Consumer Demand for North Carolina Seafood: The Choice Experiment Analysis

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Overview

Consumer demand for North Carolina seafood was estimated to further evaluate the total economic impact of the state's seafood industry. A survey of N.C. residents was conducted to determine current consumption of seafood and demand for N.C. seafood products. Ultimately, these data helped to inform the economic impact analysis.

The seafood consumer survey consisted of a questionnaire and a choice experiment. The questionnaire obtained data on consumer demographics, seafood product perceptions, and seafood product consumption behavior including frequencies and sourcing of seafood purchases. The choice experiment component was used to determine consumer willingness-to-pay (WTP) for N.C. seafood. Choice experiments are often used to determine WTP for food attributes, and have helped determine preferences with regards to local seafood (Davidson et al. 2012; Fonner and Sylvia 2014; Jaffrey et al. 2004; Roheim et al. 2012; Ropicki et al. 2010; Rudd et al. 2011; Sun et al. 2017). In choice experiments survey respondents are provided with several potential menus of food items and attributes as well as prices, and are instructed to choose the most desirable item. By comparing responses over many such menus, we can deduce the implied value the consumer is placing on various attributes like product origin.

The seafood consumer survey answered questions like the following:

- How often do NC consumers eat seafood at home? At a restaurant?
- Where do NC consumers purchase seafood? Grocery stores, specialty markets, casual dining establishments, formal restaurants?
- Are NC consumers aware of the origins of the seafood they eat?
- How do NC consumers' perceptions of seafood vary based on geographic source of product, environmental perceptions, and aspects related to quality or freshness?

Choice Experiment Design

The seafood consumer survey was designed by applying lessons learned from discrete choice experiments (Holmes, Adamowicz and Carlsson 2017). A discrete choice experiment involves survey respondents choosing a good among two or more alternatives that vary in attributes, in this case choosing among seafood products that varied by the information on their labels. Willingness to pay for the seafood product with specific attributes can then be calculated.

Choice experiments were crafted for two seafood products: shrimp and flounder. Only survey respondents that said they enjoy eating shrimp or flounder were presented with the choice experiments for each respective seafood product. The shrimp product was described as large in size, meaning there are 21-25 shrimp per pound. The flounder product was fillets.

Respondents were asked about their purchasing decisions for these two products at a hypothetical grocery store seafood counter. They were asked how many pounds of each seafood product they would typically purchase and then asked to make a sequence of choices between paired product profiles. In each choice, respondents had two seafood options that differed by the information on their labels. We consider four attributes that influence a purchase decision: origin, sustainable label, wild-caught label, and price.

- Harvest location: State or country of origin
- A wild-caught label confirms the seafood was caught in open waters, not farmed
- A sustainable seafood label confirms the seafood has been harvested by fishermen who follow rules that conserve fish populations and protect the habitats they live in
- Price (before taxes)

If neither product was satisfactory to the participant, they could choose not to make a purchase.

The attribute origin has three levels or categories, sustainable label has two levels, wild-caught label has two levels, and price has five levels. Table 1 displays the attributes and levels for the shrimp and flounder products. The levels are the same for each attribute except for origin. Origin varies by seafood product for realism. Shrimp is likely to be sourced from places other than North Carolina like China and Louisiana whereas flounder is likely to be sourced from places other than North Carolina like Iceland and Florida. A foreign and other state origin were chosen for both seafood products to determine how important domestic (U.S.) sourced seafood is relative to N.C. sourced seafood for survey respondents.

Table 1. Attributes and levels for seafood choice experiments

Attribute	**Levels for shrimp**	**Levels for flounder**
Origin	China, Louisiana, North Carolina	Iceland, Florida, North Carolina
Sustainable label	No, Yes	No, Yes
Wild-caught label	No, Yes	No, Yes
Price	$7, $11, $13, $15, $19 per pound	$7, $11, $13, $15, $19 per pound

Survey respondents were presented with 5 shrimp and 5 flounder choices to reduce cognitive burden. The number of possible combinations of attribute levels, called the full factorial design, results in a matrix of 3x2x2x5=60 rows. These can be combined into (60*59)/2=1,770 pairs, which is not practical for survey respondents to compare.

In determining which seafood choice sets to present to respondents, consider that the conditional logit probability that consumer i chooses seafood alternative j is:

$$P_{ij} = \frac{exp(x_{ij}'\beta)}{\sum_{j=1}^{J} exp(x_{ij}'\beta)}$$

The goal of the analysis is to estimate β, which represents the weight the respondents give to the different attributes in the experiment. We aim to construct the choice sets in such a way as to maximize the precision of the estimates of β. The precision of the estimates is reflected by the variance-covariance matrix Ω of the estimated coefficients.

The most commonly used efficiency measure is D-efficiency:

$$[|\Omega|^{1/K}]^{-1}$$

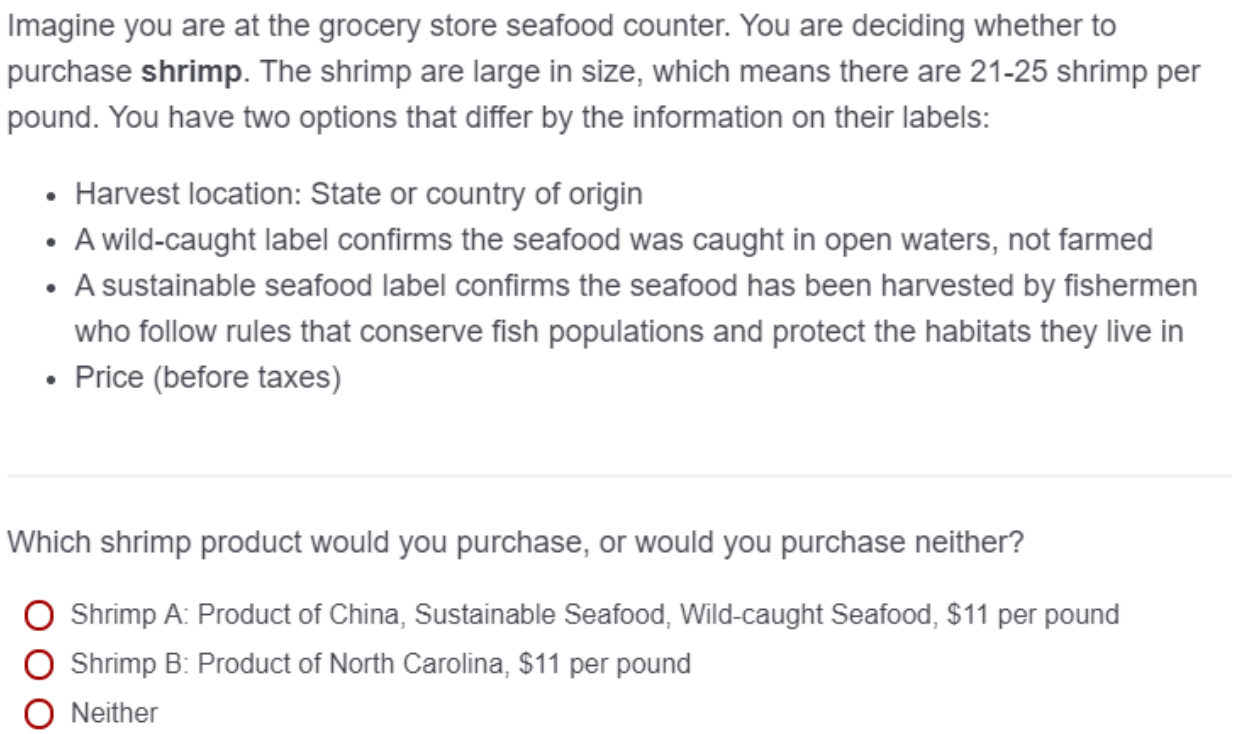
Where K is the number of parameters in the model. The goal is to find a design that maximizes D-efficiency or, equivalently, minimizes the D-error.

Each respondent was presented a series of five choices containing two seafood alternatives, as well as the opportunity to not purchase the seafood product. Prior to administering the survey, we developed an orthogonal choice matrix to minimize the prediction error (D-error) of the model. We generated a fractional factorial using the dcreate package implemented in Stata (Hole 2015). To maximize the information recovered from the survey, we specified 20 unique choice cards to be selected. We then blocked the resulting design into four blocks. The final stage in the experimental design involves randomly selecting respondents into one of the four question blocks, leaving each respondent with five choices. An example of a shrimp choice is in Figure 1.

The choice card design intentionally includes attribute level overlap. A design with no overlap is often the most efficient design, that is, assuming that respondents do not use simplifying heuristics. However, if a respondent is primarily motivated by seafood origin or price, they may dismiss the sustainable or wild-caught seafood labels for example. Attribute level overlap discourages the use of dominant strategies and can render simplifying strategies unnecessary, which significantly reduces non-attendance (Jonker et al. 2018). An interaction effect between seafood origin and price was included in the dcreate command so that respondents may have had to choose between two shrimp products of the same origin, or two products of the same price.

Throughout the development of the D-efficient design, we imposed several conditions following Parthum and Ando (2019). Non-ambiguous strictly dominated strategies were removed by imposing a no-free-lunch condition (improvement in any attribute will come at a non-zero cost) and a welfare improving restriction (no improvement across all attributes cannot come at a cost).

Figure 1. An example of a shrimp choice question



Choice Experiment Analysis

The modeling approach is based on McFadden's (1974) random utility model. When a seafood consumer chooses which type of seafood they want, they reveal which features they value relative to others. In the case of shrimp, we specify consumer i's utility of selecting shrimp choice j in choice option s as follows:

$$U_{i\,js} = \beta_1 \cdot Louisiana_{ij} + \beta_2 \cdot North\ Carolina_{ij} + \beta_3 \cdot China_{ij} + \beta_4 \cdot Sustainable_{ij} + \beta_5 \cdot Wildcaught_{ij} + \beta_6 \cdot Price_{ij} + \varepsilon_{ijs}$$

Where the βth parameters represent the marginal utilities associated with the product's attributes and ε_{ijs} is the unobserved portion of the utility function. $Louisiana$, $North\ Carolina$ and *China* are dummy variables for the attribute origin.

A conditional logit model with clustered standard errors was estimated as the base model. In addition a latent class logit model was estimated which avoids the three primary limitations of the standard multinomial logit model by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors over time (Hensher et al. 2015). By dividing the parameter estimates of each attribute by the price parameter, and then multiplying that value by -1, we can convert the parameter estimates from utility space to WTP space. The latent class model allows us to differentiate among different types of consumers.

Survey Design

An internet survey sample was obtained via an online panel administered by the firm Survey Sampling International, with the intent to survey North Carolina residents that eat seafood. Respondents are selected among those who register to participate in their online surveys and polls (Baker et al. 2010). The sample is also selected to be representative of NC geographies, and gender and racial/ethnic composition. The survey was fielded online in March 2020 using the Qualtrics platform. The survey instrument can be viewed here: go.ncsu.edu/seafoodsurvey.

We received 1,607 responses. After removing individuals with item-nonresponse, about 1,400 remain for each survey question.

The survey begins with a description of the research study, explaining that the purpose is to gain a better understanding of the demand for North Carolina seafood. Respondents are told that their answers will help North Carolina's seafood industry learn how demand for seafood is currently being met, as well as the potential for serving more markets inland from the coast. They are also told their answers will provide insight for how their experience preparing and eating North Carolina seafood could be improved. The description explains that the study is funded by the N.C. Commercial Fishing Resource Fund, which is administered by representatives of the commercial fishing industry. Respondents are also told that a summary of results will be made publicly available and accessible to commercial fishermen and women, and fishery policymakers. Finally the survey explains that responses will be used to develop sustainable commercial fishing activities in the state.

The first question on the survey asks respondents about the number of seafood meals eaten at home and at restaurants in the last year. If the respondent never ate seafood in the last year, the survey ended at that point. We only wanted to gather seafood preference information from those that eat seafood. Subsequent questions asked about the amount of seafood eaten in the last three months, both at home and restaurants.

Next respondents answered a series of questions about why they eat seafood, where they purchase it, and opinions on the importance of eating local and sustainably harvested seafood.

Respondents were then asked to select all of the seafood they enjoy eating. They were provided a list of the top 20 N.C. seafood in alphabetical order. They could also write in a seafood they enjoy eating if it wasn't listed.

If respondents said they enjoyed eating shrimp, they would then see the shrimp choice questions. If they enjoyed eating flounder, they would also see the flounder choice questions. If they only enjoyed eating flounder and not shrimp, they would only see the flounder choice questions. Before each set of seafood choice questions, the respondent was asked how many pounds of shrimp or flounder they typically purchase. After each set of seafood choice questions, the respondent was asked how important the following were to making their purchasing decision: harvest location, wild-caught label, sustainable seafood label, and price.

The questions on the next section of the survey pertained to preparation and value added seafood products that would encourage respondents to cook N.C. seafood at home. All respondents saw this part of the survey. Respondents were asked about products like recipes and pre-made marinades; meal kits; heat-and-serve seafood meals like chowders and casseroles; and ready-to-serve seafood products like dips and spreads. Respondents were also asked about their three favorite ways to cook finfish like flounder or tuna, oysters, and shrimp.

Next respondents were asked if they agreed or disagreed that survey results could affect decisions made by the North Carolina seafood industry. They were also asked if they believe the survey results should be shared with North Carolina policymakers.

Finally survey respondents were asked for personal demographic information including gender, age, educational attainment, race/ethnicity, and household annual income.

Choice Experiment Results

Shrimp choice questions were asked of NC seafood consumers who cook seafood meals at home (80% of the sample) and those who enjoy eating shrimp (81% of the sample). Analysis of the shrimp choice questions was conducted with 886 observations. Flounder choice questions were asked of NC seafood consumers who cook seafood meals at home (80% of the total sample) and those who enjoy eating flounder (59% of the sample). The flounder analysis is conducted with 645 observations. The majority of respondents purchase 1-2 pounds of shrimp (81%) and 1-2 pounds of flounder (82%) when they are at the grocery store seafood counter.

There is a significant price premium for shrimp and flounder from North Carolina and domestic U.S. sources. There is also a price premium for seafood with a wild-caught and sustainable seafood label. Respondents are willing to pay the most for N.C. seafood, then domestically sourced seafood, then wild-caught seafood, and finally sustainably caught seafood. Price is a significant attribute as well; as expected, respondents were less likely to choose a seafood product with a higher price, holding other features the same. However, price was not as important as the other seafood attributes for most respondents.

Both the shrimp and flounder choice questions were estimated with the conditional logit and latent class logit models. These models estimate the probability that a particular choice was made as a function of harvest location, sustainable fishing methods and wild stocks. The conditional logit model estimates a single parameter for each of the choice attributes. The latent class logit model estimates different parameters for different probabilistic groups of respondents. The groups are determined within the model. The appropriate number of classes is determined statistically. We choose the best model based on the model with the minimum Akaike Information Criteria statistic with the constraint that the size and sign of individual coefficient estimates make sense. For example, we reject a model that has a class of consumers who prefer to avoid sustainably caught flounder.

Each of the models behaves as expected in terms of the sign and significance of attribute coefficients. In each model as the price increases then the probability that the consumer would

purchase the product decreases. In the conditional logit models the coefficient on the harvest location is positive. The harvest location is positive in each model. Both of the sustainable and wild attribute coefficients are positive in the shrimp model. Only the wild attribute coefficient is positive in the flounder model. All of the coefficients in the conditional logit model for shrimp are statistically significant at the 99% confidence level. All of the coefficients in the conditional logit model for flounder are statistically significant at the 99% confidence level except for sustainable catch. This indicates that flounder consumers do not value sustainable catch.

Table 2. Conditional Logit Model for Shrimp

	Coefficient	SE	t-stat
Price	-0.130	0.008	-15.45
North Carolina	3.303	0.134	24.67
Louisiana	2.368	0.121	19.52
China	0.638	0.124	5.14
Sustainable	0.231	0.047	4.94
Wild	0.364	0.043	8.47
Log likelihood function	-3824.58		
Restricted log likelihood	-4638.32		
Chi squared [6 df]	1627.48		
McFadden Pseudo R-squared	0.18		
AIC	7661.2		
Individuals	886		
Choices	5		
Sample	4430		

Table 3. Conditional Logit Model for Flounder

	Coefficient	SE	t-stat
Price	-0.081	0.010	-7.97
North Carolina	2.558	0.154	16.6
Florida	1.652	0.142	11.62
Iceland	1.206	0.142	8.49
Sustainable	-0.052	0.056	-0.93
Wild	0.371	0.050	7.47

Log likelihood function	-3064.88		
Restricted log likelihood	-3238.38		
Chi squared [6 df]	347.01		
McFadden Pseudo R-squared	0.05		
AIC	6141.8		
Individuals	645		
Choices	5		
Sample	3225		

The conditional logit models ignore differences across consumers. These differences are estimated with the latent class logit models. In the latent class model for shrimp we find that a three-class model fits the data best. The largest class has a 53% probability weight (this indicates that there is s 53% probability that a shrimp consumer will be a member of this class). In this class consumers value shrimp from North Carolina and Louisiana, but not China, and place additional value on sustainable and wild harvest. The second class has a 25% probability. Consumers value shrimp from all locations equally. This group values sustainably caught shrimp but not wild shrimp. The final class has a 22% probability. This class values shrimp from North Carolina and Louisiana and wild caught shrimp. This class is also more price sensitive as the coefficient on price is at least twice as large and the price coefficients in the other two classes.

In the latent class model for flounder we find that the best model contains two classes. The dominant class has a 75% probability. Consumers value flounder from all locations and wild stocks. The second class is more price sensitive and values flounder from North Carolina and Florida. The second class places no price premium on sustainably caught flounder or wild stocks.

Table 4. Latent Class Logit Model for Shrimp

	Coeff.	SE	t-stat	Coeff.	SE	t-stat	Coeff.	SE	t-stat
PRICE	-0.133	0.019	-6.89	-0.102	0.020	-5.06	-0.282	0.028	-9.92
North Carolina	5.672	0.408	13.89	3.810	0.354	10.76	3.607	0.335	10.78
Louisiana	4.003	0.348	11.51	3.514	0.314	11.18	2.264	0.306	7.40
China	-0.320	0.279	-1.14	3.485	0.305	11.43	0.183	0.341	0.53
Sustainable	0.272	0.110	2.46	0.220	0.101	2.17	0.123	0.176	0.70
Wild	0.697	0.086	8.13	0.123	0.085	1.45	0.298	0.153	1.94
Class Prob.	0.529	0.029	18.54	0.247	0.023	10.80	0.224	0.021	10.47
Log likelihood	-3398.95								

function									
Restricted log likelihood	-4866.85								
Chi squared [20 df]	2935.80								
McFadden Pseudo R-squared	0.30								
AIC	6837.9								
Individuals	886								
Choices	5								
Sample	4430								

Table 5. Latent Class Logit Model for Flounder

	Coefficient	SE	t-stat	Coefficient	SE	t-stat
Price	-0.057	0.013	-4.53	-0.167	0.033	-5.13
North Carolina	3.276	0.197	16.60	2.564	0.364	7.05
Florida	2.537	0.185	13.75	1.057	0.344	3.07
Iceland	2.232	0.189	11.82	-0.443	0.424	-1.05
Sustainable	-0.086	0.063	-1.36	-0.029	0.198	-0.15
Wild	0.382	0.050	7.59	0.180	0.165	1.09
Class Prob.	0.753	0.030	25.38	0.247	0.030	8.32
Log likelihood function	-2883.18					
Restricted log likelihood	-3543.02					
Chi squared [15 d]	1319.69					
McFadden Pseudo R-squared	0.19					
AIC	5792.4					

Individuals	645					
Choices	5					
Sample	3225					

For each model we estimate the maximum willingness to pay for a pound of seafood harvested from each location. The willingness to pay estimates are equal to the negative of the attribute coefficient divided by the coefficient on price. These estimates represent the maximum price that the average consumer would pay. In other words, consumers would not purchase the product if it was one dollar more. These are gross willingness to pay estimates. The net willingness to pay (i.e., consumer surplus) is the gross willingness to pay minus the product price. For example, if the gross willingness to pay is $30 and the price is $20 then the net willingness to pay is $10. The net willingness to pay represents the welfare received by consumers from the product purchase. We present standard errors for the willingness to pay estimates from the Krinsky and Robb simulation method (standard errors based on the Delta Method are similar).

The baseline willingness to pay estimates are from the conditional logit models. The willingness to pay for a pound of shrimp is $25 from North Carolina, $18 from Louisiana and $5 from China. The price premium for sustainably harvested shrimp is $2 and $3 for wild stocks. These estimates are additive. For example, the gross willingness to pay for sustainably caught North Carolina shrimp is $27.

Table 6. Willingness to Pay for Shrimp: Estimates from the Conditional Logit Model

	WTP	SE	t-stat
North Carolina	25.49	0.96	26.49
Louisiana	18.28	0.67	27.19
China	4.92	0.75	6.56
Sustainable	1.79	0.34	5.31
Wild	2.81	0.38	7.39

These estimates can be considered weighted averages of the willingness to pay estimates from the latent class logit model. The willingness to pay for a pound of North Carolina shrimp is $43, $37 and $13 from class one, two and three. The willingness to pay for a pound of Louisiana shrimp is $30, $34 and $8 from class one, two and three. The willingness to pay for a pound of shrimp from China is $34 in class two. Class one price premiums are $2 and $5 for sustainably caught shrimp and wild shrimp. The premium for sustainably caught shrimp is $2 in class two and the premium for wild stocks is $1 in class three.

Table 7. Willingness to Pay for Shrimp: Estimates from the Latent Class Logit Model

	WTP Class 1	SE	t-stat	WTP Class 2	SE	t-stat	WTP Class 3	SE	t-stat
North Carolina	42.60	4.78	8.91	37.40	6.66	5.61	12.80	0.61	20.81
Louisiana	30.06	3.48	8.63	34.49	6.52	5.29	8.03	0.67	11.96
China	-2.40	2.53	-0.95	34.21	6.98	4.90	0.65	1.24	0.52
Sustainable	2.04	0.68	3.00	2.16	0.87	2.48	0.44	0.61	0.72
Wild	5.23	0.97	5.40	1.20	0.86	1.40	1.06	0.58	1.83

The willingness to pay for a pound of flounder is $31 from North Carolina, $20 from Florida and $15 from Iceland. The price premium is $5 for wild stocks. The willingness to pay for a pound of North Carolina flounder is $58 and $15 from classes one and two. The willingness to pay for a pound of Florida flounder is $45 and $6 from classes one and two. The willingness to pay for a pound of flounder from Iceland is $39 in class one. The price premium is $7 for wild flounder in class one.

Table 8. Willingness to pay for Flounder: Estimates from the Conditional Logit Model

	WTP	SE	t-stat
North Carolina	31.39	2.60	12.06
Florida	20.27	1.60	12.71
Iceland	14.80	1.32	11.19
Sustainable	-0.64	0.74	-0.86
Wild	4.55	0.79	5.77

Table 9. Willingness to Pay for Flounder: Estimates from the Latent Class Logit Model

	WTP Class 1	SE	t-stat	WTP Class 2	SE	t-stat
North Carolina	57.81	12.93	4.47	15.32	1.63	9.40
Louisiana	44.77	10.16	4.40	6.32	1.58	4.01
Iceland	39.37	9.56	4.12	-2.65	3.21	-0.82
Sustainable	-1.52	1.61	-0.94	-0.18	1.33	-0.13
Wild	6.75	1.83	3.69	1.08	1.02	1.05

When making decisions about purchasing shrimp or flounder, a majority of respondents considered all attributes to be important or very important. More respondents considered harvest location and price to be important or very important compared to the wild caught and

sustainable labels. In the shrimp choice questions, price was important or very important to 79% of respondents; harvest location was important or very important to 79% of respondents; the wild caught label was important or very important to 70% of respondents; and the sustainable label was important or very important to 69% of respondents. In the flounder choice questions, price was important or very important to 82% of respondents; harvest location was important or very important to 73% of respondents; the sustainable label was important or very important to 70% of respondents; and the wild caught label was important or very important to 64% of respondents. Figures 2 and 3 display how important each attribute was for the shrimp and flounder choice questions.

Figure 2. Importance of Shrimp Attributes

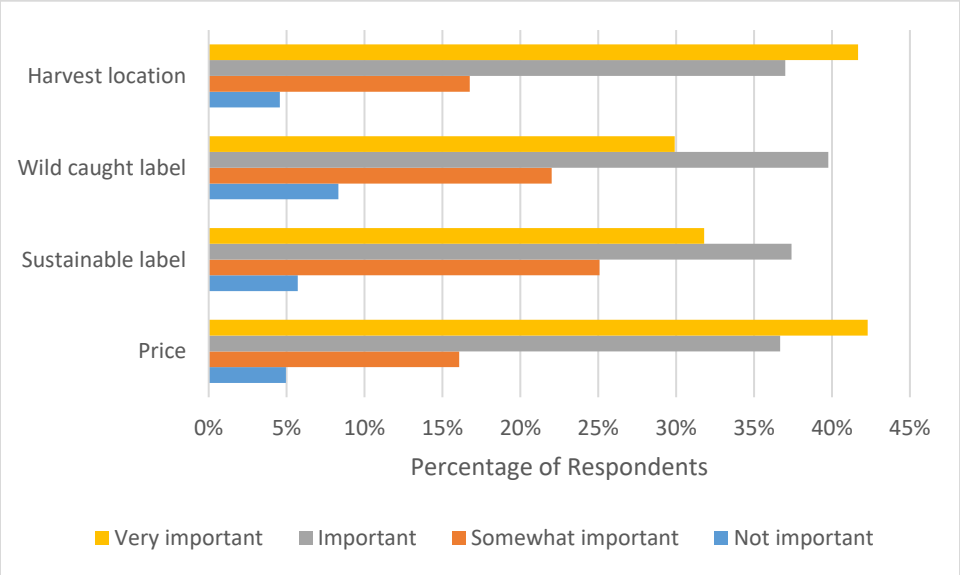
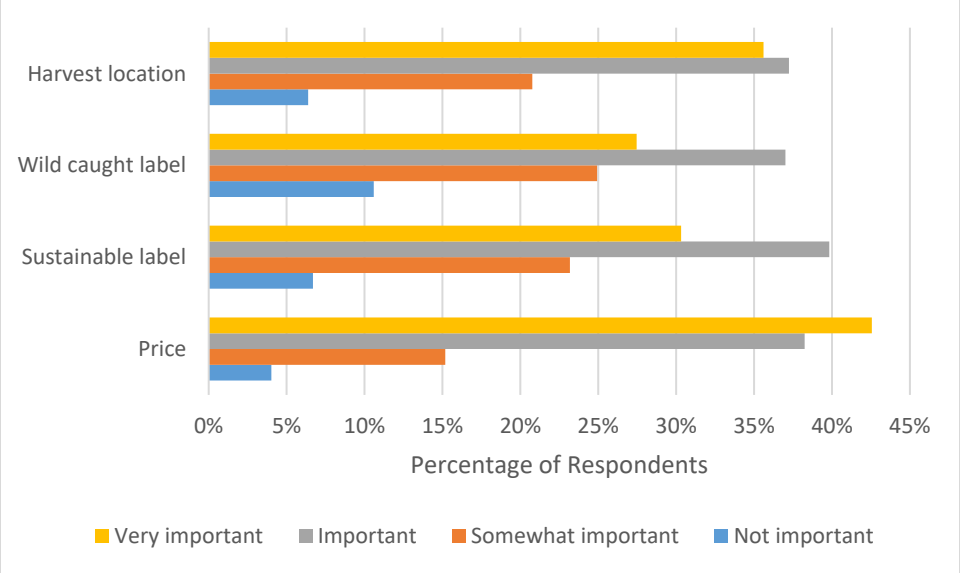


Figure 3. Importance of Flounder Attributes



A second survey of North Carolina seafood consumers was conducted in October 2020. The primary purpose was to determine if seafood preferences and behaviors had changed over the past 6 months during the COVID-19 pandemic. The same survey was used with a sample from the same population. The shrimp and flounder models are estimated with 800 and 636 consumers, respectively. A minority of these consumers were surveyed both times (future research will seek to estimate panel models with this subsample). In this section we highlight where the responses differ from early spring to early fall of 2020. Differences in the second survey include a lower demand for Chinese shrimp, a higher demand for wild shrimp and a lower demand for sustainably caught shrimp. In the market for flounder, there is a higher demand for wild flounder and a lower demand for sustainably caught flounder. There are few differences in the willingness to pay estimates, and most of these differences are not statistically significant.[1]

References

Baker, R., Blumberg, S.J., Brick, J.M., Couper, M.P., Courtright, M., Dennis, J.M., Dillman, D., Frankel, M.R., Garland, P., Groves, R.M. and Kennedy, C., 2010. AAPOR report on online panels. The Public Opinion Quarterly, 74(4), pp.711-781.

Davidson, K., M. Pan, W. Hu, and D. Poerwanto. 2012. Consumers' willingness to pay for aquaculture fish products vs. wild-caught seafood-A case study in Hawaii. Aquaculture Economics & Management 16(2): 136-54.

Fonner, R. and G. Sylvia. 2015. Willingness to pay for multiple seafood labels in a niche market. Marine Resource Economics 30(1): 51-70.

Hensher, D., Rose, J., and W. Greene. 2015. Applied Choice Analysis. Second edition. Cambridge University Press, Cambridge, UK.

Hole, A.R. 2015. DCREATE: Stata module to create efficient designs for discrete choice experiments. https://ideas.repec.org/c/boc/bocode/s458059.html

Holmes, Thomas P., Wiktor L. Adamowicz, and Fredrik Carlsson. "Choice experiments." In A primer on nonmarket valuation, pp. 133-186. Eds. PA Champ, KJ Boyle, TC Brown, LG Peterson, Springer, Dordrecht, 2017.

Jaffrey, S., H. Pickering, Y. Ghulam, D. Whitmarsh, and P. Wattage. 2004. Consumer choices for quality and sustainability labelled seafood products in the UK. Food Policy 29(3): 215-28.

Jonker, M.F., Donkers, B., de Bekker-Grob, E., and E.A. Stolk. 2018. Attribute level overlap (and color coding) can reduce task complexity, improve choice consistency, and decrease the dropout rate in discrete choice experiments. Health Economics 28: 350-363.

[1] Since the data was received at the end of the grant period, a full comparative analysis of the data is forthcoming and available upon request.

Malone, Trey, and Jayson L. Lusk. "A simple diagnostic measure of inattention bias in discrete choice models." European Review of Agricultural Economics 45, no. 3 (2018): 455-462.

Parthum, B., and A.W. Ando. 2019. Local benefits and willingness to pay to reduce hypoxia in the Gulf of Mexico. https://bryanparthum.s3.us-east-2.amazonaws.com/Parthum_Ando_2019.pdf

Roheim, C.A., P.O. Sudhakaran, and C.A. Durham. 2012. Certification of shrimp and salmon for best aquaculture practices: Assessing consumer prferences in Rhode Island. Aquaculture Economics & Management 16(3): 266-86.

Ropicki, A.J., S.L. Larkin, and C.M. Adams. 2010. Seafood substitution and mislabeling: WTP for a locally caught grouper labeling program in Florida. Marine Resource Economics 25(I): 77-92.

Rudd, M.A., N. Pelletier, and P. Tyedmers. 2011. Preferences for health and environmental attributes of farmed salmon amongst Southern Ontario salmon consumers. Aquaculture Economics & Management 15(1): 18-45.