “No” to the screening question of “Do you consume seafood at home?” were exited from the survey.
Table 1.1. Sociodemographic Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Survey Sample</th>
<th>U.S. Nationwide Population</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19-25</td>
<td>22%</td>
<td>10%</td>
</tr>
<tr>
<td>26-34</td>
<td>40%</td>
<td>12%</td>
</tr>
<tr>
<td>35-54</td>
<td>31%</td>
<td>26%</td>
</tr>
<tr>
<td>55-64</td>
<td>6%</td>
<td>13%</td>
</tr>
<tr>
<td>65+</td>
<td>1%</td>
<td>15%</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>47.70%</td>
<td>49.20%</td>
</tr>
<tr>
<td>Female</td>
<td>52.30%</td>
<td>50.80%</td>
</tr>
<tr>
<td><strong>Educational Attainment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some high school</td>
<td>&lt;1%</td>
<td>8%</td>
</tr>
<tr>
<td>HS Diploma/GED</td>
<td>28%</td>
<td>50%</td>
</tr>
<tr>
<td>Associate’s Degree</td>
<td>18%</td>
<td>10%</td>
</tr>
<tr>
<td>Bachelor’s Degree</td>
<td>40%</td>
<td>21%</td>
</tr>
<tr>
<td>Master’s Degree</td>
<td>11%</td>
<td>9%</td>
</tr>
<tr>
<td>Doctorate</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$25,000</td>
<td>21%</td>
<td>32%</td>
</tr>
<tr>
<td>$25,000-$50,000</td>
<td>34%</td>
<td>31%</td>
</tr>
<tr>
<td>$50,000-$75,000</td>
<td>20%</td>
<td>16%</td>
</tr>
<tr>
<td>$75,000-$100,000</td>
<td>14%</td>
<td>8%</td>
</tr>
<tr>
<td>$&gt;100,000</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Children in home</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>40%</td>
<td>43%</td>
</tr>
<tr>
<td>No</td>
<td>60%</td>
<td>57%</td>
</tr>
</tbody>
</table>

Data taken from the U.S. Census Bureau, the Henry J. Kaiser Family Foundation (2016), and Statista (2015).

1.4.2. Survey Design

The online survey contained four parts. The first section asked consumers about their seafood consumption and purchasing habits, along with the name of their home state. Second, participants were presented with the choice experiment. Third, participants responded to questions based on the participant’s perceptions of their health, environmental motivation, trust of science,
desire to preserve working water fronts, and food label reading habits. Last, a set of demographic questions completed the survey.

1.4.3. Choice Experiment

Conjoint analysis is a stated preference method used widely in economics and marketing to determine consumer attitudes towards and preferences for a product (Roheim et al., 2012; Harrison et al., 1998; Darby et al., 2008; Davidson et al., 2012). It allows for a buyer’s total utility to be decomposed into combinations of part-worth utilities for the attributes of a product (Harrison et al., 1998). Such capabilities provide a method to measure the relative importance of individual characteristics of a product whilst determining preferred combinations of characteristics. Conjoint analysis, which is hypothetical in nature, lends itself well to valuing new products and attributes such as organically labeled aquaculture products.

Many studies have used conjoint analysis to assess consumer preferences. Louviere (1988) was the first to use conjoint analysis to determine values of consumer goods. It was later adopted by environmental and agricultural economists, which provided them with a method to evaluate non-market goods and preferences. Teisl and colleagues (1996), for example, used conjoint analysis to compare angler opinions regarding potential management programs for Atlantic Salmon. Conjoint analysis in food products, while similar, requires respondents to choose between product profiles that typically include attributes related to product origin, product freshness, scale of producer, certification standards, and price. For example, Anderson and Betten-court (1993) applied conjoint analysis to evaluate consumer preferences of fresh salmon versus frozen salmon in New England. Others have used conjoint analysis to determine willingness to
pay for origin labeling (Darby et al., 2008; Jaffry et al., 2000; van der Lans et al., 2001; Umbarger et al., 2002), organic food products (Fotopoulos et al., 2003), and certification standards (Roheim et al., 2012).

We designed a conjoint analysis choice experiment to directly focus on the impacts of different attributes of seafood products. This was achieved by simulating a shopping experience in which the consumer is deliberating between two products, and may purchase either one of the products, or neither product. In order to do this, we included two separate images of the same product along with product attributes. Pictures were different within each pair presented in order to prevent participants from mistaking the two products for being identical. Pictures within each pair remained the same throughout the experiment. For example, the picture for Oyster A in pair one remained as the picture for Oyster A in pair one whenever pair one appeared. The pictures used for all of the products in the experiment can be seen in Appendix D.

Survey participants considered a food shopping scenario in which each of the two items were described by four attributes: production process type, certification status, origin, and price. The levels for each attribute are presented in Tables 2 and 3. In the case of “home state,” the participant’s home state, which they entered at the beginning of the survey, was piped into the scenario as they had entered it. For clarification purposes, each attribute and its levels were explained to the participants and defined alongside an example of a hypothetical choice task scenario, shown in Appendix D.

Each product was displayed in its own column, directly next to the other product, as is seen below in Figure 1.1. As part of the experimental design, half of the participants received a treatment message based on real information that stated
“Many seafood products are produced by aquaculture rather than by harvesting wild organisms. It is a growing industry that produces over $1.2 billion worth of goods in the U.S. as of 2012. Such economic activity supports over 39,000 jobs within the country, which tend to be year-round, living-wage jobs centered in coastal, rural communities. The economic impact of aquaculture extends to support working waterfronts and other aquaculture-related industries, including the same infrastructure used by capture fisheries.”

This was done in order to gauge how participant preferences for farm raised seafood and non-imported seafood changed after learning benefits of aquaculture in the U.S.

Each choice task paired two designed alternatives with an option for “neither.” The neither option was included to allow consumers to opt-out and avoid a forced choice. Rather, they can indicate that they do not prefer any of the hypothetical goods, or do not consume that type of good. Participants were asked to assume they were at the store and were shopping on a limited budget. Consumers were allowed to make only one selection per choice task. Each participant evaluated a total of 10 scenarios in a randomly presented order. The total of 10 evaluations was composed of 2 pairs of each of 5 seafood products (oysters, clams, mussels, scallops, and seaweed salad). Results are presented in this order, and not aggregated, because each of the 10 decisions made is treated as an independent choice. Upon the completed evaluation of each pair, in an effort to understand the consumer’s conscious motives, participants were asked “Why did you make this choice?”
1.4.4. Determination of Product Attributes

The design of our choice experiment was informed by three key components: (1) observations of market conditions (2) focus groups and conversations with stakeholders (3) relevant literature. In order to perform a conjoint analysis, relevant product attributes must first be defined in terms consistent with consumer understanding. Since our study involves hypothetical product development, previous work does not exist for all components. When applicable, we referred to prior research done in the field in order to gather relevant consumer information. In order to bridge this gap, we conducted focus groups in Maine and Massachusetts to gauge consumer perceptions and knowledge of aquaculture (Rickard et al., 2017). The focus groups highlighted the
uncertainty of consumers when faced with farm raised vs. wild harvested products, certified vs. non-certified products, and nearby aquaculture and wild harvest production. These findings helped inform the development of the choice experiments. In addition, we visited multiple sea-food stores in the greater Portland, Maine and Bangor, Maine regions. Other shops across New England and the United States were also viewed online. Observations were made based on the presentation of products, their prices, and the attributes highlighted by the stores. Conversations concerning the attributes used in this study occurred with shellfish farmers and the owners of the seafood stores as well. These were not, however, formal interviews.

Table 1.2 Product Attribute Levels

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Levels (one shown per product)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Process</td>
<td>Farm Raised</td>
</tr>
<tr>
<td>Certification</td>
<td>Organic</td>
</tr>
<tr>
<td>Origin</td>
<td>Home State</td>
</tr>
<tr>
<td></td>
<td>U.S.</td>
</tr>
<tr>
<td></td>
<td>Imported</td>
</tr>
</tbody>
</table>

Our pre-study investigations showed that the current study should measure, first and foremost, consumer values for farmed versus wild-harvested shellfish (oysters, clams, mussels, and scallops) and seaweed salad. Seaweed salad was selected as the method of seaweed preparation because it is more familiar to seafood consumers than its dried counterparts, as it is often found alongside sushi. Second, we made the decision to assess preferences for certification standards, because they have not yet been thoroughly researched for shellfish and seaweed salad. Certification standards currently only exist for seaweed salad in Maine, but sustainably harvested criteria exist for most wild-harvested products. Our third attribute measured is required by law, and is found to often be highlighted in Maine: origin. Last, we present price based on the average price
found in New England via in-person and online price inquiries. Levels were determined by moving the price in two fixed deviations below the average price in summer 2016 and above the average price as well.

<table>
<thead>
<tr>
<th>Table 1.3. Product Price Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
</tr>
<tr>
<td>Oysters (per oyster)</td>
</tr>
<tr>
<td>Clams (per 1 lb. clams)</td>
</tr>
<tr>
<td>Mussels (per 1 lb. mussels)</td>
</tr>
<tr>
<td>Scallops (per 1 lb. scallops)</td>
</tr>
<tr>
<td>Seaweed Salad (per salad)</td>
</tr>
</tbody>
</table>

1.4.5. Econometric and Theoretical Framework

The economic theory used to interpret the results of this attribute-based experiment is derived from Lancaster’s approach to consumer theory. Lancastrian consumer theory is based on the assumption that utility is derived from the attributes that make up the goods, not the goods themselves (Lancaster, 1966). A product’s utility is an additive utility, based on the sum of the utility of the attributes of that product. The amount of utility is determined through a random utility model (RUM). In a RUM, the utility $U_{ijk}$ individual $i$ derives from selecting alternative $j$ in choice situation $k$ composed of two components: systematic and random components. The systematic component associated with product characteristics, $V(x_{jk}, p_{jk}, r_k, z_i)$, is an observable function of product attributes, individual characteristics, and a treatment effect where $x_{jk}$ is a vector of product attributes, $p_{jk}$ is the product’s price in dollars, $r_k$ is a treatment effect, and $z_i$ is a vector containing characteristics for individual $i$. The random component, $\varepsilon_{ijk}$, is composed of unobservable influences. The random utility equation can thus be expressed as:

$$U_{ijk} = V(x_{jk}, p_{jk}, r_k, z_i) + \varepsilon_{ijk}.$$
The systematic component of individual $i$’s utility, $V(x_{jk}, p_{jk}, r_k, z_i)$, must account for the amount of utility individual $i$ derives from product attributes. This is represented by the vector $\beta_i$ the indirect utility function, where $\alpha$ is an attribute of price $V_{ij} = \alpha p_j + \beta_i x_{ij} + \beta_i r_i + \beta_i z_i + \epsilon_{ij}$ (Fonner & Sylvia, 2015).

Although respondents were presented with three options: Product A, Product B, or neither, this analysis excludes those who chose neither, which ranges from 7%-15% depending upon the species. This is due to the fact that most who chose neither did not consume that product. Since five different species were included, differences in taste and consumption between species became evident. That is to say, for example, that although a participant eats seafood and loves oysters, they may not eat clams. The majority of participants who chose neither for a product also chose neither for the other pair of the same product. In other words, they rejected that specific product, such as clams, altogether. In response to “Why did you make this choice?” those who chose neither responded that they simply did not eat that product. The neither responses have been dropped in previous work because the neither option does not provide much information for the analysis (Hensher & Bradley, 1993). Since our goal is to analyze consumers who would purchase and consume these products, we removed those who answered neither from the analysis.

The conventional multinomial logit model is often used in discrete choice analysis. However, it assumes the Independence of Irrelevant Alternatives and imposes homogeneous preferences across individuals. Random parameter logit models, instead, accommodate for individual taste preference by allowing $i$ to vary across the population, yet maintain the IID property of the error term. We assume that the random parameter, $\beta_i$, follows a normal
distribution, while the price parameter, $\alpha$, is assumed to be fixed, as explained below. The final utility function is as follows: $U_{ijk} = \alpha p_{jk} + \beta_i'x_{ijk} + \varepsilon_{ijk}$.

Rather than select a multinomial or conditional logit, the choice was made to account for heterogeneity across individual’s taste preferences through a random parameter logit (Greene et al., 2006). The probability of individual $i$ choosing product $j$ can be written as:

$$P_{ij} = \int \left( \frac{\exp(\beta'x_{ij})}{\sum_m \exp(\beta'x_{im})} \right) f(\beta | \theta) d\beta$$

Willingness to pay was estimated using Monte Carlo simulations following the methods used by Greene, Hensher, and Rose (2006). 1,000 random draws were made for each attribute based on the attribute’s parameter mean and standard deviation estimates from the econometric model. The simulated distribution for each attribute was then divided by the price parameter estimate for that product in order to form the willingness to pay distribution. Most importantly, the willingness to pay distribution presents an estimate for the mean willingness to pay for the attribute, along with the range and standard deviation of willingness to pay estimates found within the distribution. This allows researchers to view heterogeneity among respondents, indicating, for example, a certain percentage of the distribution that is willing to pay a positive, non-zero amount for a certain attribute.

1.4.6. Model Specification

Separate models were specified for each product since each decision made was a separate, independent choice. There were 10 total models run. Each model corresponds to one of the participant’s 10 total choices made, which is composed of 2 decisions made for each of the 5 species. The analysis using a random parameters logit was implemented using SAS version
The model measures the product’s attributes, or main effects, of production method, certification, origin, and price. The indirect utility expression for the model is as follows:

\[ U_{ijk} = \beta_1 \text{Wild} + \beta_2 \text{Certified} + \beta_3 \text{Home State} + \beta_4 \text{Price} + \beta_5 \text{Individual Characteristics} + \beta_6 \text{Treatment} + \varepsilon_{ijk} \]

The model was estimated using wild, certified, and home state as dummy variables. Wild indicates whether or not a product was harvested in the wild, certified shows that a product displayed a label with certification, either organic or sustainably harvested, as opposed to no certification label, and home state indicates whether a product originated from a participant’s home state, rather than from the U.S. or abroad. Price represents the price as shown on the label.

Since the coefficients production method, certification, and origin, could take either sign, each coefficient is given an independent normal distribution (Train, 2009). The mean and standard deviation are estimated within the model. The price coefficient is held fixed so that it can follow the distribution of each random parameter in determining the distribution of the willingness to pay ratio (Revelt & Train, 1998). In a separate model not shown in the paper, participant variables were interacted with the main effects model using a conditional logistic regression.

A nested logit was also tested in comparison to the random parameters mixed logit. Based on the model fit statistics of AIC and Schwarz Criterion, the random parameter mixed logit is preferred.

1.5. Results

Table 1.4 displays the parameter estimates from the random parameter logit models while Table 1.5 represents the willingness to pay estimation results for our five targeted species. The attribute coefficient estimates, shown in Table 1.4, were statistically significant at the 95%
level across all attributes, indicating that each attribute exhibits a distinct influence on product choice. Table 1.5. shows that participants are willing to pay a price premium for all shellfish products and seaweed salads that are wild, certified, or from their home state. The home state attribute produced the largest mean willingness to pay estimates, ranging from 14-41% of the product’s average price with a mean of 27.5%. The certified attribute produced the next largest mean willingness to pay estimates, 6-27% of the product’s average price with a mean of 17.3%, while the wild attribute yielded the smallest estimates, between 6% and 16% with a mean of 8.5%. In terms of products, scallop attributes generated the lowest levels of willingness to pay, spanning a range of 3-15%. This is likely due to the fact that scallops displayed the highest average price per unit ($23.00 per lb.). Oysters, which had the lowest average price per unit ($1.75 per oyster), displayed the highest percentage increase in willingness to pay, ranging from 8-37% across all attributes.

Table 1.4. Random Parameter Logit Estimates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Oysters 1</th>
<th>Standard Error</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild Mean</td>
<td>0.5317</td>
<td>0.1587</td>
<td>0.0008***</td>
</tr>
<tr>
<td></td>
<td>Std. dev.</td>
<td>2.6368</td>
<td>0.4653</td>
</tr>
<tr>
<td>Certified Mean</td>
<td>1.4854</td>
<td>0.2238</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td></td>
<td>Std. dev.</td>
<td>2.0023</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td>Home State Mean</td>
<td>1.9849</td>
<td>0.2761</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td></td>
<td>Std. dev.</td>
<td>0.669</td>
<td>0.4109</td>
</tr>
<tr>
<td>Price</td>
<td>-3.2306</td>
<td>0.3341</td>
<td>&lt;.0001***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Oysters 2</th>
<th>Standard Error</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild Mean</td>
<td>0.5581</td>
<td>0.1452</td>
<td>0.0001***</td>
</tr>
<tr>
<td></td>
<td>Std. dev.</td>
<td>2.2902</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td>Certified Mean</td>
<td>0.9179</td>
<td>0.142</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td></td>
<td>Std. dev.</td>
<td>0.0989</td>
<td>0.9707</td>
</tr>
<tr>
<td>Home State Mean</td>
<td>1.4146</td>
<td>0.238</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td></td>
<td>Std. dev.</td>
<td>1.4381</td>
<td>0.0076***</td>
</tr>
<tr>
<td>Price</td>
<td>-1.9515</td>
<td>0.2306</td>
<td>&lt;.0001***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Clams 1</th>
<th>Standard Error</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild Mean</td>
<td>0.7761</td>
<td>0.1607</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td></td>
<td>Std. dev.</td>
<td>2.2206</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Std. dev.</td>
<td>p-value</td>
</tr>
<tr>
<td>----------------</td>
<td>---------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>Certified</strong></td>
<td>0.9991</td>
<td>0.1619</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>0.5959</td>
<td>0.7209</td>
<td>0.4084</td>
</tr>
<tr>
<td><strong>Home State</strong></td>
<td>1.7948</td>
<td>0.2663</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>2.0355</td>
<td>0.4805</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>-1.5771</td>
<td>0.1668</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Clams 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wild</strong></td>
<td>Mean</td>
<td>Std. dev.</td>
<td>p-value</td>
</tr>
<tr>
<td></td>
<td>0.5331</td>
<td>0.1372</td>
<td>0.0001***</td>
</tr>
<tr>
<td><strong>Certified</strong></td>
<td>1.0383</td>
<td>0.1604</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>0.3686</td>
<td>1.0538</td>
<td>0.7265</td>
</tr>
<tr>
<td><strong>Home State</strong></td>
<td>1.6269</td>
<td>0.2408</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>1.1825</td>
<td>0.5216</td>
<td>0.0234*</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>-1.3297</td>
<td>0.1452</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Mussels 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wild</strong></td>
<td>Mean</td>
<td>Std. dev.</td>
<td>p-value</td>
</tr>
<tr>
<td></td>
<td>0.7431</td>
<td>0.1721</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Certified</strong></td>
<td>1.132</td>
<td>0.1789</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>1.6679</td>
<td>0.4334</td>
<td>0.0001***</td>
</tr>
<tr>
<td><strong>Home State</strong></td>
<td>1.984</td>
<td>0.251</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>0.1499</td>
<td>2.5052</td>
<td>0.9523</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>-1.6432</td>
<td>0.1693</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Mussels 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wild</strong></td>
<td>Mean</td>
<td>Std. dev.</td>
<td>p-value</td>
</tr>
<tr>
<td></td>
<td>0.4258</td>
<td>0.1469</td>
<td>0.0038***</td>
</tr>
<tr>
<td><strong>Certified</strong></td>
<td>1.0252</td>
<td>0.1648</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>-1.4676</td>
<td>0.4119</td>
<td>0.0004***</td>
</tr>
<tr>
<td><strong>Home State</strong></td>
<td>1.6897</td>
<td>0.2144</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>0.6182</td>
<td>0.7848</td>
<td>0.4309</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>-1.7022</td>
<td>0.1603</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Scallops 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wild</strong></td>
<td>Mean</td>
<td>Std. dev.</td>
<td>p-value</td>
</tr>
<tr>
<td></td>
<td>0.5292</td>
<td>0.1551</td>
<td>0.0006***</td>
</tr>
<tr>
<td><strong>Certified</strong></td>
<td>0.9195</td>
<td>0.1602</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>0.1806</td>
<td>2.038</td>
<td>0.9294</td>
</tr>
<tr>
<td><strong>Home State</strong></td>
<td>1.9575</td>
<td>0.3367</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>2.2672</td>
<td>0.5694</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>-0.6286</td>
<td>0.0747</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Scallops 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wild</strong></td>
<td>Mean</td>
<td>Std. dev.</td>
<td>p-value</td>
</tr>
<tr>
<td></td>
<td>0.7255</td>
<td>0.1825</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Certified</strong></td>
<td>1.0094</td>
<td>0.1666</td>
<td>&lt;.0001***</td>
</tr>
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<td><strong>Std. dev.</strong></td>
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<td>2.2133</td>
<td>0.9416</td>
</tr>
<tr>
<td><strong>Home State</strong></td>
<td>2.1157</td>
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<td>&lt;.0001***</td>
</tr>
<tr>
<td><strong>Std. dev.</strong></td>
<td>1.9482</td>
<td>0.5866</td>
<td>0.0009***</td>
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</tbody>
</table>
The standard deviation of the willingness-to-pay estimates, found in Table 1.5, indicate that preferences for the many of the tested attributes vary within the population. The wild harvested attribute, however, is the only attribute whose standard deviation reveals highly significant heterogeneous preferences across all species. The standard deviation estimates for certified and home state exhibit a mixture of significance amongst products, which prevent us from saying conclusively that attribute preferences vary amongst the population. Two exceptions to this are the home state attribute for mussels, and the certified attribute for scallops, both of which do not confirm that preferences vary amongst participants.

The willingness to pay distribution additionally presents information regarding what percentage of participants are willing to pay for a specific attribute. For instance, 100% of participants were willing to pay a dollar value more than $0 for the inclusion of the home state attribute on Oyster Pair 1. Yet for the wild harvested attribute in Oyster Pair 1, only 60% of the distribution is above 0, implying that an oyster labeled as wild harvested in Oyster Pair 1 is a positive
factor for 60% of participants, but a negative factor for 40% of participants. Across all attributes, the amount of the distribution that is willing to pay an amount above $0 for wild harvested has a very small range, between 57% and 61%, with a mean 60.1%, showing that only slightly more than half of the population views wild harvested as a positive factor. The distribution for the certified attribute, on the other hand, expresses a greater range of those willing to pay more than $0, spanning from 76% to 100%, with a mean of 90.9%, indicating that the vast majority thinks of certified goods in a positive manner. This implies that over 9 out of 10 participants view certification as a positive factor, while only 6 out of 10 participants express a positive willingness to pay for wild harvested products.

Products that were from a participant’s home state garnered the greatest amount of those willing to pay a positive price premium. 93.2% of the distribution was willing to pay a positive price premium for products that were from their home state, with a range from 80%-100%, depending upon the species. This was similar to the results for the home state attribute’s mean willingness to pay estimates, which ranged from 14%-41% of the average price of the product with a mean of 27.5%. These findings are supported in the qualitative portion of the choice experiment, where many participants indicated that their preference toward a chosen product was caused by the fact that it was “local,” a term which had not been previously mentioned in the survey. This finding is supported by the Ropicki and colleagues (2010), who determined that Floridians were willing to pay a premium for grouper labelled as “fresh Florida-caught,” and Mauracher and colleagues (2013) who found a price premium range of 46.1%-62.8% for sea bass from the Veneto region of Italy compared to elsewhere in Italy or from the EU.
Additional models were also run interacting variables such as age, income, gender, children in the household, trust in science, working waterfront support, region, and the treatment effect using a conditional logit. The results, however, were inconsistent. The only variables that displayed a sense of consistency were children in the household and gender (female). Both of these variables, when interacted with the main effects model, increased the willingness to pay for the certified and home state attributes. This is in line with Castellini and colleagues (2014), who found that gender (female) and household members both have a positive, significant impact on the determinants of a consumer’s willingness to pay for a quality certification for clams. Brécard and colleagues (2009) along with Fonner & Sylvia (2015) also found that females in their samples were associated with strong safety labeling preferences. Given past campaigns warning pregnant women and children of the potential health risks of certain seafood choices, this comes with little surprise.

However, when sociodemographic and behavioral variables were interacted using a random parameter logit and specified to follow a normal distribution, the only significant interaction occurred between local support and the home state attribute. The local support variable, which was a Likert scale variable based on the statement “I support local businesses” had a positive, statistically significant effect when interacted with the home state attribute. This result is in agreement with the idea of seafood harvested within a home state being perceived as a local good, supported by the state’s residents, as was found by Ernst and Darby (2009).

In order to account for ordering effects, a “first” variable was tested that indicated whether a participant chose product A or product B. Since the pictures for each product within each pair remained the same throughout the experiment, this variable also tests if there for any
preference that could be attributed to the pictures used. The model was estimated using the ran-
dom parameter logit. We specified that the “first” variable followed a normal distribution, since
the preferences for a picture could be either positive or negative. The results were insignificant at
the 95% confidence level for all pairs with two exceptions. Participants preferred Scallops A in
scallops pair 1 with a significance of \( p=0.0118 \) and Seaweed Salad A in seaweed salad pair 2
with significance of \( p=0.0245 \). This could indicate a preference for the pictures used for these
products. However, the picture used for Scallops A in pair 1, which garnered a statistically sig-
nificant, positive estimate, was also used in Scallops pair 2, and did not obtain any statistical sig-
nificance.

Table 1.5. Willingness-to-Pay Estimates

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean Willingness-to-Pay</th>
<th>Std. Dev. of WTP Estimate</th>
<th>Mean WTP (% of Average Product Price)</th>
<th>Percent of Participants WTP &gt; $0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oyster Pair 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wild</td>
<td>$0.17</td>
<td>$0.82</td>
<td>9%</td>
<td>60%</td>
</tr>
<tr>
<td>Certified</td>
<td>$0.46</td>
<td>$0.63</td>
<td>26%</td>
<td>77%</td>
</tr>
<tr>
<td>Home State</td>
<td>$0.62</td>
<td>$0.21</td>
<td>35%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Oyster Pair 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wild</td>
<td>$0.29</td>
<td>$1.19</td>
<td>16%</td>
<td>61%</td>
</tr>
<tr>
<td>Certified</td>
<td>$0.47</td>
<td>$0.05</td>
<td>27%</td>
<td>100%</td>
</tr>
<tr>
<td>Home State</td>
<td>$0.72</td>
<td>$0.74</td>
<td>41%</td>
<td>83%</td>
</tr>
<tr>
<td><strong>Clams Pair 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wild</td>
<td>$0.49</td>
<td>$1.42</td>
<td>9%</td>
<td>64%</td>
</tr>
<tr>
<td>Certified</td>
<td>$0.63</td>
<td>$0.38</td>
<td>12%</td>
<td>95%</td>
</tr>
<tr>
<td>Home State</td>
<td>$1.14</td>
<td>$1.30</td>
<td>21%</td>
<td>81%</td>
</tr>
<tr>
<td><strong>Clams Pair 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wild</td>
<td>$0.40</td>
<td>$1.59</td>
<td>7%</td>
<td>61%</td>
</tr>
<tr>
<td>Certified</td>
<td>$0.78</td>
<td>$0.28</td>
<td>14%</td>
<td>100%</td>
</tr>
<tr>
<td>Home State</td>
<td>$1.22</td>
<td>$0.90</td>
<td>22%</td>
<td>92%</td>
</tr>
<tr>
<td><strong>Mussels Pair 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wild</td>
<td>$0.45</td>
<td>$1.77</td>
<td>13%</td>
<td>61%</td>
</tr>
<tr>
<td>Certified</td>
<td>$0.69</td>
<td>$1.03</td>
<td>20%</td>
<td>76%</td>
</tr>
<tr>
<td>Home State</td>
<td>$1.21</td>
<td>$0.09</td>
<td>35%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Mussels Pair 2</strong></td>
<td></td>
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<td></td>
<td></td>
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</table>

31
### Table 1.5. Continued

<table>
<thead>
<tr>
<th></th>
<th>Wild</th>
<th>Certified</th>
<th>Home State</th>
<th>Scallops Pair 1</th>
<th>Home State</th>
<th>Scallops Pair 2</th>
<th>Home State</th>
<th>Seaweed Salad Pair 1</th>
<th>Home State</th>
<th>Seaweed Salad Pair 2</th>
<th>Home State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$0.25</td>
<td>$1.45</td>
<td>7%</td>
<td>59%</td>
<td></td>
<td></td>
<td></td>
<td>$0.84</td>
<td>4%</td>
<td>$3.90</td>
<td>60%</td>
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<tr>
<td>Certified</td>
<td>$0.60</td>
<td>$0.87</td>
<td>17%</td>
<td>86%</td>
<td></td>
<td></td>
<td></td>
<td>$1.46</td>
<td>6%</td>
<td>$0.29</td>
<td>100%</td>
</tr>
<tr>
<td>Home State</td>
<td>$0.99</td>
<td>$0.37</td>
<td>28%</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td>$3.11</td>
<td>14%</td>
<td>$3.64</td>
<td>80%</td>
</tr>
<tr>
<td>Scallops Pair 2</td>
<td>Wild</td>
<td>$1.42</td>
<td>$5.59</td>
<td>6%</td>
<td>61%</td>
<td></td>
<td></td>
<td>$1.97</td>
<td>9%</td>
<td>$0.32</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Certified</td>
<td>$0.86</td>
<td>$0.40</td>
<td>25%</td>
<td>99%</td>
<td></td>
<td></td>
<td>$4.14</td>
<td>18%</td>
<td>$3.85</td>
<td>86%</td>
</tr>
<tr>
<td></td>
<td>Home State</td>
<td>$1.08</td>
<td>$0.73</td>
<td>31%</td>
<td>93%</td>
<td></td>
<td></td>
<td>$0.23</td>
<td>7%</td>
<td>$1.67</td>
<td>57%</td>
</tr>
<tr>
<td>Seaweed Salad Pair 1</td>
<td>Wild</td>
<td>$0.25</td>
<td>$1.69</td>
<td>7%</td>
<td>57%</td>
<td></td>
<td></td>
<td>$0.60</td>
<td>17%</td>
<td>$0.89</td>
<td>76%</td>
</tr>
<tr>
<td></td>
<td>Certified</td>
<td>$0.86</td>
<td>$0.40</td>
<td>25%</td>
<td>99%</td>
<td></td>
<td></td>
<td>$1.05</td>
<td>30%</td>
<td>$0.63</td>
<td>95%</td>
</tr>
</tbody>
</table>

### 1.6. Discussion and Conclusions

Although there is an emerging literature on consumer preferences for farm-raised fish (Quagrainie et al., 2008; Olesen et al., 2010; Solgaard., 2011; Davidson et al., 2012; Roheim et al., 2012; Mauracher et al., 2013; Fonner & Sylvia., 2015), there has been little exploration into consumer preferences for farm-raised shellfish and seaweed. This is of particular importance because the products included in this study can serve as more than a source of food. Bivalve and seaweed aquaculture can provide positive water quality effects such as reducing nutrient and sediment loading, enhancing oxygen, and serving as ecosystem restoration tools (Phillips., 1990; National Research Council., 2010). With NOAA calling for a 50% expansion in marine aquaculture by 2020, it is imperative for both policymakers and farmers to understand the paths they can take towards an ecologically and economically sustainable expansion.
Even though this study found a slight preference for wild harvested products, only 60% of participants were willing to pay a positive price premium for the wild harvested attribute. The standard deviation estimates also indicate that preferences for the attribute do vary within the population for all species. Perhaps this variance in preferences accounts for the fact that the mean willingness to pay estimates, 4%-16% with a mean of 8.5%, are notably lower than those found by Davidson and colleagues (2012) for wild-caught salmon, tuna, and moi, 55.8%, 63.5%, and 25.4% respectively, and Roheim and colleagues, who in 2012 found Rhode Island consumers to be willing to pay 82% more for wild salmon and 54% more for wild shrimp. These signs could potentially indicate that consumer preferences against farm raised shellfish and seaweed salad are weaker than those for finfish, which could be key for those who raise these products. It is difficult, however, to directly compare the magnitude of these price premium estimates to other studies because of the myriad differences between shellfish and fish consumption.

Participants in this study indicated a stronger preference for certified products than they did for wild harvested products, exhibiting a willingness to pay ranging from 6%-27% of the average label price with a mean price premium of 17.3%. The findings of a positive willingness to pay for certification are in agreement with the majority of the previous literature. However, these results are of slightly larger magnitude than the research of Olesen and colleagues (2009), who found that the average consumer is willing to pay a 15% price premium for organic salmon, and Mauracher and colleagues (2013), who found an average premium of 11.6% for organic sea bass. Yet these estimates remain lower than the 45% willingness to pay estimate found by Disegna and colleagues (2009) for organic trout, which places our results within the bounds of much previous research. These findings could provide a response to Roheim and colleagues (2012), who found a negative willingness to pay for shrimp and salmon that “meet the standards” for certification.
Although Roheim and colleagues (2012) found a negative marginal willingness to pay for shrimp and salmon, our finding that an average of 90.9% of participants exhibited a positive willingness to pay for shellfish and seaweed products reinforces the results in this work.

The home state attribute overpowered the others in both magnitude and number of supporters. These findings are in agreement with the results of Costanigro and colleagues (2010) and Loureiro and Hine (2002), who found that people are willing to pay more for local production than for organic. Products that were from a participant’s home state garnered the greatest mean willingness to pay, with a range from 14%-41% of the average price of the product and a mean of 27.5%, while the certified attribute only received a 6%-27% price premium with a mean of 17.3%. In addition, products from a participant’s home state yielded the greatest amount of participants willing to pay a positive price premium for the product, 93.2%. These findings are also supported in the qualitative portion of the choice experiment, where participants were asked “Why did you make this choice?” After “price,” “local” was the most commonly expressed as the rationale for product selection. This finding is in agreement with previous research that suggested using state boundaries as a proxy for local for terrestrial-based activities, but instead applies it in a fisheries and aquaculture context (Ernst & Darby, 2009; Meas et al., 2013). This also supports the work done by Ropicki and colleagues (2010) as well as Mauracher and colleagues (2013), who found strong, positive price premiums for fish labeled using state and regional borders. The result is even further strengthened by the fact that participants used the word “local” without any previous prompting or usage of the word in this study.

Our results for both certified and “locally” produced foods are in agreement with much of the previously discussed fisheries literature (Jaffry et al., 2004; Olesen et al., 2009; Mauracher et al., 2013; Fonner & Sylvia., 2015), and much related agricultural literature as well (Darby et al.,
These results can be helpful for policymakers across the country, as they suggest that special attention must be paid to determining standards for certification. This is especially true for organic certification for aquaculture. Ecologically, they could help to further promote healthy ecological conditions by creating certain mandates for water quality and harvesting methods. Economically, they could help farmers to diversify their products and potentially add value. The finding that 40% of the population was not willing to pay a positive price premium for wild harvested products also indicates that there is a notable potential for a large portion of seafood consumers to support farm raised products.

Despite the fact that participants did not have distinct preferences for or against products from the U.S. in the econometric model, unlike previous work which found a price premium for food from both their region and country of origin (Mauracher et al., 2013), we did find a preference against imported products. Consumer preferences for product origin highlights the role that could be played by an improved labeling policy and the development of local marketing strategies that focuses on traceability and promotes products being sold within their state of production. Similar to organic certification, a diversification strategy based on the product’s origin could help to differentiate a farmer’s products and increase profit margins, especially when in direct competition with foreign products. Perhaps this increased price premium in origin labeling compared to certification is due to the fact that consumers find it even simpler to understand.

Although we did not find any significant relationships between sociodemographic and behavioral information and attribute preferences, this is an important avenue to research in future work. While it is possible that sociodemographics and behaviors exhibit large variation across these five products, it would be valuable for both policy makers and producers for research to
further address these relationships to determine what personal variables influence consumer choice to purchase shellfish and seaweed.
CHAPTER 2
AQUACULTURE SEAFOOD LABELS: DO ORGANIC CERTIFICATION AND ORIGIN MATTER?

2.1. Chapter Abstract

The second chapter more closely analyzes the potential impacts the research could have on the aquaculture industry using both quantitative and qualitative data. We explore seafood consumer purchasing habits and find that participants are likely to purchase seafood from a grocery store or a local fish market -- both places where labels play a prominent role in the purchasing process. This highlights the large role played by seafood labeling, and could thus benefit farmers by presenting them with a medium to highlight the origin and any certification of their products. Economic analysis shows that consumers are willing to pay from 9%-29% more for aquaculture-raised shellfish and seaweed salad that is certified organic, and 13%-35% more for products that are from the consumer’s home state. Participants highlighted the “local” and “organic” aspects of the products as their reasons for purchase in the qualitative section. This could have implications for farmers in how they produce and market their products, along with where they are sold. The results of this work will be relayed directly to members of the seafood industry through future publication in an industry journal.

2.2. Introduction

The United States, despite possessing the world’s largest Exclusive Economic Zone, produces relatively little seafood through marine aquaculture (NOAA, 2016). The U.S. ranks 17th in total aquaculture production worldwide, accounting for only 0.4% of global production (FAO, 2016). Even within the United States, all forms of aquaculture only account for 6% of total U.S.
seafood production by volume (NOAA, 2016). Marine aquaculture has yet to reach its full potential in the U.S., however, U.S. aquaculture has grown to become an economically important industry that creates jobs in coastal communities and supports related sectors such as seafood processing, food service, and transportation. The industry has increased production by 8% per year according to the most recent data available (NOAA, 2016). With agencies such as NOAA calling for “at least a 50% increase in responsible U.S. marine aquaculture production by the year 2020,” many are left asking how this can be achieved.

One method to aid the sustainable expansion of aquaculture is to use economic and marketing research. This type of research focuses on aiding those in the aquaculture industry by addressing specific topics to help industry members make better-informed business decisions and explore avenues for the growth of their businesses. Researchers at the University of Maine conducted experiments to gauge what consumer are looking for in their seafood products. Specifically, the researchers looked into oysters, clams, mussels, scallops, and seaweed salad. The focus was placed on these products as a response to NOAA’s interest in the environmental and human health benefits associated with shellfish and seaweed aquaculture. In addition, a notable amount of research already exists for consumer preferences for farm-raised finfish.

The goal of the research was to help emerging areas of aquaculture in the U.S., especially in Maine. The goal of this article is to show how consumers react to products that are labeled as certified organic along with those that are labeled as from their home state. This report intends to explain the potential benefits of these types of labeling from both the farmer and from the consumer perspective.
2.3. Previous Seafood Labeling Research

Many previous researchers have studied seafood labelling for wild capture fisheries. But, very little research has been focused on aquaculture labelling. Of the few researchers that looked into preferences for aquaculture products, authors such Olesen and colleagues (2010), Mauracher and colleagues (2013), and Ankamah-Yeboah and colleagues (2016), found consumers are willing to pay more for organic farm-raised fish in Norway, Italy, and Denmark, respectively. Other authors, such as Fonner & Sylvia (2015) and Mauracher and colleagues (2013) found that people are willing to pay more money for seafood that comes from their home state, region, or country. While these findings could be helpful for the aquaculture industry, they are all focused on farmed finfish. Considering the expansion of shellfish and seaweed aquaculture in the U.S., it is necessary that more research be done to explore the markets for these products that have not yet been established.

2.4. Background Information Collection

We visited multiple seafood stores throughout Maine to observe the presentation of products, their prices, and the attributes highlighted by the stores. We also spoke with the owners of the seafood stores and shellfish farmers in order to inform our work. Focus groups were held in Portland, Maine, Bangor, Maine, and Boston, Massachusetts in order to assess what consumers already know or think they know about aquaculture (Rickard et al., 2017). In-person experiments were held at the University of Maine in the spring of 2016. Real products were displayed for consumers to view, but not eat, in order to simulate a purchasing decision as it would occur in a store.
Based on the outcomes from the focus groups and in-person experiments, we designed online choice experiments in the summer of 2016. The goal of the experiments was to determine how much seafood consumers nationwide are willing to pay for farm-raised shellfish and seaweed that is certified organic or from a consumer’s home state. Participants were recruited from coastal states across the country, including the Great Lakes. The experiment showed participants two pictures of products side-by-side. They were given corresponding labels to the products, and asked which product they would prefer. After they made this choice, participants were asked “Why did you make this choice?” The data used in this current project comes from the online experiments.

2.5. Participants & Their Task

Seafood consumers from coastal U.S. states and the Great Lakes were invited to participate in an online choice experiment and survey. In order to gauge consumer preferences in seafood labels, we designed the choice experiments shown in Figure 2.1. Two products were shown next to one another, and participants chose either Product A or Product B based on their personal preferences for the attributes of the products and the product’s price. The products varied in terms of certification (organic or not certified), origin (home state, U.S., or imported), and price. Figure 2.1 represents a pair of profiles that a participant could have seen. Each participant was presented with 2 different pairs of each of the 5 seafood products (oysters, clams, mussels, scallops, and seaweed salad) and evaluated a total of 10 scenarios that were presented randomly.

The survey followed the choice experiments, and asked participants about their seafood consumption habits. Figure 2.2 provides information from the consumers about where frequent
and infrequent seafood consumers purchase their seafood. Frequent seafood consumers, or those who purchase seafood weekly or more often, comprised 57% of participants.

Figure 2.1. Farm-Raised Seafood Choice Experiment Labels

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Seaweed Salad A</td>
<td>Seaweed Salad B</td>
</tr>
<tr>
<td>Farm Raised</td>
<td>Farm Raised</td>
</tr>
<tr>
<td>----</td>
<td>Organic</td>
</tr>
<tr>
<td>US</td>
<td>Maine</td>
</tr>
<tr>
<td>$3.00 (per salad)</td>
<td>$3.50 (per salad)</td>
</tr>
</tbody>
</table>

Above all, over 90% of the seafood consumers purchase their seafood from the grocery store. These findings highlight the importance of seafood labels, as seafood purchased in a grocery store or local fish market relies on a label to identify the product, its characteristics, and its price. Often, seafood labels are the only source of information for consumers before they decide
whether or not to purchase a product. A grocery store, the location where seafood is most frequently purchased, is even more likely to rely on the use of labels, as fish markets tend to have employees with extensive knowledge on the subject, as was found in the pre-experiment work.

In addition, the main reasons cited for buying seafood is taste, followed by health, as shown in Figure 2.3. Although this study did not research how taste can be addressed via seafood labels, it does study the effects of certified organic products – an attribute consumers often associate as being an indicator of products that are safer and healthier (Dumortier et al., 2017; Rodman et al., 2014). Considering the large role played by health in the purchasing decision, the effects of organic remain very important. According to the participant information in this study, labels can play a large role in affecting the purchase decisions of seafood consumers, especially frequent consumers.
2.6. Research Methods and Numerical Results

The main goal of this project was to find how much consumers are willing to pay for certain aspects of the seafood included in the study, such as whether or not it is from a consumer’s home state, or if a product is organic. Since some of these label attributes, such as organic, do not yet exist, the approach to finding such answers is through the hypothetical choice experiment explained above. Participants respond to the choice experiment based on their personal preferences and the attributes of the products shown, and select either Product A or Product B. The attributes associated with the selection are recorded in the data. Researchers then use the economic tools of discrete choice analysis in order to estimate how much consumers are willing to pay for certain attributes. In this study, a random parameter mixed logit is used in order to arrive at the results. Further details on the economic modeling and theory can be found in Brayden & Noblet (2017). The phrase “willing to pay” indicates how much more a consumer would pay for a product with that certain attribute when all other product attributes are the same. For example, if a consumer is
willing to pay $0.25 for the certified organic attribute of an oyster, which has an average price of $1.75, that means the consumer is willing to pay $2.00 for an oyster that is certified organic.

This study calculated this willingness-to-pay for all species for two different attributes of farm-raised products: (1) whether or not a product is certified organic and (2) whether or not a product is from a consumer’s home state. The results are listed below in Table 2.1. The numbers in parentheses indicate what percent more consumers are willing to pay on top of the average price of the product.

<table>
<thead>
<tr>
<th>Willingness to Pay Estimates</th>
<th>Certified</th>
<th>Home State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oysters (per oyster)</td>
<td>$0.52</td>
<td>$0.61</td>
</tr>
<tr>
<td></td>
<td>(29%)</td>
<td>(35%)</td>
</tr>
<tr>
<td>Clams (per lb.)</td>
<td>$0.69</td>
<td>$0.88</td>
</tr>
<tr>
<td></td>
<td>(13%)</td>
<td>(16%)</td>
</tr>
<tr>
<td>Mussels (per lb.)</td>
<td>$0.63</td>
<td>$1.22</td>
</tr>
<tr>
<td></td>
<td>(18%)</td>
<td>(35%)</td>
</tr>
<tr>
<td>Scallops (per lb.)</td>
<td>$2.13</td>
<td>$3.03</td>
</tr>
<tr>
<td></td>
<td>(9%)</td>
<td>(13%)</td>
</tr>
<tr>
<td>Seaweed Salad (per salad)</td>
<td>$0.83</td>
<td>$1.18</td>
</tr>
<tr>
<td></td>
<td>(24%)</td>
<td>(34%)</td>
</tr>
</tbody>
</table>

When consumers face two farm-raised products, they seek the product that is certified organic. Shellfish and seaweed farmers could receive price premiums ranging from 9%–29% for certified organic products depending on the product. For example, seafood farmers could receive an additional $2.13 per lb. for scallops when they are certified organic, and an additional $0.52 per oyster if they were to be certified organic.
However, above all, the results indicate that over 90% of consumers desire products from their home state. Consumers are willing to pay between 13% and 35% more for these products. For mussels, for instance, this means that seafood farmers could earn an additional $1.22 per lb. by indicating the state of where the product was raised and then selling it within that state. This is a notable result for farmers because this distinction garners a significant price premium without farmers needing to change anything in their production or harvesting process. Additional economic estimates show that 84% of consumers would be willing to pay a price premium for a product that is certified organic, while 94% would be willing to pay a price premium for a product that is from their home state. This large potential market could help farmers to capitalize upon highlighting these attributes for their products.

2.7. Open-Ended Consumer Responses

After consumers made choices in the experiment, they also answered, “Why did you make this choice?” Thanks to this question, we have a breadth of information on consumers’ rationales for their purchase decisions. Answers focus on topics such as local, U.S., organic, farm raised, and price. Price indicated that someone purchased one product instead of the other because it was cheaper, as expected. Local, however, provides a more complicated answer.

We did not mention the word local before the experiment portion of the survey. Participants themselves referred to products from their home state as local. In fact, it was the most important reason that participants selected a certain product after price. As has been seen with other types of food (Constanigro et al., 2010), local matters most to consumers.
The second-most mentioned reason for buying a product after local was due to a product being organic. This also supports the results we found through our econometric model, as well as the results from previous research.

Following consumer preferences for organic products, we found that consumers preferred products that were from the U.S. Since all of the participants were living in the U.S. and thus had their home state in the U.S., this would be referring to a preference for U.S. raised goods in comparison to those imported from abroad. This is complemented by the fact that several participants noted they did not buy a product because it was imported, while very few bought a product that was imported.

Last, many participants expressed a preference for farm raised products, more than three times as many as those who did not buy a product because it was farm raised. For oysters, for example, while 38 participants indicated that they did not purchase a product because it was farm raised, 159 participants purchased a product because it was farm raised. This also supports previous research done by Brayden & Noblet (2017), which found that although consumers preferred wild harvested shellfish and seaweed salad, the consumer preferences were much weaker than previous studies. These findings are in line with the that consumer trends are shifting towards farm raised products, as farm-raised was seen as a positive factor more than three times as much as it was seen negatively.

Table 2.2 Reasons for Purchasing Product

<table>
<thead>
<tr>
<th>Reason</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>866</td>
</tr>
<tr>
<td>Local</td>
<td>451</td>
</tr>
<tr>
<td>Organic</td>
<td>301</td>
</tr>
<tr>
<td>U.S.</td>
<td>267</td>
</tr>
<tr>
<td>Imported (negative)</td>
<td>108</td>
</tr>
</tbody>
</table>
2.8. Implications

As a member of the seafood industry, the information relayed through this article’s results could help you to better assess increasing the profitability of your business. In terms of organic certification, the results indicate that organic certification alone could increase the price consumers will pay for your product by 29%. Although organic standards in the U.S. currently exist for seaweed only, these results could be used as evidence to guide the push towards establishing organic certification standards nationwide. Once they are established, you can then use the information from this research to assess the cost efficiency of your business gaining organic certification. In addition, an attribute such as certified organic could help to distinguish your product from others, and possibly increase the quantity demanded for you products.

In terms of in-state production and sales, the benefits are even stronger. Seafood farmers can receive up to 35% more for products if they are labeled as the state in which they are produced, and then are sold within state boundaries. Labeling the home state of the products gains a very low-cost price premium for the producer, yet still taps into the local food movement. Additionally, selling the product in-state can help to save money on transportation costs, and can often provide a fresher product. Unlike with gaining organic certification, production and/or harvesting methods do not need to meet a standard, only the labeling must change. This could be made even easier through the development of local marketing strategies. Selling products within their home state of production can also cause a multiplier effect, stimulating the local economy and creating local jobs. This could especially provide benefits in the areas in which the seafood is often raised, in rural, coastal communities.
The information provided by this study is intended to help explain the potential benefits of gaining organic certification for your products or labeling the state of origin of your products and selling them within the state. The results could be used by individual farmers in order to assess the potential gains while weighing the costs. The researchers hope that this work can help to inform both individual farmers and the aquaculture industry to be able to expand sustainably and help those in the coastal communities and states where aquaculture occurs.
REFERENCES


APPENDIX A: IRB APPROVAL FORM

APPLICATION FOR APPROVAL OF RESEARCH WITH HUMAN SUBJECTS
Protection of Human Subjects Review Board, 114 Alumni Hall, 581-1498

PRINCIPAL INVESTIGATOR: Christian Brayden
EMAIL: william.brayden@maine.edu  TELEPHONE: (207) 604-2852

CO-INVESTIGATOR(S): Caroline Noblet

FACULTY SPONSOR (Required if PI is a student): Caroline Noblet

TITLE OF PROJECT: Assessing Consumer Use of Seafood Labels

START DATE (mm/dd/yyyy): 04/15/2016  PI DEPARTMENT: School of Economics

MAILING ADDRESS: 207 Winslow Hall, University of Maine, Orono, ME 04469

FUNDING AGENCY (if any): Maine EPSCoR, SEANET

STATUS OF PI

1. If PI is a student, is this research to be performed:
   - [ ] for an honors thesis/senior thesis/capstone?
   - [ ] for a master’s thesis?
   - [ ] for a doctoral dissertation?
   - [ ] for a course project?
   - [ ] other (specify):

2. Does this application modify a previously approved project? [ ] No   [ ] Yes
   If yes, please give assigned number (if known) of previously approved project:

3. Is an expedited review requested? [ ] Yes  [ ] No

Submitting the application indicates the principal investigator's agreement to abide by the responsibilities outlined in Section I.E. of the policies and Procedures for the protection of Human Subjects.

Faculty Sponsors are responsible for oversight of research conducted by their students. The Faculty Sponsor ensures that he/she has read the application and that the conduct of such research will be in accordance with the University of Maine’s Policies and Procedures for the Protection of Human Subjects of Research. REMINDER: if the principal investigator is an undergraduate student, the faculty sponsor MUST submit the application to the IRB

Date

FOR IRB USE ONLY  Application # 2016-03-13  Date received 03/18/2016  Review (F/E): E

ACTION TAKEN:

☑ Judged Exempt; category [ ] Modifications required? [ ] Yes  [ ] No  Accepted (date) 4/5/2016
☑ Approved as submitted. Date of next review: [ ] Degree of Risk: [ ]
☑ Approved pending modifications. Date of next review: [ ] Degree of Risk: [ ]
Modifications accepted (date): [ ]
[ ] Not approved. (See attached statement.)
[ ] Judged not research with human subjects

FINAL APPROVAL TO BEGIN: 04/09/2016

57
APPENDIX B: ONLINE INFORMED CONSENT FORM

Hello,

Thank you for your interest. You are invited to participate in a research project being conducted by Christian Brayden, a Master's student in the School of Economics at the University of Maine, under the direction of faculty sponsor Dr. Caroline Noblet. Ms. Maryam Kashkooli and Ms. Margaret Snell are also working alongside this team as research assistants. The purpose of the research is to better understand how people perceive product attributes of sea products.

What Will You Be Asked to Do?
If you decide to participate, you will be asked to take part in an online economic experiment. This experiment involves choosing between 10 sets of sea products based on your personal preferences. It may take approximately 20 minutes to complete this experiment. You will also be asked to fill out a short questionnaire on your perceptions and demographic information.

Risks
Except for your time and inconvenience, there are no risks to you from participating in this study.

Benefits
While this study will have no direct benefit to you, this research will provide crucial knowledge about the consumer use of seafood labeling. The data collected will allow us to document which attributes of sea products matter most to consumers. This data can be used to inform policy makers and producers on how to match the desires of consumers.

Compensation
You will be compensated $1.00 for participating in this study through your Amazon MTurk worker account.

Confidentiality
Your name will not be on any of the documents. The information you provide in response to the survey questions will be confidential and will only be used for research purposes. Your Amazon Worker ID and email will be accessible to the researchers during data collection for tracking purposes only. Only the principal researchers will have access to the data during the collection stage and all data will be kept confidential. After data collection is complete your worker ID will be stripped from the final dataset. The data will only be published in summarized form, so your individual responses will never
be revealed or shared with anyone outside the research team. An electronic key linking participant information to data will be kept for one year and stored using software that provides additional security. We will store the data gathered in a secure electronic database at the University of Maine until the end of the grant (2019).

Voluntary
Your participation is voluntary and you may choose to skip any question or stop at any time.

Contact Information
If you have any questions about this research, you may contact the research team at (207) 536-8130. If you have any questions about your rights as a research participant, you may contact Gayle Jones, Assistant to the University of Maine’s Protection for Human Subjects Review Board, at (207) 581-1498.

Do you agree with the terms outlined?
APPENDIX C: IN-PERSON INFORMED CONSENT FORM

Informed Consent

You are invited to participate in a research project being conducted by Christian Brayden, a Master’s student in the School of Economics at the University of Maine, under the direction of faculty sponsor, Dr. Caroline Noblet. Ms. Maryam Kashkooli is also working alongside this team as an undergraduate research assistant. The purpose of the research is to better understand how people perceive product attributes of Maine sea products. You must be between 18 and 65 years of age to participate.

What Will You Be Asked to Do?

If you decide to participate, you will be asked to take part in an in-person economic experiment. This experiment involves choosing between 12 sets of sea products based on your personal preferences. It may take approximately 20 minutes to participate in this experiment. You will also be asked to fill out a short questionnaire on your perceptions and demographic information. A sample of the experiment would be selecting between these two products:

<table>
<thead>
<tr>
<th>$2.99 per lb.</th>
<th>$2.49 per lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquaculture raised</td>
<td>Wild harvested</td>
</tr>
<tr>
<td>Certified organic</td>
<td></td>
</tr>
<tr>
<td>Locally raised</td>
<td></td>
</tr>
</tbody>
</table>

Risks

Except for your time and inconvenience, there are no risks to you from participating in this study.

Benefits

While this study will have no direct benefit to you, this research will provide crucial knowledge about the consumer use of seafood labeling. The data collected will allow us to document which
attributes of sea products matter most to Maine consumers. This data can be used to inform policy makers and producers on how to match the desires of consumers.

Compensation

You will receive $40 upon completion of the study. You will be asked to fill out and sign a participant payment log in order to confirm your receipt of the compensation. If you leave the experiment prior to its completion you will not receive compensation.

Confidentiality

The information gathered during the experiments will only be used for research purposes. These data will only be published in summarized form, so your individual responses will never be revealed or shared with anyone outside the research team. We will store the data gathered in a secure electronic database at the University of Maine until the end of the grant (2019). Participant codes are only used in order to match the scenario you evaluated with your questionnaire. The identifying information collected in the payment log is not connected to responses. The identifying information will only be kept in order to maintain records regarding disbursement of funds according to requirements of funding agencies. The payment log will be retained for seven years by the investigator or the National Science Foundation office according to funding requirements.

Voluntary

Your participation is voluntary and you may choose to skip any question or stop at any time. However, you must complete the study to be eligible for compensation. Continuing to the experiment tells us you have read and understood the information above and agree to be part of the study.

Contact Information

If you have any questions about this study, please contact me, Christian Brayden, at william.brayden@maine.edu or (207) 604-2852. You may also reach the faculty advisor, Caroline Noblet, on this study at (207) 581-3172 or caroline.noblet@maine.edu.

If you have any questions about your rights as a research participant, please contact Gayle Jones, Assistant to the University of Maine’s Protection of Human Subjects Review Board, at 581-1498 (or e-mail gayle.jones@umit.maine.edu).
APPENDIX D: ONLINE SURVEY

What state do you live in?

Q79

What county do you live in?

Page Break

Block 15
Block Options
Q65
Do you consume seafood at home? Select only one.

- Yes
- No

Seafood Consumption
Block Options
Q80

Seafood Consumption

Please tell us a little bit about your seafood consumption.

Q64
How often do you typically purchase seafood? Select only one.

- Every day
- A few times per month
- A few times per week
- Once per month
- Once per week
- Rarely
- Other

Q66
Why do you eat seafood? Select all that apply.

- Health
- Taste
- Convenience
- Price
- Ethics
- Dietary restriction
- Other
Q67
What type(s) of seafood do you typically purchase? Select all that apply.

☐ Fish
☐ Lobsters
☐ Mussels
☐ Scallops
☐ Other

☐ Clams
☐ Oysters
☐ Crab
☐ Seaweed

Q68
From where do you typically purchase your seafood? Select all that apply.

☐ Grocery store
☐ Local fish market
☐ Harvester
☐ Restaurant
☐ Other

Q69
In what form do you usually purchase your seafood? Select all that apply.

☐ Frozen - breaded/battered
☐ Fresh - breaded/battered

☐ Frozen - smoked
☐ Fresh - smoked

☐ Frozen - natural
☐ Fresh - natural
☐ Other

Seafood Experiment

Please choose one answer for each of the following pairings and explain your rationale. Assume you are at the grocery store with a limited budget when making your decisions.
Each product that you see will be labeled according to four different categories. The categories include:

Production Type:
Farm raised means that the product is cultivated in an ocean or river under monitored conditions.
Wild harvested means that the product is taken from its natural habitat.

Certified Label:
Organic means that the product is certified organic.
Sustainably harvested means that the product is certified to have been harvested in a manner that considers the long term vitality and well-being of the species, oceans, and rivers.

Production Location:
Imported indicates that a product comes from a country outside of the U.S.
U.S. indicates that a product comes from U.S. waters.
$\{q://QID80/ChoiceTextEntryValue\}$ indicates that a product comes from $\{q://QID80/ChoiceTextEntryValue\}$ waters.

Price:
Price is shown in dollars ($). The amount sold for that price is indicated on the same line, e.g. per lb.

Please note the example below:
You will be asked to choose either Oyster A, Oyster B, or neither based on the profiles presented. You will then be asked to explain why you made this choice.

<table>
<thead>
<tr>
<th>Oyster A</th>
<th>Oyster B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm raised</td>
<td>Wild harvested</td>
</tr>
<tr>
<td>Organic</td>
<td>Sustainably harvested</td>
</tr>
<tr>
<td></td>
<td>US</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td></td>
<td>$2.25 (per oyster)</td>
</tr>
</tbody>
</table>

### Choice Experiment

<table>
<thead>
<tr>
<th>Oyster A</th>
<th>Oyster B</th>
</tr>
</thead>
<tbody>
<tr>
<td>${e://Field/production1}</td>
<td>${e://Field/production2}</td>
</tr>
<tr>
<td>${e://Field/certification1}</td>
<td>${e://Field/certification2}</td>
</tr>
<tr>
<td>${e://Field/location1}</td>
<td>${e://Field/location2}</td>
</tr>
<tr>
<td>${e://Field/price1} (per oyster)</td>
<td>${e://Field/price2} (per oyster)</td>
</tr>
</tbody>
</table>

- Oyster A
- Oyster B
- Neither

Q47 Why did you make this choice?
<table>
<thead>
<tr>
<th>Clams A</th>
<th>Clams B</th>
</tr>
</thead>
<tbody>
<tr>
<td>${e://Field/production3}$</td>
<td>${e://Field/production4}$</td>
</tr>
<tr>
<td>${e://Field/certification3}$</td>
<td>${e://Field/certification4}$</td>
</tr>
<tr>
<td>${e://Field/location3}$</td>
<td>${e://Field/location4}$</td>
</tr>
<tr>
<td>${e://Field/price3} \ (per \ lb.)</td>
<td>${e://Field/price4} \ (per \ lb.)</td>
</tr>
</tbody>
</table>

- [ ] Clams A
- [ ] Clams B
- [ ] Neither

Q48
Why did you make this choice?

Block 6
Block Options
Q25

<table>
<thead>
<tr>
<th>Mussels A</th>
<th>Mussels B</th>
</tr>
</thead>
<tbody>
<tr>
<td>${e://Field/production5}$</td>
<td>${e://Field/production6}$</td>
</tr>
<tr>
<td>${e://Field/certification5}$</td>
<td>${e://Field/certification6}$</td>
</tr>
<tr>
<td>Location 5</td>
<td>Location 6</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Price 5</td>
<td>Price 6</td>
</tr>
<tr>
<td>(per lb.)</td>
<td>(per lb.)</td>
</tr>
</tbody>
</table>

- **Mussels A**
- **Mussels B**
- **Neither**

Q64 Why did you make this choice?

Block 7

<table>
<thead>
<tr>
<th>Production 7</th>
<th>Production 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certification 7</td>
<td>Certification 8</td>
</tr>
<tr>
<td>Location 7</td>
<td>Location 8</td>
</tr>
<tr>
<td>Price 7 (per lb.)</td>
<td>Price 8 (per lb.)</td>
</tr>
</tbody>
</table>

- **Scallops A**
- **Scallops B**
- **Neither**

Q49 Why did you make this choice?

Block 8
### Q26

<table>
<thead>
<tr>
<th>Seaweed Salad A</th>
<th>Seaweed Salad B</th>
</tr>
</thead>
<tbody>
<tr>
<td>${e://Field/production9}</td>
<td>${e://Field/production10}</td>
</tr>
<tr>
<td>${e://Field/certification9}</td>
<td>${e://Field/certification10}</td>
</tr>
<tr>
<td>${e://Field/location9}</td>
<td>${e://Field/location10}</td>
</tr>
<tr>
<td>${e://Field/price9} (per salad)</td>
<td>${e://Field/price10} (per salad)</td>
</tr>
</tbody>
</table>

- Seaweed Salad A
- Seaweed Salad B
- Neither

Why did you make this choice?

---

### Q50

**Why did you make this choice?**

---

### Block 9

### Block Options

### Q27

---

---

---
<table>
<thead>
<tr>
<th>Oyster A</th>
<th>Oyster B</th>
</tr>
</thead>
<tbody>
<tr>
<td>${e://Field/production11}</td>
<td>${e://Field/production12}</td>
</tr>
<tr>
<td>${e://Field/certification11}</td>
<td>${e://Field/certification12}</td>
</tr>
<tr>
<td>${e://Field/location11}</td>
<td>${e://Field/location12}</td>
</tr>
<tr>
<td>${e://Field/price11} (per oyster)</td>
<td>${e://Field/price12} (per oyster)</td>
</tr>
</tbody>
</table>

- Oyster A
- Oyster B
- Neither

Q52
Why did you make this choice?

Clams A

<table>
<thead>
<tr>
<th>Clams B</th>
</tr>
</thead>
<tbody>
<tr>
<td>${e://Field/production13}</td>
</tr>
<tr>
<td>${e://Field/certification13}</td>
</tr>
<tr>
<td>${e://Field/location13}</td>
</tr>
<tr>
<td>${e://Field/price13} (per lb.)</td>
</tr>
</tbody>
</table>

- Clams A
- Clams B
- Neither

Q51
Why did you make this choice?

Block 11
Block Options
Q29

<table>
<thead>
<tr>
<th>Mussels A</th>
<th>Mussels B</th>
</tr>
</thead>
<tbody>
<tr>
<td>${e://Field/production15}</td>
<td>${e://Field/production16}</td>
</tr>
<tr>
<td>${e://Field/certification15}</td>
<td>${e://Field/certification16}</td>
</tr>
<tr>
<td>${e://Field/location15}</td>
<td>${e://Field/location16}</td>
</tr>
<tr>
<td>${e://Field/price15} (per lb.)</td>
<td>${e://Field/price16} (per lb.)</td>
</tr>
</tbody>
</table>

- ☐ Mussels A
- ☐ Mussels B
- ☐ Neither

Q53
Why did you make this choice?

Block 12
Block Options
Q30
<table>
<thead>
<tr>
<th>Scallops A</th>
<th>Scallops B</th>
</tr>
</thead>
<tbody>
<tr>
<td>${e://Field/production17}$</td>
<td>${e://Field/production18}$</td>
</tr>
<tr>
<td>${e://Field/certification17}$</td>
<td>${e://Field/certification18}$</td>
</tr>
<tr>
<td>${e://Field/location17}$</td>
<td>${e://Field/location18}$</td>
</tr>
<tr>
<td>${e://Field/price17}$ (per lb.)</td>
<td>${e://Field/price18}$ (per lb.)</td>
</tr>
</tbody>
</table>

- [ ] Scallops A
- [ ] Scallops B
- [ ] Neither

Q54
*Why did you make this choice?*

---

Block 13
Block Options
Q31
Seaweed Salad A | Seaweed Salad B
---|---
${e://Field/production19}$ | ${e://Field/production20}$
${e://Field/certification19}$ | ${e://Field/certification20}$
${e://Field/location19}$ | ${e://Field/location20}$
$\$(e://Field/price19)$ (per salad) | $\$(e://Field/price20)$ (per salad)

- • Seaweed Salad A
- • Seaweed Salad B
- • Neither

Q55
Why did you make this choice?

Perspective

Thank you for completing the experiment portion of the survey. Please tell us about your opinions on the following statements. All of your responses will remain confidential.

Q65
Please respond to the following questions based on how much you disagree on a scale from strongly disagree to strongly agree:

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am healthier than the average person</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I thoroughly read food labels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientists provide reliable information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Due to my personal beliefs, I avoid behaviors that hurt the environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q66</td>
<td>Please respond to the following questions based on how much you disagree on a scale from strongly disagree to strongly agree:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I trust scientists</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strongly disagree</td>
<td>Disagree</td>
<td>Neither agree nor disagree</td>
<td>Somewhat disagree</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>I help protect the environment so other people think I am a good person</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strongly disagree</td>
<td>Disagree</td>
<td>Neither agree nor disagree</td>
<td>Somewhat disagree</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>I am familiar with &quot;organic&quot; food</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strongly disagree</td>
<td>Disagree</td>
<td>Neither agree nor disagree</td>
<td>Somewhat disagree</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>I think scientists are doing important work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strongly disagree</td>
<td>Disagree</td>
<td>Neither agree nor disagree</td>
<td>Somewhat disagree</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>It is important to me that other people know I work to help protect the environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strongly disagree</td>
<td>Disagree</td>
<td>Neither agree nor disagree</td>
<td>Somewhat disagree</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>I try to make pro-environmental decisions in order to avoid social disapproval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strongly disagree</td>
<td>Disagree</td>
<td>Neither agree nor disagree</td>
<td>Somewhat disagree</td>
<td>Agree</td>
</tr>
</tbody>
</table>

Q67
Please respond to the following questions based on how much you disagree on a scale from strongly disagree to strongly agree:
<table>
<thead>
<tr>
<th>Component</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A balanced diet is important to me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I didn't help protect the environment, I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>would worry that others would think of me as</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a bad person</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science has greatly improved my life</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientists share my values</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I support protecting / restoring/ enhancing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>working waterfronts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Q13**
Which of the following are components of organic food? Select all that apply.
- ☐ No antibiotics
- ☐ Organic feed for livestock
- ☐ No chemical fertilizers
- ☐ No added growth hormones
- ☐ No GMOs
- ☐ No pesticides

**Q68**
Please respond to the following questions based on how much you disagree on a scale from strongly disagree to strongly agree:

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I support local businesses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I do things harmful to the environment, I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strongly disagree</td>
<td>Disagree</td>
<td>Somewhat disagree</td>
<td>Neither agree nor disagree</td>
<td>Somewhat agree</td>
<td>Agree</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------</td>
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<td>------------------</td>
<td>--------------------------</td>
<td>---------------</td>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td>feel like others judge me negatively</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientists provide unbiased information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am concerned about seafood safety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q12
Please respond to the following questions based on how much you disagree on a scale from strongly disagree to strongly agree:

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science can raise our standard of living</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I try to behave in pro-environmental ways because it is personally important to me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My concern for the environment motivates me to engage in good environmental behaviors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I support practices that preserve the environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q63
Demographics

Please tell us a little bit about yourself for statistical purposes. All of your responses will remain confidential.
Q1
What is your current age? (years)

Q2
How do you identify by gender?
• Male
• Female

Q5
How many years have you lived in ${q://QID80/ChoiceTextEntryValue}?

Q6
Are there children living in your household?
• Yes
• No
• Condition: No is selected. Skip To: How many adults live in your household?

Page Break
Q74
How many children (under age 18) live in your household? Select only one.
• 1
• 2
• 3
• 4
• 5
• 6
• 7
• 8

Q75
How many adults live in your household? Select only one.
• 1
• 2
• 3
• 4
• 5
• 6
• 7
• 8
• 9
• 10

Page Break
Q8
What is the highest level of education that you have completed? Select only one.
• Some high school
• High school diploma/GED
• Associate's degree
• Bachelor's degree
• Master's degree
• Doctorate

Q9
What is your current employment status? Select only one.

• Employed full-time
• Employed part-time
• Student
• Retired
• Stay at home
• Unemployed

Page Break

Q3
What is your annual household income? Select only one.

• $25,000 or less
• $25,000-$50,000
• $50,000-$75,000
• $75,000-$100,000
• $100,000 or more

Q4
What is your occupation?

Q19
Is your livelihood or the livelihood of someone close to you dependent on the sea?

• Yes
• No

Q20
Please tell us more about your or your relative's dependence on the sea:
### APPENDIX E: LIST OF ECO370 STUDENTS

<table>
<thead>
<tr>
<th>Student ID</th>
<th>Name</th>
<th>Status of IRB*</th>
</tr>
</thead>
<tbody>
<tr>
<td>772407</td>
<td>Altvater, Sam</td>
<td>SAME started 2/25 -- did one module</td>
</tr>
<tr>
<td>958955</td>
<td>Bannister, Holiday Violet</td>
<td>Yes, passed 2/24/16</td>
</tr>
<tr>
<td>ID</td>
<td>Name</td>
<td>Status</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>905375</td>
<td>Bennett, Abigail Joslyn</td>
<td>Yes, passed 2/25/16</td>
</tr>
<tr>
<td>779180</td>
<td>Brann, Ryan Scot</td>
<td>Same</td>
</tr>
<tr>
<td>815454</td>
<td>Bunnell, Alec</td>
<td>Same</td>
</tr>
<tr>
<td>881678</td>
<td>Buonomano, Nolan Louis</td>
<td>Same</td>
</tr>
<tr>
<td>967054</td>
<td>Burdick, David Michael</td>
<td>Same</td>
</tr>
<tr>
<td>758699</td>
<td>Bussiere, Cameron Michael</td>
<td>Same</td>
</tr>
<tr>
<td>799895</td>
<td>Cromwell, Alexander</td>
<td>Same</td>
</tr>
<tr>
<td>779978</td>
<td>Deegan, Lauren Armande</td>
<td>Same</td>
</tr>
<tr>
<td>813266</td>
<td>Emery, Tyler Enoch</td>
<td>Same</td>
</tr>
<tr>
<td>812247</td>
<td>Ewing, Paul George</td>
<td>Same</td>
</tr>
<tr>
<td>880358</td>
<td>Gayton, Dominic Allen Vincent</td>
<td>Same</td>
</tr>
<tr>
<td>834857</td>
<td>Goodwin, Cameron</td>
<td>Same</td>
</tr>
<tr>
<td>793002</td>
<td>Hallwell, Angela</td>
<td>Same</td>
</tr>
<tr>
<td>825873</td>
<td>Houston, Emma Wesley</td>
<td>Same</td>
</tr>
<tr>
<td>816014</td>
<td>Huntress, Zai James</td>
<td>Same</td>
</tr>
<tr>
<td>789436</td>
<td>Jennings, Ryan Michael</td>
<td>Same</td>
</tr>
<tr>
<td>900304</td>
<td>Kashkooli, Maryam</td>
<td>Same</td>
</tr>
<tr>
<td>841612</td>
<td>Leblanc, Brandon</td>
<td>Same</td>
</tr>
<tr>
<td>981889</td>
<td>Masters, Tom (Masters, Thomas)</td>
<td>Same</td>
</tr>
<tr>
<td>828090</td>
<td>McKenna, Dalton Tyler</td>
<td>Same</td>
</tr>
<tr>
<td>872500</td>
<td>Melcher, Zac E</td>
<td>Same</td>
</tr>
<tr>
<td>850678</td>
<td>Robles, Griffin Earl</td>
<td>Same</td>
</tr>
<tr>
<td>721382</td>
<td>Saunders, Thomas Logan</td>
<td>Same</td>
</tr>
<tr>
<td>823099</td>
<td>Short, Freeman Locklin</td>
<td>Same</td>
</tr>
<tr>
<td>706321</td>
<td>Shortt, Caleb</td>
<td>Same</td>
</tr>
<tr>
<td>854457</td>
<td>Small, Joel Sawyer</td>
<td>Same</td>
</tr>
<tr>
<td>440013</td>
<td>Sturrock, Erica Joyce</td>
<td>Same</td>
</tr>
<tr>
<td>812540</td>
<td>Sutton, Joe Wilson</td>
<td>Same</td>
</tr>
<tr>
<td>798395</td>
<td>Tourigny, Troy Neil</td>
<td>Same</td>
</tr>
<tr>
<td>904919</td>
<td>Warmuth, Greg Maxwell</td>
<td>Same</td>
</tr>
<tr>
<td>773111</td>
<td>White, Justin James</td>
<td>Same</td>
</tr>
<tr>
<td>77311</td>
<td>Williams Jr, Art Anthony (Williams Jr, Arthur Anthony)</td>
<td>Same</td>
</tr>
</tbody>
</table>
APPENDIX F: RECRUITMENT FOR IN-PERSON EXPERIMENTS
UMaine master’s student Christian Brayden and Assistant Professor Dr. Caroline Noblet
are looking for volunteers for a research study at the University of Maine. Participants will be
asked to meet with college researchers for 20 minutes to make hypothetical purchases of seafood
products and fill out a computer-based survey. This survey will be about information you use to
buy seafood, but will not include any actual consumption of seafood.

In order to participate in this study, you must:

- Be between 18 and 65 years of age
- Purchase and eat shellfish and/or seaweed that is prepared at home
- Be able to read English

Why participate? We will pay you $40 for your time and participation!

Where? TBD
When: Dates to be determined - by Appointment

If you are interested and you meet the qualifications please contact: (email account will be
set up specifically for this purpose)

If you are a student of UMaine, please indicate so in your email.
APPENDIX G: RECRUITMENT SCRIPT/TASK DESCRIPTION FOR MTURK
This task is a prescreen for a related future task that is part of a University of Maine study; there are two questions. The payment for the related future task is $5. If you qualify for the related task, you will receive an email inviting you to participate:

Question 1: Do you purchase and eat shellfish and/or seaweed that is prepared at home?
• If Yes, please continue to next question
• If No, thank you for participating; you are not eligible to continue with our study.

Question 2: Are you between 18 and 65 years of age?
• If Yes - thank you, you are eligible for the next task. You will receive an email shortly with instructions for participation
• If No, thank you for participating; you are not eligible to continue with our study.
APPENDIX H: EXPERIMENT PROTOCOL (IN-PERSON)

Experiment Protocol
1 - Students of ECO 370 and Christian will place two identical products in clear, sealed plastic containers on five separate tables. There will be an additional area available for participants to complete the questionnaire.
2 - Participants arrive at the lab. They are greeted and checked in by a member of ECO 370. They will review the consent form and verbally agree.
3 - While the participant is reviewing the form, the researcher will set up a laptop for the participant by opening the program for them. The ECO 370 student will ask the participant if they have any questions before beginning the experiment. They will take and file away the consent form. The student will then walk the participant to the first station. Participants in the information treatment group will be asked to read the information on the screen prior to evaluating the products at the first station.
4 - Participants read the directions and begin the experiment, performing two choices per food station.
5 - Christian will be in the lab in case anyone has any issues. He will also be helping participants move from station to station.
6 - When the participant finishes with the experiment, he/she will be able to move to a larger table in order to complete the questionnaire on the same laptop.
7 - When the participant has completed the survey, a member of ECO 370 can then take his/her laptop. The participant will then sign the payment log and receive compensation and the debriefing form before exiting.
APPENDIX I: EXPERIMENT DEBRIEF

Thank you for your participation today.

This study is concerned with the consumer use of seafood labels through conjoint valuation. Conjoint valuation is a method used by environmental economists, behavioral economists, and policy makers in order to understand the extent to which consumers or users value a certain aspect of a good. Previous experiments have been done to see how consumers value attributes such as organic, non-GMO, eco-label certified, and local, and found that consumers are often willing to pay a higher price. We hope to determine whether or not such a price premium exists for similar attributes of shellfish and seaweed.

How was this tested?
In this experiment, you were given 12 pairs of products from which you chose one. Each pair had a different permutation of attributes listed including price. Through statistical analysis we will be able to see how much each attribute is valued based on its selection in relation to other variables. The questionnaire will provide links with socio demographic information and personal characteristics that may help us explain purchase patterns.

Hypotheses and main questions
We expect to find that people are willing to pay more for the labels listed, especially when certified. However, we are interested to see the results of how the labels of farmed products will compare to their wild counterparts.

Why is this important to study?
Conjoint valuation is an increasingly used policy and research tool. It has come to be used by both government agencies and business alike in order to elicit preferences for specific qualities or attributes. In this case, the valuation of seafood labels will help to bridge the gap of information between seafood producers and consumers. In other words, producers will have a better understanding of what consumers desire, and they will be able to help meet their preferences.

What if I want to know more?
If you have any questions about this study, please contact me, Christian Brayden, at william.brayden@maine.edu. You may also reach the faculty advisor on this study, Caroline Noblet, at (207) 581-3172 or caroline.noblet@maine.edu. If you have any questions about your rights as a research participant, please contact Gayle Jones, Special Assistant for Research Administration at (207) 581-1498, or gayle.jones@umit.maine.edu.
APPENDIX J: QUESTIONNAIRE

Sample Information Experiment Message (to be read by half of participants in the ‘information treatment group’ prior to evaluating the product at station 1)

Many of Maine’s seafood products are produced by aquaculture rather than by harvesting wild organisms. Maine aquaculture directly employs X people across Y firms contributing $Z to Maine’s economy. Maine’s ‘farmers on the water’ have an average firm size of A employees.

[Note: Economic impact analysis is being completed by colleague Dr. Todd Gabe. He anticipates being able to share the information with us by April 15.]

What is your current age? _____
How do you identify by gender? M F
What is your household income? $______________
Are there children living in your household? Y N
What are the ages of your children? ___________________
What is your highest level of educational attainment? High school diploma/GED Associate’s degree Bachelor’s degree Master’s degree Doctorate
What is your current employment status? Employed full-time Employed part-time Student Retired Stay at home Unemployed

Please respond to the following questions based on how much you disagree on a scale from 1, strongly disagree, to 7, strongly agree:
I pay more attention to my health than the average person
I am concerned about contamination in seafood
I thoroughly read food labels
I trust scientists to inform me about public health issues
I trust scientists to relay accurate information about environmental issues
I strive to support local businesses
A balanced diet is important to me
I support practices that preserve the environment

How often do you typically purchase seafood?
Every day A few times per week
Once per week A few times per month
Once per month Rarely
Never Other __________
Why do you eat seafood?
Health          Taste
Convenience     Price
Ethics          Dietary restriction
Other __________

What type(s) of seafood do you typically purchase? Please check all that apply.
Fish            Clams
Lobsters        Oysters
Mussels         Crab
Scallops        Sea vegetables
Other __________

From where do you typically purchase your seafood?
Grocery store   Local fish market
Harvester       Restaurant
Other __________

In what form do you usually purchase your seafood?
Frozen-breaded/battered   Frozen-natural
Frozen              Fresh-breaded/battered
Fresh-smoked        Fresh-natural
Other __________
APPENDIX K: OUTPUTS


BIOGRAPHY OF THE AUTHOR

William Christian Brayden III was born in Niskayuna, New York, and graduated from Thornton Academy in Saco, Maine in 2011. Christian attended the College of the Holy Cross in Worcester, Massachusetts, and spent the 2013-2014 academic year abroad as a student at the Université de Bourgogne in Dijon, France. He graduated from the College of the Holy Cross with a Bachelor of Arts in Economics and a minor in French. Christian is a candidate for the Master of Science degree in Resource Economics and Policy from the University of Maine in August 2017.