Consumers' Willingness to Pay for Seafood Attributes:

A Multi-species and Multi-state Comparison

Thong Meas and Wuyang Hu

Department of Agricultural Economics, University of Kentucky

Lexington, KY

thong.meas@uky.edu

wuyang.hu@uky.edu

Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Dallas, TX, February 1-4, 2014.

Abstract

This study surveys consumers' perception of issues in seafood consumption and production and uses choice experiments to investigate consumer preference for the most consumed fish species. Results suggest that consumers were willing to pay positive premiums for fish from U.S. domestic origin and eco-friendly production practices. They were also willing to pay more for fish raised locally and fed with only natural vegetable based feeds. However, for two of the three species examined, there were no premiums found for fresh fish as compared to previously frozen fish. Importantly, comparing wild-caught to farm-raised seafood, the study found no positive willingness to pay, signaling higher acceptance of fish from aquaculture production over time.

Keywords

Consumer Preferences for Seafood, Wild-Caught, Aquaculture, Willingness to Pay, Choice Experiment

JEL Code: Q13

Consumers' Willingness to Pay for Seafood Attributes:

A Multi-species and Multi-state Comparison

Seafood and fish have always been an alternative, often viewed as healthier, source of human diet. However, compared to other animal protein, seafood is also mostly pricey, a factor determining the demand for it. Globally there is an upward trend in fish consumption, as world per capita consumption has doubled over the last five decades (FAO, 2012). Consumption has also always been higher in the developed countries. In the U.S., the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration (NOAA-NMFS, 2010b) estimated that per capita seafood consumption would increase by 4% to 15.8 pounds in 2010 from a decade earlier.

One of the speculated reasons for the increase in seafood consumption has been the rise in supply and lower prices fueled by the expansion of aquaculture production. Based on the State of World Fishery and Aquaculture report (FAO, 2012), total world fisheries production experienced an increase about 12%, from 137.3 million tons in 2006 to 154 million tons in 2011. However, the production growth has mainly been driven by aquaculture (both marine and inland), which grew over 33% from just 47.3 to 63.6 million tons while wild capture remained stagnant at 90 million tons. With the constraints faced by wild seafood supply and the transition to rely more on aquaculture to meet demand, an interesting question attracting much attention in the literature is how consumer preferences for seafood from these two different production sources have evolved over time.

Intensive commercial wild capture and the current shift to intensive marine aquaculture have also fueled the concerns about marine ecology sustainability. The interests in studying the

marketability of farmed seafood using different production have also been on the rise. Not all new product attributes resulted from different aquaculture production practices are desirable for consumers, especially for those consumers who are used to consuming wild fish. In this sense, this study aims to survey consumer's attitudes towards and perceptions of issues related to seafood consumption and production. Furthermore, consumer preferences for a range of seafood attributes resulted from various production methods were studied and willingness to pay (WTP) was estimated through choice experiments.

Our study's contribution to the literature in seafood marketing is twofold. On one hand, the investigation of the use of label and seafood attributes preferred by the consumers helps producers make better labeling decision. On the other, the estimation of consumers' WTP for the designed attributes lends information to assist seafood producers to evaluate the profitability of tailoring seafood features using different production practices.

The article proceeds with a survey of the relevant studies, followed by the brief discussion about the underpinning econometric model used to analyze the data. Next, description of survey design and data collection method is elaborated. The results are presented in two main parts. The first section provides the general findings regarding consumer's consumption behavior and perceptions of issues around seafood purchase and production, while the last compares WTP estimates for seafood attributes of the three different species across the two states examined in this study: Colorado and Florida.

Background

A number of national and regional studies have addressed consumer perceptions of and attitudes toward fish consumption over time (Hanson et. al., 1995; O'Dierno et al., 2006; Whitmarsh and

Palmieri, 2009). There has also been growing interest in investigating consumers' attitudes towards aquaculture and acceptance of farm-raised seafood (Gempesaw II et al., 1995). According to NOAA-NMFS (2010b), over 50% of the seafood consumed in the U.S. was farm-raised. This figure points to the importance of aquaculture as a mean to meet rising demands.

There are growing interests in using country of origin label (COOL) on food products. Proponents of the use of COOL argue that consumers have the right to know where their food comes from (Becker, 1999). Supporters of COOL system also advocate that its use help promote and increase demand of domestically produced products. In the U.S., about 84% of seafood supply was imported (NOAA-NMFS, 2010a), while recent report prepared for Natural Resources Defense Council (Smith et al., 2014) estimated the figure to be up to 91%. Mandatory COOL labeling of wild and farm-raised fish and shellfish was signed into law and due to be implemented starting in 2005 (USDA-AMS, 2004). However, study by Kuchler et al. (2010) using national household data in the U.S. found no impact of the implementation of COOL on household seafood consumption. Preference for COOL was also addressed in this study with the use of a label to differentiate salmon as U.S. domestic or imported.

Ecolabels are voluntarily provided labels, often certified by credible agencies, which convey the environmental impacts from the production, distribution, consumption or use, and disposal of a product (Vitalis, 2002). Concerns about the sustainability of marine fisheries have motivated campaigns to propose seafood ecolabeling as market incentives to encourage sustainable fishery practices, relying of the perception that consumers are environmentally conscious in purchasing. A number of stated preference studies have identified preferences for seafood with eco-friendly label. Johnston et al. (2001) investigated the factors influencing consumers' likelihood of selecting ecolabeled seafood. In a later study, Johnston and Roheim

(2006) found that consumers' choices of species to purchase were influenced by the label indicating whether the species was overfished. Using retail market data, Teilsl et al (2002) found that dolphin-safe label did affect consumers' purchase of canned tuna and increase the products' market share. In this study, consumers' preference for eco-labels was investigated with the use of a fictitious 'Turtle-Safe' label attached to fresh tuna steak.

Interests in and popularity of organic and local food also motivate the investigation of consumer preferences for organic and local aquatic products. Survey by Seafood Choice Alliance (2003) on U.S. consumers in 2001 asked the respondents to rate how much more likely they were to choose organic seafood but found more consumers to be indifferent or less likely to purchase. O'Dierno et al. (2006) surveyed consumers' perceptions on what makes farm-raised seafood organic. In this survey, however, up to 70% of respondents stated their interest in purchasing and willingness to pay for organic seafood. On the other hand, survey by Quagrainie et al. (2008) on Indiana residents suggested that the majority were interested in locally operated aquaculture ranch; however, the prices they stated were only within the market price ranges of the products and the consumers were not willing to pay for any high premiums. Giving these mixed results, we were also interested in examining the preferences for value-added marketing attributes in tilapia fish farming such as being fed with natural feed and raised locally.

Previous research has also examined consumers' attitudes toward fresh and frozen fish. Results from focus group interview by Peavey (1994) showed that several misperceptions have been held against frozen fish, for example, for it being less nutritious and off-cut. For this reason, in the choice experiments, a label indicating whether the fish was fresh (never previously frozen) or previously frozen was included as an attribute for all species.

While consumer preferences have often been examined, few studies have compared preferences for attributes across species and consumers of distinct geographical locations. This study fills the gap in the literature by offering a comparison of consumers' preference and WTP for a range of seafood attributes between three species and two different American states.

Model

Based on the concept introduced by Lancaster (1966), the utilities derived from consuming products having different bundles of attributes differ in the sense that consumers derive their utilities based on the embedded attributes. Consumer choice data can be analyzed using the random utility theory as a framework. In a *n*-choice situation (*n*=1, 2, …, N), consumer *i*'s utility (U_{ijn}) from choosing the *j*-th product (*j*=1, 2, …, J) can be modeled as a linear function of product attributes X_{ijn} (McFadden 1974):

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

where $\boldsymbol{\beta}$ is a vector representing unknown part-worth utilities generated from attributes X_{ijn} of the alternative *j* in choice situation *n*, and ε_{ijn} denotes the random error component of the utility.

In the utility maximizing situation, consumer *i* chooses alternative *j* in the *n*-choice situation only when *j* provides the highest utility compared to the other options available (McFadden, 1974). With the assumptions of independent and identical distribution (*iid*) of the error term (ε_{ijn}) and Independence of Irrelevant Alternatives (IIA) hold, a conditional logit (CL) choice model can be applied to the probability of the *j*-th option being selected as follow:

(2) $$P(Y_{in} = j) = \frac{\exp(X_{ijn}\boldsymbol{\beta})}{\sum_{j=1}^{J}\exp(X_{ijn}\boldsymbol{\beta})} \qquad \text{for } j = 1, 2, \dots, J,$$

where Y_{in} is an indicator variable indicating the option consumer *i* has chosen in the *n*-choice situation. Based on the underlying closed form probability function of the CL model, estimation can be performed using Maximum Likelihood method.

Following the estimation of $\boldsymbol{\beta}$ in the CL model, WTP for an attribute *k* can be calculated as the part-worth utility estimate for the attribute divided by the negative of the marginal utility of income (negative part-worth of price) (Louviere, Hensher and Swait, 2000):

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

Survey and Experimental Design

The survey was designed in two parts to understand respondent's seafood consumption behaviors and estimate WTP for seafood attributes. In the first part of the survey, consumers' consumption habits and preferences for seafood types were identified. The questions asked also include reasons for consuming seafood, the most common species purchased for home consumption and attention to product labels. In addition, some questions to access the acceptance of aquaculture were included, for example, the preference between wild-caught and farm-raised fish.

Choice experiment was used in the second section to elicit preferences for a variety of attributes differentiating the products. The attributes incorporated in the choice design include seafood type (wild-caught, farm-raised, or naturally fed), product form (fresh, previously frozen or live), and country of origin (domestic versus imported), eco-friendly catch practice (Turtle-Safe). The choice data collected were analyzed using a series of discrete choice models to estimate WTP for the various attributes.

Three versions of the choice survey were created and only choice experimental questions for two species (either Salmon-Tuna, Tuna-Tilapia or Salmon-Tilapia) were assigned to each

respondent. This was to avoid survey fatigue and reduce the risk of suboptimal decision making resulted from exposure to too many choice sets. It also helped reduce the total survey time. The sequence of the two types of fish appearing in the survey was randomized to reduce ordering effect. For this reason, the results with respect to WTP are from different subsamples of varying number of respondents. Nonetheless, the choice sets for each species were the same across the four different survey versions.

Table 1 provides descriptions of the levels of attributes presented in the choice sets with respect to each species. Overall four main attributes were included in each seafood product, with two species-wide common attributes (production method and product form), one species-specific attribute (origin, Turtle-Safe or natural feed) and price. Regarding production method, marine fish (salmon and tuna) is typically either farm-raised or wild-caught, while in contrast tilapia is more commonly raised in aquaculture. However, an attribute "produced locally in the state" was used to examine whether consumers favor local production. For production form, the products were identified as being fresh (meaning never been frozen before) or previously frozen. In addition, for tilapia species the preference for purchasing live fish was also studied.

Within species there was also a species specific attribute. For salmon preference for COOL was assessed. Contingent choice situations also allow for hypothetical product attributes to be evaluated. Therefore, for tuna the attribute "Turtle safe" was used as a hypothetical feature to gauge the consumers' environmental conscience when purchasing. Fish labeled as 'Turtle-Safe' can be understood to be from fisheries taking necessary measures to avoid turtle bycatch, which is considered a major threat to the health of a local ecological environment. As for tilapia, the hypothetical "natural vegetable based feed" attribute was also used, referring to fish raised with natural and vegetable-based feed rather than synthetic feed, analogous to organic production

in farming. Irrespective of the species, four price levels were used, based on previously observed retail prices. The price for Tuna was considered to be for sashimi grade steak, as also specified in the choice attribute presented to the respondents.

Fractional factorial design was used to generate product profiles for the three species considered. Following this, two randomly selected hypothetical product profiles were paired, differentiated with respect to a number of attributes. The two product alternatives and a third option of purchasing neither product comprise a complete choice card. The design of including the third option was to ensure that respondents are presented with exhaustive choice situations (Louviere, Hensher and Swait, 2000). During the survey, the respondents were also instructed that, other than the attributes explicitly presented, all other product characteristics are identical.

Based on such design principle, a total of four choice sets each were generated for Salmon and Tuna, while, on the other hand, eight were designed for Tilapia species as it contains more product attribute levels. Therefore, with the combination of any two species in the choice experiment section, each consumer was presented with a total of either eight or twelve choice situations (Louviere, Hensher and Swait, 2000).

Data Collection

The finalized survey questionnaire was administered online, through a Survey Monkey. The survey was delivered in the month of July 2012 to residents in two different U.S. states. For comparison, Colorado and Florida, were chosen based on their contrasting geographical characteristics. Colorado is an inland state with no proximity to marine fishery production while the coastal state Florida was the second largest in terms of both sales and value added generated from seafood production (NOAA-NMFS, 2010a).

A total of 817 respondents completed the survey, of which 407 were from Colorado and the other 410 from Florida. However, the elimination of completed questionnaires with partial incompleteness and ineligibility retained only 778 samples (383 in Colorado and 395 in Florida). Table 2 reports the summary statistics and compares sample and state population demographics. The population statistics were obtained from the 2012 American Community Survey 1-Year Estimates for the state of Colorado and Florida.

The samples in both states very well represented the state population in terms of race (white) and annual household income distribution. However, in Colorado, female respondents were over-sampled by over 10%. On the other hand, the younger age groups were under-represented while the proportion of elderly respondents was comparatively high, which is in contrast with the sampling in Florida. For education attainment, the samples in both states were slightly skewed toward respondents with at least some tertiary training (some college and above). Nevertheless, the samples in both states are comparable to the population.

Perception Survey Results

General Seafood Consumption

Among the total 383 respondents in Colorado and 395 respondents in Florida surveyed, a great majority reported that they consume seafood, 90% and 93% in Colorado and Florida, respectively. Most respondents consume seafood both at home and restaurants, as shown in Table 3. Furthermore, the respondents were asked the main reasons they consume seafood. Table 4 shows that the participants in both states are very similar in terms of why seafood is consumed. The slight majority (53% in both states) reported taste as the foremost factor. Seconded to the superior sensory feature of seafood over meat and poultry, the belief that seafood serves as a

healthier choice of food was cited by about one third of each sample as another reason to choose seafood. This explains the traditional effort by the seafood industry in positioning it as a nutritious alternative (National Research Council, 1989). Furthermore, a small number of respondents (just 5% in each state) held the belief that seafood contains fewer calories than other types of meat per equal size of serving. Note in table 4 the reasons for consuming seafood is highly consistent in both states. What is more, the results are also in line with the study by O'Dierno et al (2006) which observed the same ranking of reasons.

All respondents were also asked to indicate, among a list of most consumed seafood species, the species they had purchased for home consumption during the past two months. The responses were compared to a list of top 10 seafood species consumed by Americans in 2010 published by the National Oceanic and Atmospheric Administration (NOAA-NMFS, 2010b) and are reported in table 5. The ranking of the most purchased species in both states are consistent with that for the U.S. average, particularly for the top four species: shrimp, canned tuna, salmon, and tilapia. However, residents of the Colorado state reported to have purchased more canned tuna, possibly due to lower access to fresh seafood.

Preference between Wild-Caught and Farm-Raised Fish

Previous studies have found that consumers favor wild-caught seafood O'Dierno et al (2006). However, in the sensory study by Drake et al. (2006), salt water farm-raised southern flounder was rated higher than wild-caught fish. In this study, the consumers were asked how often farm-raised fish can be found in their local grocery stores, measured on a five-point Likert scale ranging from never to always, with an extra option to indicate being unsure. As reported in table 6, about 42% (in Colorado) and 44% (in Florida) of respondents reported frequent availability of

aqua-cultured fish (from most of the time to always). Surprisingly, however, approximately one third of the surveyed consumers in each state reported being unsure. One possible explanation for this is the ignorance of this production feature when purchasing seafood.

The consumers were also asked what type of seafood they prefer the most, be it wild-caught, raised in marine aquaculture or farmed in inland aquaculture. It was found that, similarly in both states, about 40% of respondents prefer wild-caught seafood; however, a slightly greater percentage of consumers indicated no preference at all. Only 16% to 19% of residents in Colorado and Florida, respectively, showed preference for marine- and land-based aquaculture, with the latter the least preferred (just under 5% in each state), as presented in table 7. Furthermore, respondents were asked to specify the reason shaping their preference. The majority who prefer wild-caught seafood cited taste as their main reason, followed by food safety issues and concerns of environmental pollution's effect on farmed fish. This result implies that aquaculture practices have not yet fully earned general consumer confidence.

In a separate question, consumers were enquired whether they are able to differentiate between wild and farmed fish without the aid of labels, either before or after consumption. It was shown in table 8 that only one third of Colorado respondents (33%) to 43% of Florida consumers were able to distinguish between the two differently sourced fish.

Questions were asked about which type of product (wild-caught, farm-raised, both or no purchase) the respondents have purchased for each of the species considered in this study. For tuna, questions for both canned tuna and fresh tuna steak were asked. The responses are summarized and presented in table 9. The responses for each species were very similar in both states. For those who have bought the species, both types of seafood have been chosen. However, in general, consumers purchasing wild-caught salmon and tuna (both canned and

fresh) outnumbered those choosing farm-raised fish. In contrast, for the highly aqua-cultured tilapia species, farmed fish was more frequently purchased. Note also in this table that a sizable percentage of respondents (similarly in the two states) indicated that they were not sure whether their purchased seafood was wild-caught or farm-raised.

Attention to Labels and Their Influence

Product labels have been important in revealing inherent attributes or information that aid consumers to make purchase decision. A few questions were also used to assess whether the surveyed respondents pay attention to seafood labeling. With respect to COOL, consumers were asked whether they have noticed COOL or domestic or imported labels. Similar responses have been recorded for residents in both states, with the majority (56% to 58%) paying no attention to such labels. This suggests that the effect of COOL on most of the consumers' buying decision is still minimal. Only about 28% of respondents claimed to have notices this kind of label although over 80% of surveyed consumers have purchased seafood for home consumption.

Likewise, they were also asked whether they have ever noticed label indicating seafood as being from the wild or farm. The result shows that over half of the Colorado residents sampled have noted such label, while just over one third had not. In Florida, however, the proportion of residents having and having not noticed the label were about equal (45% vs 43%). Given the collected responses on the two questions, reported in table 10, it can be inferred that production label plays a much more important role than COOL in consumers' purchasing decision.

Lastly, the consumers were also asked to indicate how much their purchasing decision is influenced by the two aforementioned labels, on a five-point scale from 1(Not at all) to 5 (Very much). The result, also reported in table 11, shows high similarity between perceptions of

residents of the two states. The majority (about one third) rated label influence at a medium level, and the mean score for each state was close to 2.85.

Choice Experiment Results

Part-worth Utility

The choice data collected from the conjoint experiment part of the survey were analyzed using CL model. Initially the data collected in both states were pooled together and only one single model was estimated for each distinct species, assuming no difference exists between the two groups of residents. However, this assumption was rejected based on the log-likelihood tests performed on the pooled data. Therefore, separate models were specified for consumer data in the two states, resulting in a total of six model estimations (two states × three species).

The estimated part-worth utilities coefficients of the six CL models are reported in table 12. The McFadden's LRI statistics reported from 0.05 to 0.11 are considered acceptable. Except for tilapia, the total number of respondents participated in the choice experiment varies across species. However, more than 250 consumers were surveyed for all species. On the other hand, the estimated coefficients are also fairly consistent for each species across states, and most of the part-worth utilities estimates are statistically significant at 1% level.

A binary variable 'Buy Neither' included in the model represent the third option in the choice set design which allows the consumer to choose not to purchase either product. The part-worth estimates for this variable were negative and significantly different from zero for all species, implying decreases in utilities if the surveyed respondents choose not to purchase. It also suggests most of the consumers choose to purchase the seafood presented. Price variables were also significant in all models, except differing in magnitude. The negative sign of all coefficient

estimates was also consistent with economic theory. As price of the fish products presented increases higher, the less likely they will be chosen or purchased.

The wild-caught attribute used in the models was evaluated against farm-raised. For salmon, surprisingly the estimate for wild-caught attribute was not significant in the Colorado model, suggesting that the average consumers in the states were indifferent between purchasing wild or farmed salmon. Contradictory, for residents of Florida, the estimate was significant but negative. The negative direction of this variable implies that seafood labeled as from the wild was less likely to be selected compared to farmed fish. This finding appears counterintuitive, given that a great number of respondents stated their preference for wild-caught seafood in the perception survey section. Recall that in the perception survey section only from 30% to 40% of consumers were able to differentiate between the two types of products. This suggests that the majority may not prefer pricey wild-caught fish. Similar results are also obtained for the estimates in the two tuna models, with both coefficients being negative and significant.

In terms of product form, it appears that the preference for fresh or previously frozen seafood is dependent on species. This can be seen from the part-worth estimates for the variable 'Previously Frozen' incorporated in the model, which was compared to the attribute of being fresh (never frozen before). For salmon and tuna, this variable was estimated to be insignificant, suggesting no particular preference was found between fresh and previously frozen. However, as indicated by the negative but significant coefficient in both tilapia models, previously frozen tilapia was less likely to be selected than fresh fish. Also for tilapia, the preference for live fish was assessed through the variable 'Live', as compared to fresh fish. However, it was found that consumers in both states were more in favor of fresh fish, unarguably due to the habits of purchasing and handling only prepared meat.

The last attribute assessed for the salmon species was the production origin label denoting whether the fish was sourced from domestic or foreign origins. This was represented by the variable 'Imported' as opposed to 'U.S. Domestic'. The result shows that the consumers did not prefer imported salmon. Or, they were more likely to choose fish from the domestic U.S..

The study also elicited respondents' preference for eco-friendly fishery practices through the use of a label stating that the fish was from harvest under stringent practice to avoid marine animal bycatch, such as turtles. The label was represented by a 'Turtle Safe' variable included in the tuna model. Significant and positive coefficient was estimated in the models in both states. Such result implies that the average consumers were also environmentally conscious when it comes to purchasing seafood.

On the other hand, for aquaculture, the preferences for non-conventional production methods such as local production and using feed from naturally ingredients were also investigated. Consistent estimates obtained in the two models for tilapia also clearly suggest that consumers were more likely to choose the fish claimed to be raised locally and fed with natural vegetable based feed. This result is not surprising given the current supporting local trend and tendency to source safer food produced with organic inputs or minimal chemical ingredients.

Willingness to Pay

Willingness to pay for each attribute is presented in table 13. Following the procedure described in Krinsky and Robb (1986), the mean WTP estimates and their respective standard errors were calculated with 10,000 iterations. The WTP measures for wild-caught range from negative 2.98 to 6.69 USD per pound. This should only be interpreted as the unwillingness to pay higher price for wild-caught salmon and tuna steak compared to the farm-raised fish. Estimates for

'Previously Frozen' attributes reported in table 13 for salmon and tuna species were not significantly different from zero. This, as discussed in the previous section, means that the consumers do not discount previously frozen fish and neither were they willing to pay more for fresh fish. However, for tilapia, previously frozen fish was discounted by 2.67 USD per pound in Colorado and up to 4.47 USD in Florida as opposed to fresh fish, suggesting a particular preference for this fish species.

Also reported in in table 13, it can be seen that the consumers were willing to pay a premium for domestically sourced fish. The negative premiums for imported salmon ranged from 4 to over 6 USD per pound. This can be interpreted as an equal amount of premium of 4 to 6 USD per pound for domestic salmon. The respondents were also willing to pay positive premiums for other labels, for example, up to 4.52 USD per pound for 'Turtle-Safe' label in Colorado. Sizable premiums of about 4 to 5 USD per pound were also evident for the local production claim attached to tilapia fish. However, although significantly above zero, the WTP measures for fish fed with natural vegetable-based feed were not large (53 cents to 1.09 dollars). On the other hand, compared to fresh but prepared tilapia, live fish was discounted by 1.89 to 2.48 USD per pound due possibly to the inconvenience associated with handling live fish.

Conclusion

This study surveys consumer perceptions on issues related to fishery and seafood production and consumer preferences for a range of seafood attributes. The results show that consumers' seafood consumption habits and attitudes were fairly similar across the two geographically distinct states, and were also consistent with findings from previous studies. The great majority of respondents consume seafood, for that it tastes better and is a healthier choice of animal protein. Generally,

wild-caught fish was preferred to farm-raised because it tastes better. Nonetheless, more respondents stated they were unsure or could not differentiate between these two types of seafood and indicated that they purchase both. With respect to labels, only less than 30% of respondents said they have noticed COOL when shopping seafood but over half have noted production label indicating whether the fish was wild-caught or farm-raised.

Consumer preferences and WTP for a number of seafood attributes were investigated using choice experiments. Surprisingly, results of the estimated CL models shows that facing hypothetical choices the consumers did not particularly favor wild-caught salmon or tuna. They did not particularly prefer fresh to previously frozen seafood either, except for tilapia. However, the results show that the surveyed respondents were willing to pay considerable premiums for seafood with Country of Origin and fictitious 'Turtle-Safe' labels. Furthermore, fish raised locally or fed with only natural based feeds was also preferred.

Findings from this study provide better understanding about current consumers' attitudes and perceptions. Such knowledge is useful in aiding seafood producers or marketers to operate more efficiently in the ever evolving industry toward more aquaculture based. Results of our stated choice preference study and WTP estimation also provide valuable information to assess the potential of developing and offering new seafood with the desirable attributes found.

References

Becker, G.S. *Country-of-Origin Labeling for Foods: Current Law and Proposed Changes.* Washington, DC: The Committee for the national Institute for the Environment, October 21, 1999.

Drake, S.L., M.A. Drake, H.V. Daniels, and M.D. Yates. “Sensory Properties of Wild and Aquacultured Southern Flounder.” *Journal of Sensory Studies*, 21(2006): 218-227.

FAO Fisheries and Aquaculture Department. *The State of World Fisheries and Aquaculture 2012*. Rome, 2012.

Gempesaw, C.M., R. Bacon, C.R. Wessells, and A. Manalo. "Consumer perceptions of aquaculture products." *American Journal of Agricultural Economics* 77, no. 5 (1995): 1306-1312.

Hanson, G.D., R.O. Herrmann, and J.W. Dunn. "Determinants of seafood purchase behavior: consumers, restaurants, and grocery stores."*American Journal of Agricultural Economics* 77, no. 5 (1995): 1301-1305.

Johnston, R.J., and C.A. Roheim. "A battle of taste and environmental convictions for ecolabeled seafood: A contingent ranking experiment." *Journal of Agricultural and Resource Economics* (2006): 283-300.

Johnston, R.J., C.R. Wessells, H. Donath, and F. Asche. "Measuring consumer preferences for ecolabeled seafood: an international comparison." *Journal of Agricultural and Resource Economics* (2001): 20-39.

Kuchler, F., B. Krissoff, and D. Harvey. "Do Consumers Respond to Country-of-Origin Labelling?." *Journal of Consumer Policy* 33, no. 4 (2010): 323-337.

Lancaster, K.J. “A new approach to consumer theory.” *Journal of Political Economy* 74(1966):132-157.

Louviere, J.J., D.A. Hensher, and J.D. Swait. *Stated Choice Methods: Analysis and applications.* Cambridge University Press, 2000.

McFadden, D. “Frontiers in econometrics.” In P. Zarembka, ed. *Conditional Logit Analysis of Qualitative Choice Behavior.* New York, NY: Academic Press, 1974.

National Marine Fisheries Service (NMFS) Office of Science and Technology. *Fisheries Economics of the United States, 2009*. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-F/SPO-118, 172p, 2010a. Internet site: https://www.st.nmfs.noaa.gov/st5/publication/index.html. (Accessed January 05, 2013).

National Marine Fisheries Service (NMFS) Office of Science and Technology. *Fisheries of the United States 2009*.Silver Spring, MD, 2010b. Internet site: http://www.st.nmfs.noaa.gov/st1/fus/fus09/index.html. (Accessed August 10, 2013).

National Research Council (U.S.) Committee on Diet and Health. *Diet and Health: Implications for Reducing Chronic Disease Risk.* Academic Press, Washington, DC, 1989.

O’Dierno, L., R. Govindasamy, V. Puduri, J.J. Myers, and S. Islam. “Consumer Perceptions and Preferences for Organic Aquatic Products: Results from the Telephone Survey.” New Jersey Agricultural Experiment Station, Rutgers University Department of Agricultural, Food and Resource Economics (2006): 1-5.

Peavey, S., T. Work, and J. Riley. "Consumer attitudes toward fresh and frozen fish." *Journal of Aquatic Food Product Technology* 3, no. 2 (1994): 71-87.

Quagrainie, K., S. Hart, and P. Brown. "Consumer acceptance of locally grown food: The case of Indiana aquaculture products." *Aquaculture Economics & Management* 12, no. 1 (2008): 54-70.

Seafood Choices Alliance. *U.S. Marketplace: Growing Appetites and Shrinking Seas*. Internet site: http://www.seafoodchoices.com/resources/documents/SCA_report_final.pdf (Accessed January 10, 2014).

Smith, Z., M. Gilroy, M. Eisenson, E. Schnettler and S. Stefanski. *Net Loss: The Killing of Marine Mammals in Foreign Fisheries*. New York, NY: National Research Defense Council Report, 2014.

Teisl, M.F., B. Roe, and R.L. Hicks. "Can eco-labels tune a market? Evidence from dolphin-safe labeling." *Journal of Environmental Economics and Management* 43, no. 3 (2002): 339-359.

U.S. Department of Agriculture—Agricultural Marketing Service. "Country of Origin Labeling." Internet site: http://www.ams.usda.gov/AMSv1.0/COOL (Accessed January 05, 2013).

Vitalis V. *Roundtable on Sustainable Development – Private Voluntary Eco-labels: Trade Distorting, Discriminatory and Environmentally Disappointing*. Paris: OECD, 18 pp, 2002

Whitmarsh, D. and M. Giovanna Palmieri. "Social acceptability of marine aquaculture: The use of survey-based methods for eliciting public and stakeholder preferences." *Marine Policy*, 33(2009): 452-457

Table 1. Product Attributes Used in the Conjoint Experiment

Seafood Type	Attribute	Level	Description
Salmon	Production Method	2	Wild-Caught
			Farm-Raised
	Product Form	2	Previously frozen
			Fresh (never frozen)
	Origin	2	Foreign Import
			U.S. Domestic
	Price/lb[1]	4	4.99
			6.99
			8.99
			10.99
Tuna	Production Method	2	Wild-Caught
			Farm-Raised
	Product Form	2	Fresh (never frozen)
			Previously frozen
	Turtle Safe	2	Yes
			No
	Price/lb[1,2]	4	8.99
			14.49
			19.99
			25.49
Tilapia	Locally Produced (in the state)	2	Yes
			No
	Product Form	3	Live
			Previously frozen
			Fresh (never frozen)
	Natural Vegetable-based Feed	2	Yes
			No
	Price/lb[1]	4	1.99
			3.99
			5.99
			7.99

[1]Based on observed retail prices

[2]Tuna prices reflect sashimi grade tuna

Table 2. Summary statistics of socio-demographic characteristics

	Colorado		Florida	
	Sample	State	Sample	State
Number	385	5,187,582	393	19,317,568
Sex (%)				
Female	63.1	49.9	49.1	51.1
Race (%)				
White	88.1	84.4	74.1	76.3
Age (%)				
18 to 19 years	1.8	3.7	2.3	3.2
20 to 24 years	1.6	9.2	5.1	8.6
25 to 34 years	7.3	19.1	18.8	15.5
35 to 44 years	15.1	17.9	24.4	15.7
45 to 54 years	22.6	18.3	21.6	17.9
55 to 64 years	26.0	16.2	9.9	16.1
65 to 74 years	20.5	9.1	7.9	12.4
75 to 84 years	3.9	4.5	8.1	7.3
85 years and over	1.3	1.9	1.8	3.2
Educational attainment (%)*				
Not a high school graduate	0.0	9.4	1.8	13.5
High school graduate (includes equivalency)	11.2	21.8	20.0	29.8
Some college, no degree	33.1	22.9	21.8	20.8
Associate's degree	8.9	8.4	14.4	9.2
Bachelor's degree	31.5	23.8	27.7	17.3
Graduate or professional degree	15.4	13.7	14.4	9.6
Household Income (%)**				
Below $14,999	6.6	10.9	10.9	14.3
$15,000 to $24,999	12.0	9.8	10.9	12.8
$25,000 to $49,999	24.3	23.3	29.8	27.3
$50,000 to $74,999	24.9	18.6	21.7	17.9
$75,000 to $99,999	17.7	13.1	15.0	10.6
$100,000 to $149,999	10.6	13.9	8.6	10.2
Above $150,000	4.0	10.4	3.1	6.9
Mean household income (dollars)	-	76,489	-	64,229
Median household income (dollars)		56,765		45,040

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

* Population 25 years and over

** In 2012 inflation-adjusted dollars

Table 3. Seafood Consumption

	Colorado (N=385)		Florida (N=393)	
	Frequency	**Percent**	**Frequency**	**Percent**
At home only	31	8.1	47	12.0
At restaurants only	43	11.2	31	7.9
At home and restaurants	271	70.4	288	73.3
Not at all	40	10.4	27	6.9

Table 4. Reasons for Consuming Seafood

	Colorado (N=345)		Florida (N=366)	
	Frequency	**Percent**	**Frequency**	**Percent**
Taste	184	53.3	193	52.7
I believe seafood is healthier than other types of meat	108	31.3	123	33.6
I believe seafood has fewer calories than other types of meat	19	5.5	19	5.2
Preparation (i.e., seafood is easy to prepare)	5	1.4	5	1.4
Cultural tradition	3	0.9	2	0.5
Unsure	18	5.2	18	4.9
Other, please specify	48	13.9	33	9.0

Table 5. Most Consumed Seafood

Top 10 Seafood consumed in the U.S. in 2010*	Colorado (N=345)			Florida (N=366)		
	Species	**Frequency**	**Percent**	**Species**	**Frequency**	**Percent**
Shrimp	Canned Tuna	206	59.7	Shrimp	242	66.1
Canned Tuna	Shrimp	202	58.6	Canned Tuna	217	59.3
Salmon	Salmon	154	44.6	Salmon	166	45.4
Tilapia	Tilapia	113	32.8	Tilapia	164	44.8
Pollock	Crab	80	23.2	Crab	106	29.0
Catfish	Cod	51	14.8	Scallops	82	22.4
Crab	Scallops	50	14.5	Catfish	55	15.0
Cod	Catfish	38	11.0	Claims	54	14.8
Pangasius	Claims	37	10.7	Fresh Tuna	47	12.8
Clams	Fresh Tuna	29	8.4	Cod	50	13.7
	Pollock	15	4.3	Pollock	19	5.2
	Other	99	28.7	Other	74	20.2

* Based on NOAA's statistics, Accessed December 10, 2013 at http://www.nmfs.noaa.gov/aquaculture/faqs/faq_seafood_health.html#8what

Table 6. Availability of Farm-Raised Seafood

	Colorado (N=385)		Florida (N=393)	
	Frequency	**Percent**	**Frequency**	**Percent**
Always	68	17.7	67	17.05
Most of the time	95	24.7	106	26.97
Occasionally	64	16.6	67	17.05
Never	17	4.4	28	7.12
Unsure	141	36.6	125	31.81

Table 7. Seafood Preferences and Reasons

	Preference				
Reason	**Wild Catch**	**Marine Aquaculture**	**Land-based Aquaculture**	**Unsure / don't know**	**Total**
Colorado (N=385)					
Environmental issues	16	4	4	2	26
Natural resource uses	16	9	2	0	27
Taste	81	11	3	3	98
Food safety standards	17	10	4	3	34
Price	3	8	1	7	19
Habit/tradition	9	1	2	1	13
Unsure/don't know	9	1	0	132	142
Other, please specify	8	0	0	18	26
Total	159	44	16	166	385
	41.3%	11.4%	4.2%	43.1%	
Florida (N=393)					
Environmental issues	16	8	3	4	31
Natural resource uses	10	10	1	1	22
Taste	81	18	7	3	109
Food safety standards	14	4	5	3	26
Price	2	7	1	9	19
Habit/tradition	19	6	0	1	26
Unsure/don't know	9	3	1	128	141
Other, please specify	4	0	0	15	19
Total	155	56	18	164	393
	39.4%	14.3%	4.6%	41.7%	

Table 8. Ability to Differentiate Between Wild Fish and Aquaculture/Farm-Raised Fish

	Colorado (N=385)		Florida (N=393)	
	Frequency	**Percent**	**Frequency**	**Percent**
Always	12	3.1	31	7.9
Most of the time	45	11.7	49	12.5
Sometimes	69	17.9	88	22.4
Rarely	61	15.8	47	12.0
Never	66	17.1	62	15.8
Unsure/don't know	132	34.3	116	29.5

Table 9. Preference between Wild-Caught and Farm-Raised Fish, by Species

	Colorado (N=385)		Florida (N=393)	
	Frequency	**Percent**	**Frequency**	**Percent**
Salmon				
Wild -Caught Only	62	16.1	57	14.5
Farm-Raised Only	17	4.4	31	7.9
Both	142	36.9	139	35.4
Neither	96	24.9	92	23.4
Unsure	68	17.7	74	18.8
Tilapia				
Wild -Caught Only	28	7.3	39	9.9
Farm-Raised Only	67	17.4	68	17.3
Both	58	15.1	96	24.4
Neither	125	32.5	96	24.4
Unsure	107	27.8	94	23.9
Canned Tuna				
Wild -Caught Only	49	12.7	64	16.3
Farm-Raised Only	19	4.9	20	5.1
Both	66	17.1	92	23.4
Neither	59	15.3	49	12.5
Unsure	192	49.9	168	42.8
Fresh Tuna				
Wild -Caught Only	44	11.4	68	17.3
Farm-Raised Only	9	2.3	14	3.6
Both	40	10.4	64	16.3
Neither	189	49.1	144	36.6
Unsure	103	26.8	103	26.2

Table 10. Product Types Purchased for Home Consumption, by Species

	Colorado (N=385)		Florida (N=393)	
	Frequency	**Percent**	**Frequency**	**Percent**
Salmon				
Wild -Caught Only	62	16.1	57	14.5
Farm-Raised Only	17	4.4	31	7.9
Both	142	36.9	139	35.4
Neither	96	24.9	92	23.4
Unsure	68	17.7	74	18.8
Tilapia				
Wild -Caught Only	28	7.3	39	9.9
Farm-Raised Only	67	17.4	68	17.3
Both	58	15.1	96	24.4
Neither	125	32.5	96	24.4
Unsure	107	27.8	94	23.9
Canned Tuna				
Wild -Caught Only	49	12.7	64	16.3
Farm-Raised Only	19	4.9	20	5.1
Both	66	17.1	92	23.4
Neither	59	15.3	49	12.5
Unsure	192	49.9	168	42.8
Fresh Tuna				
Wild -Caught Only	44	11.4	68	17.3
Farm-Raised Only	9	2.3	14	3.6
Both	40	10.4	64	16.3
Neither	189	49.1	144	36.6
Unsure	103	26.8	103	26.2

Table 11. Attention to Labels and Their Influence

	Colorado (N=385)		Florida (N=393)	
	Frequency	**Percent**	**Frequency**	**Percent**
Notice of Country-of-Origin Label				
Yes	108	28.1	111	28.2
No	214	55.6	226	57.5
Unsure/Do not know	63	16.4	56	14.3
Notice of Production Label				
Yes	204	53.0	175	44.5
No	135	35.1	169	43.0
Unsure/Do not know	46	12.0	49	12.5
Label Influence				
Not at all	62	16.1	70	17.8
Low	74	19.2	78	19.9
Medium	129	33.5	136	34.6
High	86	22.3	66	16.8
Very much	34	8.8	43	10.9

Table 12. Utility Function Parameter Estimates

Variable	Colorado			Florida		
	Coefficient		Standard Error	Coefficient		Standard Error
Salmon						
Buy Neither	-1.667	***	0.152	-1.449	***	0.142
Price	-0.129	***	0.013	-0.100	***	0.013
Wild-Caught	0.106		0.115	-0.289	***	0.109
Previously Frozen	-0.126		0.114	-0.077		0.111
Imported	-0.529	***	0.107	-0.613	***	0.109
Number of respondents	254			263		
Number of observations	1016			1052		
Log-likelihood function	-1024			-1066		
McFadden's LRI	0.082			0.078		
Tuna						
Buy Neither	-0.806	***	0.175	-1.176	***	0.175
Price	-0.082	***	0.009	-0.066	***	0.009
Wild-Caught	-0.255	**	0.112	-0.430	***	0.108
Previously Frozen	-0.038		0.101	-0.080		0.098
Turtle-Safe	0.371	***	0.111	0.257	**	0.105
Number of respondents	255			263		
Number of observations	1020			1052		
Log-likelihood function	-1035			-1096		
McFadden's LRI	0.077			0.049		
Tilapia						
Buy Neither	-1.136	***	0.108	-1.480	***	0.110
Price	-0.226	***	0.015	-0.170	***	0.014
Locally Raised	0.862	***	0.078	0.890	***	0.074
Fed with Natural Feed	0.120	*	0.072	0.184	***	0.069
Live	-0.556	***	0.081	-0.317	***	0.079
Previously Frozen	-0.602	***	0.093	-0.758	***	0.086
Number of respondents	522			263		
Number of observations	2088			1052		
Log-likelihood function	-2047			-2093		
McFadden's LRI	0.108			0.088		

Note: Asterisks *, ** and *** denote variables significant at 10%, 5% and 1% level, respectively.

Table 13. Mean WTP Estimates (USD/Pound)

Variable	Colorado		Florida	
	Coefficient	Standard Error	Coefficient	Standard Error
Salmon				
Buy Neither	-12.99	1.05	-14.72	1.66
Wild-Caught	0.00 [a]	0.87	-2.98	1.31
Previously Frozen	0.00 [a]	0.88	0.00 [a]	1.13
Imported	-4.17	1.02	-6.32	1.55
Tuna				
Buy Neither	-9.72	1.51	-17.87	2.17
Wild-Caught	-3.14	1.50	-6.69	2.25
Previously Frozen	0.00 [a]	1.25	0.00 [a]	1.51
Turtle-Safe	4.52	1.34	3.89	1.58
Tilapia				
Buy Neither	-5.03	0.41	-8.71	0.68
Locally Raised	3.83	0.29	5.25	0.45
Fed with Natural Feed	0.53	0.32	1.09	0.44
Live	-2.48	0.43	-1.89	0.55
Previously Frozen	-2.67	0.45	-4.47	0.63

[a] denotes the part-worth utility estimate was not significantly different from zero.