



ATLANTIC
CORPORATION

U.S. Consumer Attitudes and
Preferences about Domestic Farm-
Raised Finfish and Shellfish:

**CONSUMER PREFERENCES
AND WILLINGNESS TO PAY
FOR LOCAL FARM-RAISED
FINFISH AND SHELLFISH
PRODUCTS**

FEBRUARY 2023

1. INTRODUCTION



In January 2023, Atlantic Corporation (Atlantic) published *U.S. Consumer Attitudes and Preferences about Domestic Farm-Raised Finfish and Shellfish: Descriptive Statistics Report* (Descriptive Statistics Report), which presents findings of a comprehensive survey of consumers in all 50 states about their attitudes and preferences towards domestic farm-raised finfish and shellfish. This report follows the Descriptive Statistics Report and focuses on U.S. consumers' preferences and willingness to pay (WTP) for local farm-raised finfish and shellfish products. Atlantic used economic models to examine factors affecting U.S. consumers' WTP for farm-raised finfish and shellfish products raised locally in their home state. The results will help aquaculture industry stakeholders gain a better understanding of U.S. consumers' valuation of and provide guidance on marketing strategies to promote locally raised aquaculture seafood products.

2. DATA

The project team designed a consumer survey and hired Dynata to field the survey through their U.S. consumer panel during June 8 through August 14, 2022. The collected dataset is a random and census-representative sample of at least 400 responses from each of the 50 U.S. states and contains 20,029 observations.

The survey asked respondents the maximum premiums they would be willing to pay for a farm-raised finfish or shellfish product that is raised locally in their home state, compared to one from other states. Atlantic used a payment card method to elicit the maximum premiums respondents are willing to pay for either of the products. The survey gave respondents a list of the following price increase values/intervals: 0%, 1-19%, 20-39%, 40-59%, 60-79%, 80-99%, and 100% or more, and asked them to answer the question by choosing an option from the list. Atlantic explained to the respondents that that these ranges represent the percentage exceeding the average price they would agree to pay.

THE DATASET:

400

random and census-representative responses from

50

U.S. states

20,029

observations contained

Also presented in the Descriptive Statistics Report, **Figure 1** presents the frequency distributions of consumers' WTP for finfish and shellfish products are similar. About 23% of respondents indicated they are not willing to pay premiums for a locally raised finfish/shellfish product, compared to one from other states. About 32% of respondents are willing to pay a 0-19% premium for locally raised finfish/shellfish, about 17% are willing to pay a 20-39% premium, and about 28% are willing to pay a 40% or higher premium.

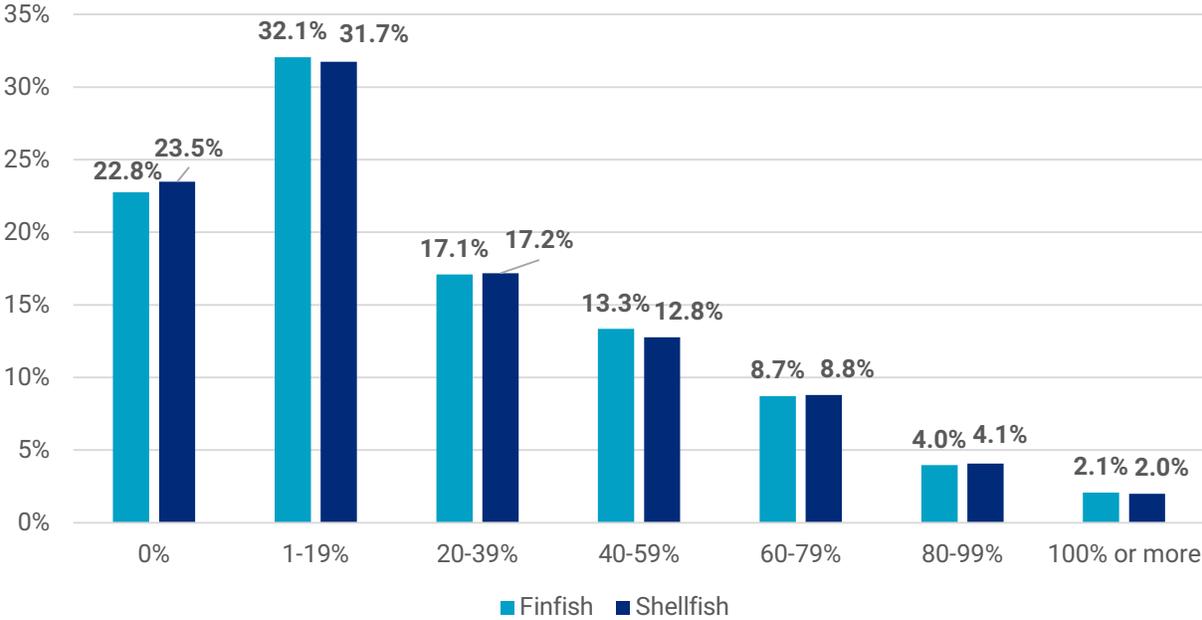


Figure 1. Willingness to pay for a farm-raised finfish/shellfish product raised locally in their home state



3. METHOD



Responding to the survey questions designed using the payment card method, consumers selected an interval to represent the maximum premium they are willing to pay for a farm-raised finfish or shellfish product raised locally, heretofore referred to as locally raised, in their home state, compared to one from other states. Respondents also had the option to choose a value of 0%, which means they are not willing to pay a premium for a farm-raised finfish or shellfish product raised locally in their home state. The WTP values elicited are not continuous, instead, they contain intervals and censored data. Based on the interval a respondent chose, Atlantic knows the range representing the respondent's WTP premium, but not the exact amount. Due to the nature of the data, Atlantic used an interval censored regression model to estimate consumers' WTP for a farm-raised finfish or shellfish product raised locally in their home state.

Atlantic used a latent WTP variable, denoted by WTP^* , to represent the true WTP values which are only observed to lie in the $(J+1)$ mutually exclusive intervals $(-\infty, \alpha_1], (\alpha_1, \alpha_2], \dots, (\alpha_j, +\infty)$, where $\alpha_1, \dots, \alpha_j$ is known. The WTP^* can be specified as

$$WTP_i^* = x_i' \beta + u_i$$

where x_i represents the vector of independent variables, β represents the vector of coefficients, and u_i is the error term that follows a normal distribution $N(0, \sigma^2)$. In this case, Atlantic included respondents' sociodemographic characteristics, seafood origin awareness, knowledge of aquaculture, and perceptions of aquaculture's environmental impact as independent variables.

The observed WTP value, denoted by WTP , is the particular interval in which the unobserved WTP^* lies.

$$WTP = \begin{cases} 0 & \text{if } WTP^* \leq \alpha_1 \\ 1 & \text{if } \alpha_1 < WTP^* \leq \alpha_2 \\ \dots & \dots \\ J & \text{if } WTP^* > \alpha_j \end{cases}$$

The probability of a respondent choosing the interval $(\alpha_j, \alpha_{j+1}]$ is

$$P(\alpha_j < WTP^* \leq \alpha_{j+1}) = P(WTP^* \leq \alpha_{j+1}) - P(WTP^* \leq \alpha_j) = F^*(\alpha_{j+1}) - F^*(\alpha_j)$$

Maximum likelihood estimation is used to obtain estimates of the coefficient vector β and the error term standard deviation σ .

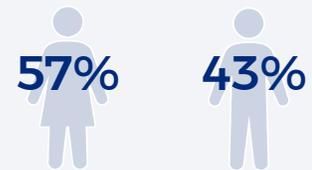
4. RESULTS



4.1 Summary statistics of variables used in the model

Table 1 shows the summary statistics of variables used in the model, including consumers' sociodemographic characteristics, awareness of origin, knowledge of aquaculture, and perceptions of aquaculture's environmental impact. In the data sample, 43% of respondents were male, 57% were female, and 0.003% selected other. Their age ranged from 18 to 85 years old, averaging 47 years old. About 18% of respondents had obtained up to a high school degree or GED, 23% had some college education but no degree, 14% had an associate degree, 28% had a bachelor's degree, and 18% had a graduate or professional degree. On average, the annual household income in 2021 before taxes was \$78,800. The average household size was 2.66 people. About 38% of households had children present.

Based on this survey, about 31% of respondents were always or most of time aware of where the seafood is grown prior to purchasing, 56% of respondents were aware of it half the time or sometimes, and 13% were never aware of it. The survey asked respondents about their knowledge of finfish or shellfish aquaculture in their state, in the U.S., and in foreign countries. About 39% of respondents were aware of finfish aquaculture in their home state, 60% were aware of it in the U.S., and 39% were aware of it in foreign countries. In terms of shellfish aquaculture, about 38% of respondents were aware of it in their home state, 62% were aware of it in the U.S., and 43% were aware of it in foreign countries. Atlantic also asked respondents their perceptions of finfish and shellfish aquaculture's environmental impact. About 33%, 28%, and 39% of respondents perceive finfish aquaculture having positive, negative, and no environmental impact, respectively. About 35%, 26%, and 39% of respondents perceive shellfish aquaculture having positive, negative, and no environmental impact, respectively.



18 - 85 (47 av.)

age range

\$78,800

average household income in 2021

2.66

average household size

38%

household had children

31%

aware of where the seafood is grown prior to purchasing

39%

were aware of finfish aquaculture in their home state

Table 1. Summary statistics of variables used in the model

Variable	Description	Mean	Std Dev
<i>male</i>	=1 if male; =0 otherwise	0.43	0.49
<i>female</i>	=1 if female; =0 otherwise	0.57	0.50
<i>other</i>	=1 if other gender; =0 otherwise	0.003	0.05
<i>age</i>	age in years	47.25	16.66
<i>edu_high school</i>	up to high school or GED	0.18	0.38
<i>edu_college</i>	some college, no degree	0.23	0.42
<i>edu_associate</i>	associate degree	0.14	0.35
<i>edu_bachelor</i>	bachelor's degree	0.28	0.45
<i>edu_graduate</i>	graduate or professional degree	0.18	0.38
<i>income</i>	annual household income in 2021 before taxes, in \$1,000	78.80	54.95
<i>household size</i>	number of household members, including self	2.66	1.41
<i>if children present</i>	if child(ren) are present in household	0.38	0.48
<i>awareorigin_most</i>	=1 if always or most of time aware of where seafood is grown prior to purchasing; =0 otherwise	0.31	0.46
<i>awareorigin_half</i>	=1 if about half the time or sometimes aware of where seafood is grown prior to purchasing; =0 otherwise	0.56	0.50
<i>awareorigin_never</i>	=1 if never aware of where seafood is grown prior to purchasing; =0 otherwise	0.13	0.34
<i>awareaquaculture_state (finfish)</i>	=1 if aware of finfish aquaculture in home state; =0 otherwise	0.39	0.49
<i>awareaquaculture_US (finfish)</i>	=1 if aware of finfish aquaculture in the US; =0 otherwise	0.60	0.49
<i>awareaquaculture_foreign (finfish)</i>	=1 if aware of finfish aquaculture in foreign countries; =0 otherwise	0.39	0.49
<i>awareaquaculture_state (shellfish)</i>	=1 if aware of shellfish aquaculture in home state; =0 otherwise	0.38	0.48
<i>awareaquaculture_US (shellfish)</i>	=1 if aware of shellfish aquaculture in the US; =0 otherwise	0.62	0.49
<i>awareaquaculture_foreign (shellfish)</i>	=1 if aware of shellfish aquaculture in foreign countries; =0 otherwise	0.43	0.49
<i>env_impact_positive (finfish)</i>	=1 if perceiving finfish aquaculture has a positive environmental impact; =0 otherwise	0.33	0.47
<i>env_impact_negative (finfish)</i>	=1 if perceiving finfish aquaculture has a negative environmental impact; =0 otherwise	0.28	0.45
<i>env_impact_no (finfish)</i>	=1 if perceiving finfish aquaculture has no environmental impact; =0 otherwise	0.39	0.49
<i>env_impact_positive (shellfish)</i>	=1 if perceiving shellfish aquaculture has a positive environmental impact; =0 otherwise	0.35	0.48
<i>env_impact_negative (shellfish)</i>	=1 if perceiving shellfish aquaculture has a negative environmental impact; =0 otherwise	0.26	0.44
<i>env_impact_no (shellfish)</i>	=1 if perceiving shellfish aquaculture has no environmental impact; =0 otherwise	0.39	0.49

4.2 Results of estimated WTP regression models

Table 2 shows the results of the estimated interval censored WTP regression models. The following subsections focus on explaining the estimated coefficients which are significant at least at the 5% level. For continuous variables, the estimated coefficients indicate the change in the WTP (in %) for a local finfish or shellfish product of a unit change of the variable. For categorical variables, the estimated coefficients show the difference in WTP between the category that the variable represents and the base category (omitted in the model).

4.2.1 WTP for a farm-raised finfish product raised locally in consumers' home state

The finfish columns on **Table 2** show the results of the estimated model of WTP for a local farm-raised finfish product. Female consumers are willing to pay a 2% lower premium for a finfish product raised in their home state than male consumers (used as the base and omitted in the model). Consumers who chose "other" as gender are willing to pay 12.5% less than male consumers. The coefficient on age is negative and significant, meaning older consumers are willing to pay less for local farm-raised finfish products. When consumers age by one year, across all intervals, they are willing to pay 0.5% less for local farm-raised finfish products. Consumers having a bachelor's degree are willing to pay 1.8% less than those who had up to high school education. Consumers in households with children are willing to pay 7.1% more for local farm-raised finfish products than those without children.

Consumers' awareness of seafood origin, knowledge of aquaculture, and perception of aquaculture's environmental impact all play a role in affecting their WTP for local farm-raised finfish products. Consumers who were aware of where the product is grown at least most of the time, are willing to pay a 10.6% higher premium for local farm-raised finfish products than consumers who were never aware of seafood origin. Consumers who were about half the time or sometimes aware of where seafood is grown are willing to pay 7.1% more for local farm-raised finfish products. The acceptable premium dropped to 7.1% when the consumer is only aware of origin about half of the time or less, compared to those who were never aware of seafood origin.

Consumers who were aware of finfish aquaculture in their home state are willing to pay 10.3% more for finfish products raised locally in their state. Consumers who were aware of finfish aquaculture in foreign countries are willing to pay 1.4% less for local farm-raised finfish products. Based on NOAA data, the U.S. imports about 70%-85% of its seafood and more than half of this imported seafood is produced via foreign aquaculture.¹ Consumers who were aware of foreign aquaculture or knowing that imported seafood accounts for a large portion of seafood consumption in the U.S. market may not particularly value locally raised seafood products.

Consumers who perceive finfish aquaculture having a positive environmental impact are willing to pay 7.1% more for local farm-raised finfish products than consumers who perceive finfish aquaculture having no environmental impact. While consumers who perceive finfish aquaculture having a negative environmental impact are willing to pay 2.2% less for local farm-raised finfish products.

¹ NOAA Office of Aquaculture. *U.S. Aquaculture*. NOAA. Published September 20, 2022. <https://www.fisheries.noaa.gov/national/aquaculture/us-aquaculture>

To examine the spatial difference in consumers' WTP for the locally raised finfish products, Atlantic included 49 binary variables in the model to represent the U.S. states except for Maine. Atlantic used Maine as the base and omitted the binary variable representing Maine in the model. Accordingly, the coefficients on the binary state variables can be interpreted as the difference in WTP between consumers in the state represented by the state variable and consumers in Maine, as shown on **Figure 1**, where the color of the states represents the magnitude of the estimated coefficients on the state variables. The orange-blue diverging color pattern shows the coefficient values from large (orange), to medium (grey), and to small (blue). The darkest orange represents the largest coefficient, and the darkest blue represents the smallest coefficient. If the state variable coefficients are not statistically significant, it means that consumers in those states have the same WTP for locally raised finfish products as consumers in Maine. Correspondingly, the color of those states on the map is the same as that of Maine.

Minnesota has the darkest orange color, representing that Minnesota consumers are willing to pay the highest premium, 3.83% higher than the WTP of Maine consumers, for a farm-raised finfish product locally raised in the home state, compared to one from other states. Consumers in the states in grey color are willing to pay the same premiums for locally raised finfish products as Maine consumers. The other states in blue colors are willing to pay less for locally raised finfish products than Maine consumers. Notably, Alaska consumers' WTP for local farm-raised finfish products is the lowest, 9.13% less than Maine consumers, probably because Alaska is a major wild-caught fish producer in the world and commercial aquaculture activities in Alaska are relatively small-scale. Finfish farming is prohibited by law in state waters in Alaska. Hence, Alaska consumers are not interested in locally raised finfish products.

4.2.2 WTP for a farm-raised shellfish product raised locally in the home state

The shellfish columns on **Table 2** show the results of the estimated model of consumers' WTP for a local farm-raised shellfish product. Female consumers are willing to pay a 1.4% lower premium for a shellfish product raised locally in their home state than male consumers. Consumers who chose "other" as gender are willing to pay 10.1% less than male consumers. When consumers age by one year, across all intervals, they are willing to pay 0.4% less for local farm-raised shellfish products. Consumers having an associate degree are willing to pay 1.3% more for local farm-raised shellfish products than those who had up to high school education. Consumers having a bachelor's degree are willing to pay 1.9% less than those who had up to high school education. Consumers in larger households are willing to pay more for local farm-raised shellfish products. Consumers having children in the households are willing to pay 7% more for local farm-raised shellfish products than those without children.

Consumers who were always or most of time aware of where the seafood is grown prior to purchasing are willing to pay 9.7% higher premium for local farm-raised shellfish products than consumers who were never aware of seafood origin. Consumers who were about half the time or sometimes aware of where the seafood is grown are willing to pay 6.4% more for local farm-raised shellfish products, compared to those who were never aware of seafood origin.

Consumers who were aware of shellfish aquaculture in their home state are willing to pay 11.5% more for shellfish products raised locally in their state. Unlike the finfish model, consumers' awareness of foreign shellfish aquaculture is not a significant factor impacting consumers'

WTP for local shellfish products. This might be because except for shrimp, the U.S. import of other shellfish species is not as large as finfish species. U.S. domestic shrimp products are limited and about 90% of shrimp consumed in U.S. is imported farm-raised products. Other than shrimp, the other top imported seafood in the U.S. is finfish such as freshwater fish, tuna, salmon, and groundfish. Thus, being aware of foreign shellfish aquaculture does not directly affect consumers' WTP for local shellfish products, especially non-shrimp shellfish products.

Consumers who perceive shellfish aquaculture as having a positive environmental impact are willing to pay 7.1% more for local farm-raised finfish products than consumers who perceive shellfish aquaculture having no environmental impact. While consumers who perceive shellfish aquaculture having a negative environmental impact are willing to pay 1.9% less for local farm-raised shellfish products.

Figure 2 shows the estimated coefficients of the state variables in the WTP for locally raised shellfish products model. Minnesota has the darkest orange color, representing that Minnesota consumers are willing to pay the highest premium, 4.91% higher than the WTP of Maine consumers, for a farm-raised shellfish product raised in their home state, compared to one from other states. Consumers in the grey color states are willing to pay the same premiums for locally raised shellfish products as Maine consumers. The other states in blue colors are willing to pay less for locally raised shellfish products than Maine consumers. Alaska consumers' WTP for local farm-raised shellfish product is the lowest, 8.27% less than Maine consumers.

Table 2. Results of estimated interval censored WTP regression models

	Finfish		Shellfish	
	Coefficient	Std. Err.	Coefficient	Std. Err.
female	-1.994***	0.357	-1.357***	0.358
other	-12.473***	3.311	-10.143***	3.319
age	-0.451***	0.012	-0.421***	0.012
edu_college	-0.580	0.547	-0.093	0.548
edu_associate	1.178*	0.620	1.349**	0.622
edu_bachelor	-1.791***	0.551	-1.944***	0.552
edu_graduate	-0.638	0.639	-1.005	0.640
income	0.004	0.004	0.003	0.004
household size	0.274*	0.157	0.356**	0.158
if children present	7.138***	0.477	6.972***	0.478
awareorigin_most	10.551***	0.596	9.693***	0.597
awareorigin_half	7.069***	0.535	6.409***	0.536
awareaquaculture_state	10.300***	0.428	11.502***	0.429
awareaquaculture_US	-0.580	0.450	-0.383	0.445
awareaquaculture_foreign	-1.392***	0.410	-0.597	0.407
env_impact_positive	7.091***	0.416	7.122***	0.413
env_impact_negative	-2.232***	0.429	-1.809***	0.438
constant	36.659***	1.577	33.472***	1.587
state variables	omitted in the table			

Note: ***p<0.01, **p<0.05, *p<0.1.

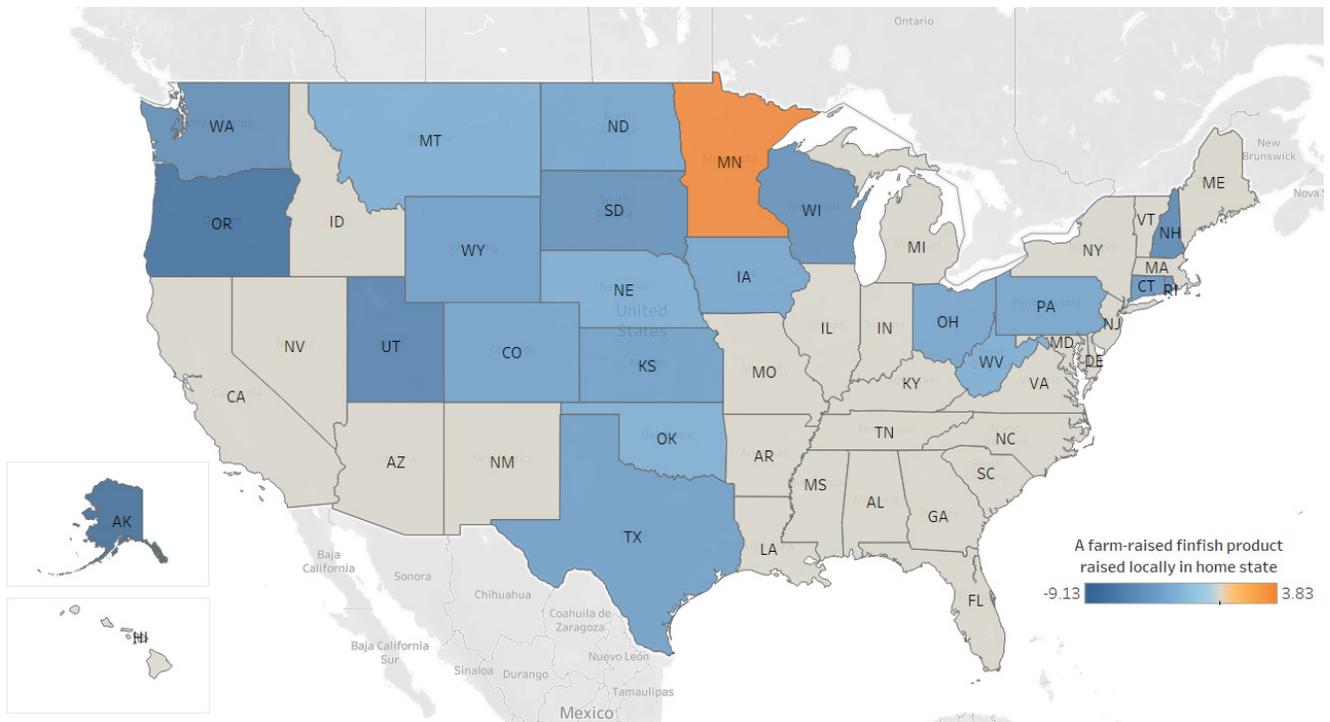


Figure 1. Results of estimated WTP regression models for locally raised finfish products: state effect

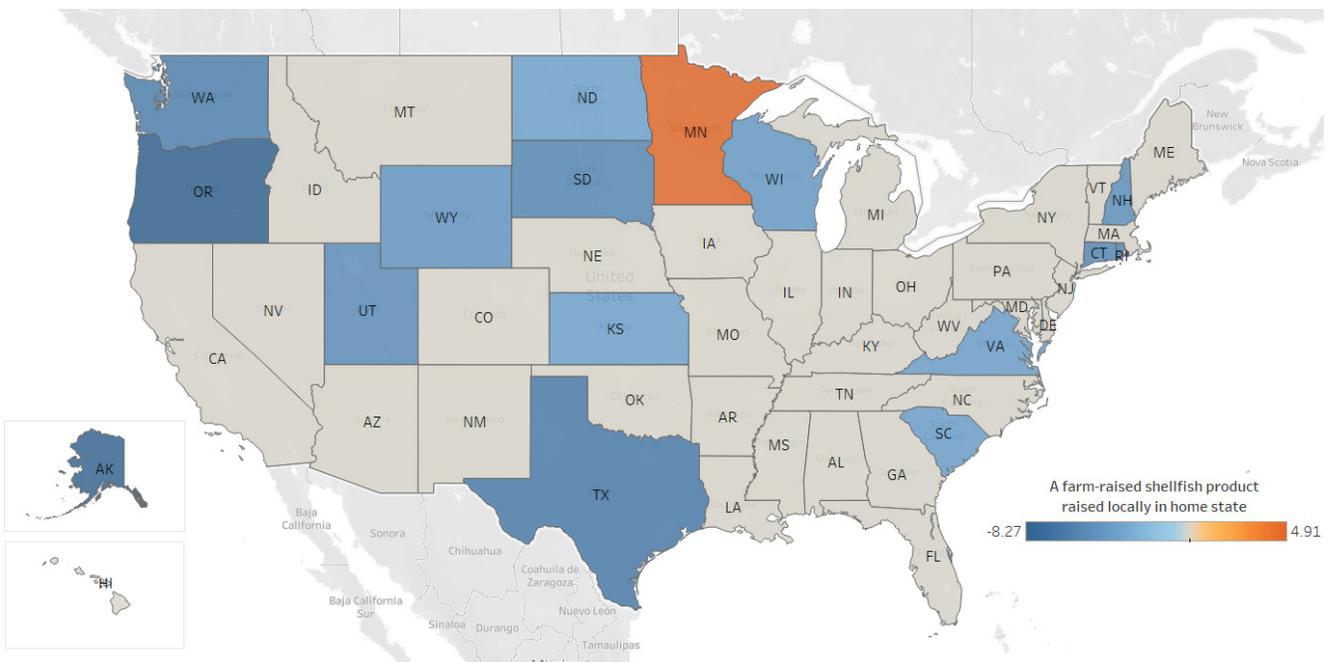


Figure 2. Results of estimated WTP regression models for locally raised shellfish products: state effect

5. CONCLUSION

Based on data from a comprehensive consumer survey, Atlantic used interval censored regression models to examine factors affecting U.S. consumers' WTP for farm-raised finfish and shellfish products raised locally in their home state, compared to those from other states. Following are the study's five key findings.

The survey asked separate questions about consumers' perceptions, preferences, and WTP for local farm-raised finfish and shellfish products to assess if consumers' have different views depending on the type of seafood. The data shows that on average, consumers are willing to pay similar premiums for local farm-raised finfish and shellfish products. The factors affecting their WTP for the two products are also similar.

Consumers' characteristics influence their WTP for local farm-raised seafood products. Consumers who are female, older, or do not have children in the households are willing to pay less for local farm-raised seafood. It's worth noting that income is not a significant factor affecting consumers' WTP for finfish or shellfish products raised locally in their home state.

Consumers' awareness of seafood origin is positively associated with their WTP for locally raised finfish or shellfish products. The more consumers pay attention to seafood origin, the higher their WTP premium for local farm-raised finfish or shellfish products. This suggests that to promote locally raised seafood products, aquaculture businesses may design strategies to improve consumers' awareness that origin is an important attribute of seafood products and differentiate locally farm-raised seafood products from products from other origins.

Consumers' perceptions of aquaculture's environmental impact is a factor affecting their valuation of locally raised finfish or shellfish products. Consumers perceiving that aquaculture has a positive environmental impact are more likely to support local aquaculture, and accordingly are willing to pay a higher premium for locally raised farm-raised seafood products. In contrast, consumers who perceived a negative environmental impact are not willing to pay more for locally raised seafood products. This suggests that improving consumers' awareness of the positive environmental impact of aquaculture can help gain their support for local farm-raised seafood products.

U.S. consumers' WTP for locally raised finfish and shellfish products varies across states. In general, consumers in the northeast and south U.S. are willing to pay higher premiums for locally raised seafood products. Many of these states are top aquaculture producers in the nation, which may play a role in affecting consumers' willingness to pay and support for the local aquaculture and seafood products.



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