

Feelings about fish: An analysis of social survey results about seafood

https://github.com/ztw814/ENV872_FinalProject

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1 Rationale and Research Questions

According to catch reconstructions, global fishing rates peaked in 1996 at roughly 130 million tons of fished biomass or, according to reported catches, at roughly 85 million tons that same year (Pauly & Zeller 2016). In the wake of this peak and an accompanying recognition that seafood extraction remains unsustainable, many researchers have become increasingly interested in understanding how communities interact with seafood consumption, seafood sustainability, etc. Understanding how consumers and communities interact with seafood and sustainability concepts is the first, crucial step in beginning to make more comprehensive progress toward achieving sustainable seafood extraction. This background sets the stage for both this data examination as well as the original research that collected the data on which this examination relies.

1.1 Research Questions

1. (a) When consumers buy seafood, which species do they prefer? (b) Do they prefer wild or farmed fish?
2. (a) What qualities do consumers associate with wild vs. farmed seafood? (b) What qualities do they value in seafood?
3. Are seafood values predicted by demographic variables such as age or education level?

2 Dataset Information

2.1 Description of the Data

Our data were obtained from a social science survey conducted by a multi-university team of researchers, including the Murray lab at Duke University. The survey was conducted in the summer of 2020 via Qualtrics and targeted North Carolina residents from across the state.

The survey asked respondents a total of 37 questions. The question topics can be broken down into the following categories: eating habits for 8 types of seafood, what qualities respondents associate with seafood, attitudes about mariculture, attitudes about North Carolina seafood versus commercial fishing, respondents' involvement with seafood production, and demographic indicators. This study focuses on questions about eating habits, what qualities are associated with seafood, and demographic indicators.

Respondents answered each question by selecting one option from a menu of choices; the number of choices available depended on the question. The dataset contained responses from 1436 participants.

2.2 Data Wrangling

For each analysis, we created a new dataset containing only the relevant columns. For each category within the survey question, we then created a table with the frequency of each questions response. For example, one question asked respondents to rate how often they ate each of 8 types of seafood; respondents could choose from 7 responses for each seafood type. To wrangle this data, we created a dataframe for each type of seafood, for a total of 8 dataframes, each of which contained a column with the response choices and a column with the number of respondents that chose each response. Because the response choices were only represented by a number in the raw data, we renamed the response column with the meaning of each number for greater clarity. We repeated this process for the first two research questions (how often participants eat each type of seafood, whether participants prefer each type wild or farmed, whether participants associate each quality with wild or farmed seafood).

For the third research question, we created a dataframe with responses to a question about how important each of 11 qualities was when respondents were buying seafood. We then renamed the columns and removed rows with alternate responses to demographic variables, such as “prefer not to answer.”

2.3 Data Structure: Consumer preferences

****Data from these responses are categorical, but the response choices could be situated along a linear scale, allowing us to analyze response means.

Research Question	Survey Question	Response choices
1a. When consumers buy seafood, which species do they prefer?	In the past year, how often did you eat the following type of seafood**?	0 = Never, 1 = Once in the past year, 2 = A few times in the past year, 3 = Once a month, 4 = A few times every month, 5 = Once a week, 6 = More than once a week
1b. Do consumers prefer wild or farmed fish?	Between wild-caught and farmed versions of the same seafood species**, which do you prefer to eat?	1 = Strongly prefer wild-caught, 2 = Slightly prefer wild-caught, 3 = No preference, 4 = Slightly prefer farmed, 5 = Strongly prefer farmed, 6 = I don't know
2a. What qualities do consumers associate with wild vs. farmed seafood?	How do you associate the following qualities*** with different types of seafood (farmed and wild-caught)?	1 = More associated with wild-caught, 2 = Associated equally with wild-caught and farmed, 3 = More associated with farmed, 4 = Associated with neither wild-caught or farmed, 5 = I don't know
2b. What qualities do consumers value in seafood?	When you are buying seafood, how important are the following qualities*** to you?	1 = Not at all important, 2 = Slightly important, 3 = Moderately important, 4 = Very important, 5 = Extremely important

** Seafood types: Tuna, Shrimp, Salmon, Flounder, Blue Crab, Clams, Mullet, Oysters (8)

*** Qualities: Healthy, Local, Safe, Tasty, Affordable, Sustainable, Fresh, Easy Access, Local Culture, Local Economies, Local Environment (11)

2.4 Data structure: Demographics

Demographic Category	Response choices	Counts
Age	1=19 or younger	74
.	2=20-29	201
.	3=30-39	170
.	4=40-49	159
.	5=50-59	156
.	6=60-69	172
.	7=70 or older	100
.	8=Prefer not to answer	8
Education level	1=Less than high school	35
.	2=High school graduate	229
.	3=Some college	302
.	4=2 year degree	167
.	5=4 year degree	382
.	6=Professional degree	260
.	7=Doctorate	49
.	8=Prefer not to answer	12
Political party	1=Republican	449
.	2=Democrat	459
.	3=Independent	384
.	4=Other	28
.	5=Prefer not to answer	116

3 Exploratory Analysis

Below, we explore and visualize how often respondents consume select seafood products, regardless of the seafood species.

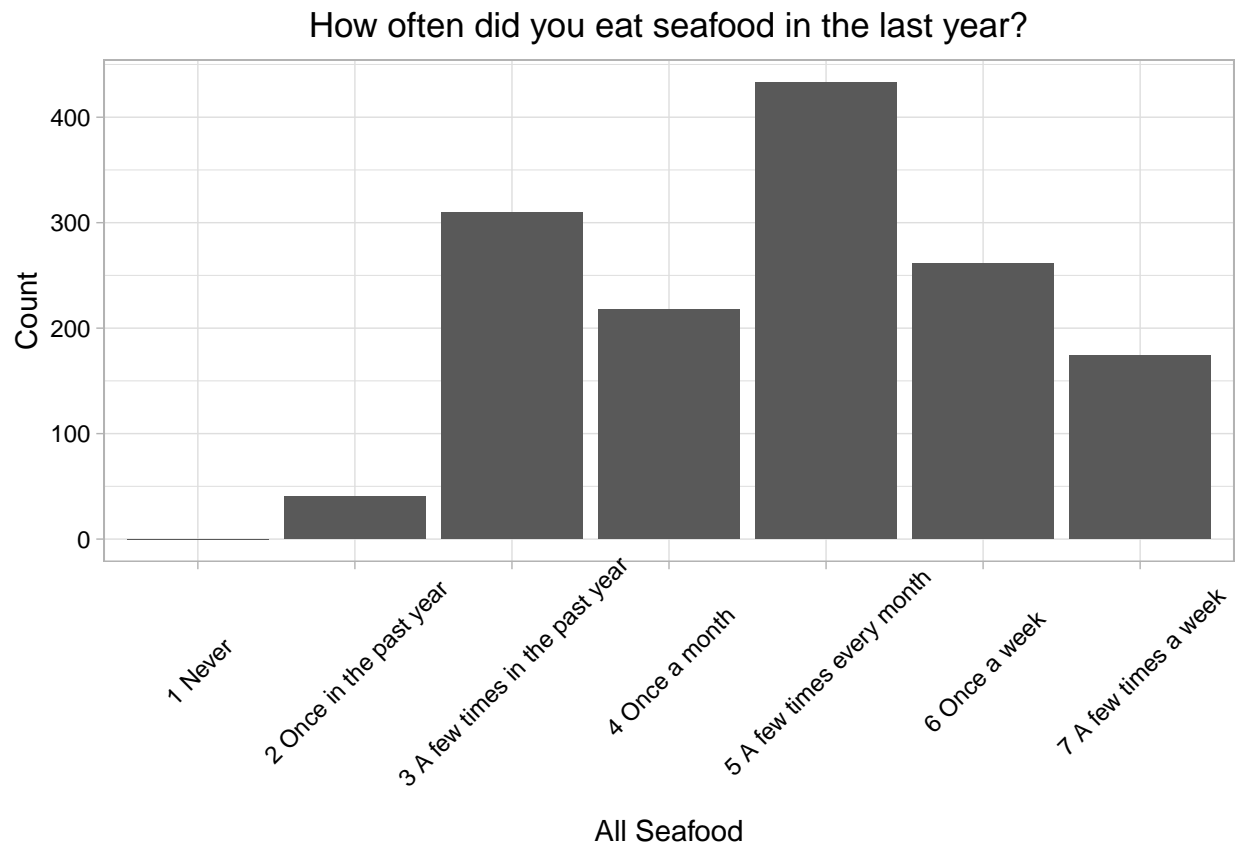


Figure 1: Bar plot of the frequency of general seafood consumption

Figure 1 shows the distribution of responses regarding frequency of seafood consumption in the last year. The mean frequency reported for all seafood consumption was 4.76. This means that the average respondent ate seafood between once a month and a few times per month.

4 Analysis

4.1 Question 1a: When consumers buy seafood, which species do they prefer?

Figure 2 shows that respondents tend to eat Shrimp, Tuna, and Salmon more often than they eat the other species. Respondents overwhelmingly never eat Mullet. Respondents seem to eat Blue Crab, Clams, and Oysters very infrequently if ever. However, this information is still pulled apart by frequency. The below visualization simplifies the data even further, capturing the number of respondents who ever consume each species.

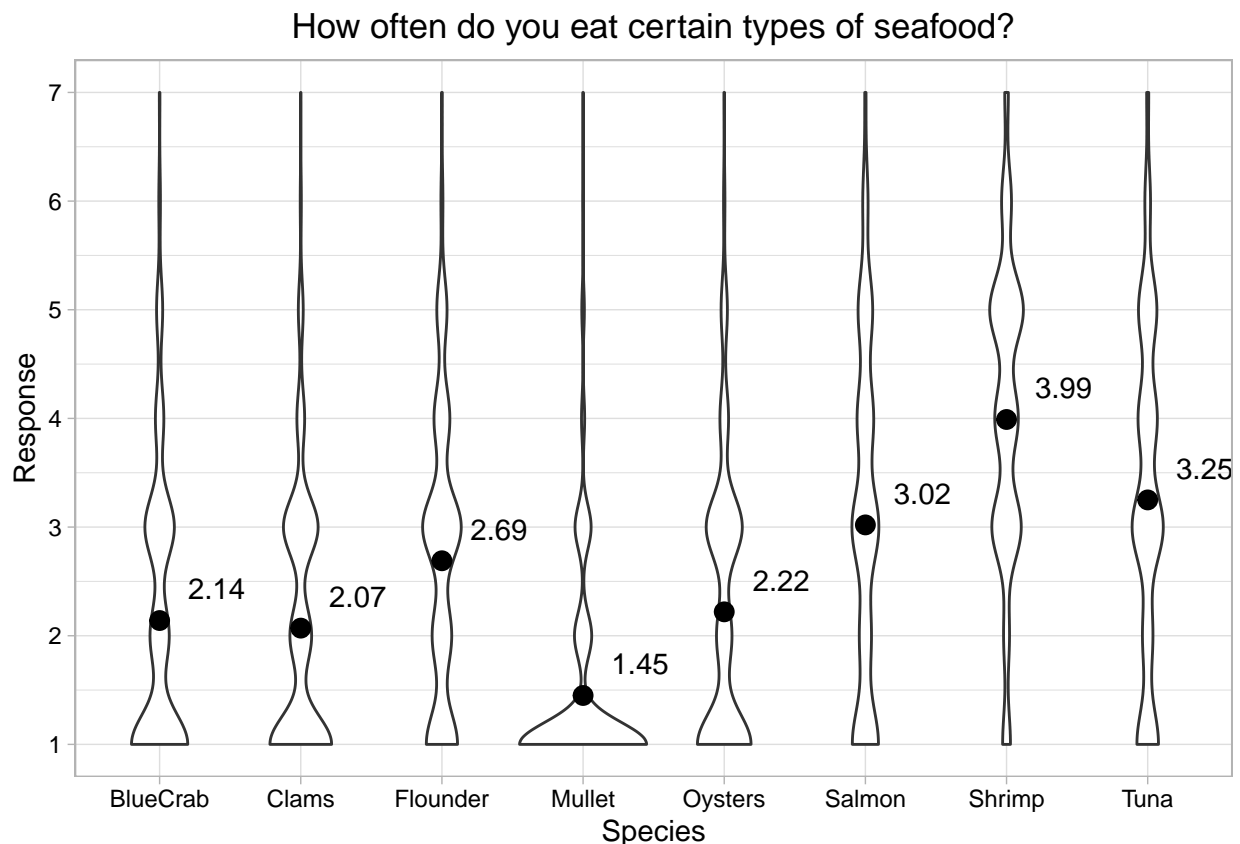


Figure 2: Violin plot and means of the frequency of seafood consumption based on type

4.1.1 Question 1b: Do consumers prefer wild or farmed fish?

On the whole, respondents seem to have some degree of preference for wild caught seafood or don't have any preference between wild caught and farmed seafood. However, very few respondents identified any degree of preference for farmed fish.

Figure 3 does a clear job of showing that the preference trends remain relatively uniform across all species but with a couple interesting points. For those species that respondents said

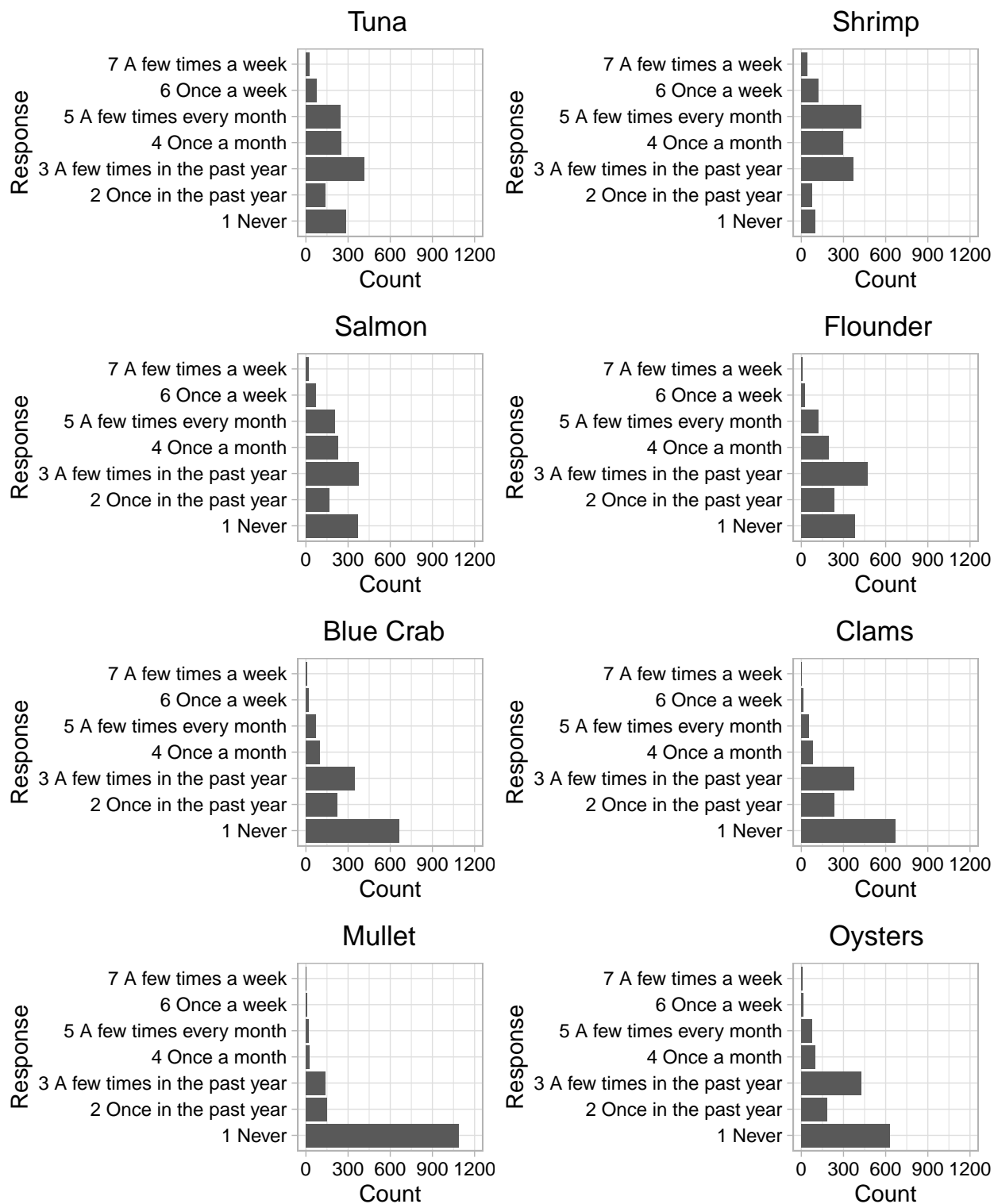


Figure 3: Bar plot of the frequency of seafood consumption based on type

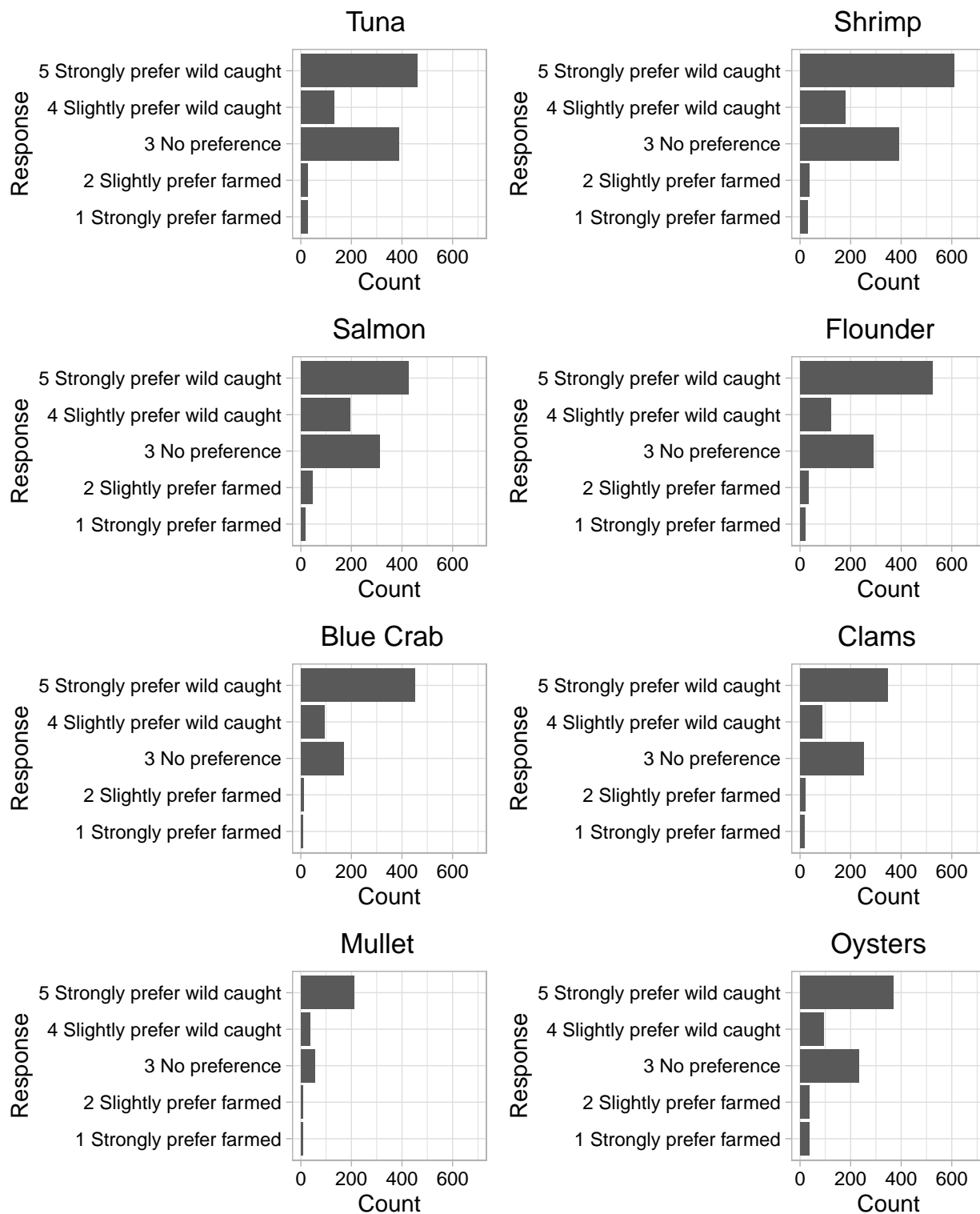


Figure 4: Do you prefer wild-caught or farmed versions of these seafood?

they consumed less often, Mullet and Blue Crab, respondents showed a larger “stronger preference for wild caught.” Meanwhile, for those species that respondents said they consumed more often, Tuna, Shrimp, and Salmon, respondents identified “no preference” between farmed and wild-caught a little more readily.

4.2 Question 2a: What qualities do consumers associate with seafood?

There is quite the spread in associations of particular qualities with farmed or wild-caught seafood, as shown in figure 4. Specifically, it seems as though respondents tend to associate tasty, fresh, safe, healthy, and the various local categories more heavily with wild-caught seafood. However, respondents tend to associate sustainability, easy access, and affordability more heavily with farmed seafood.

4.3 Question 2b: What qualities do consumers value in seafood?

In figure 5, we can see that respondents prioritized certain qualities like safety, tastiness, freshness, and healthiness of the seafood but didn't seem to place as much emphasis on other qualities like whether the seafood was farmed or wild.

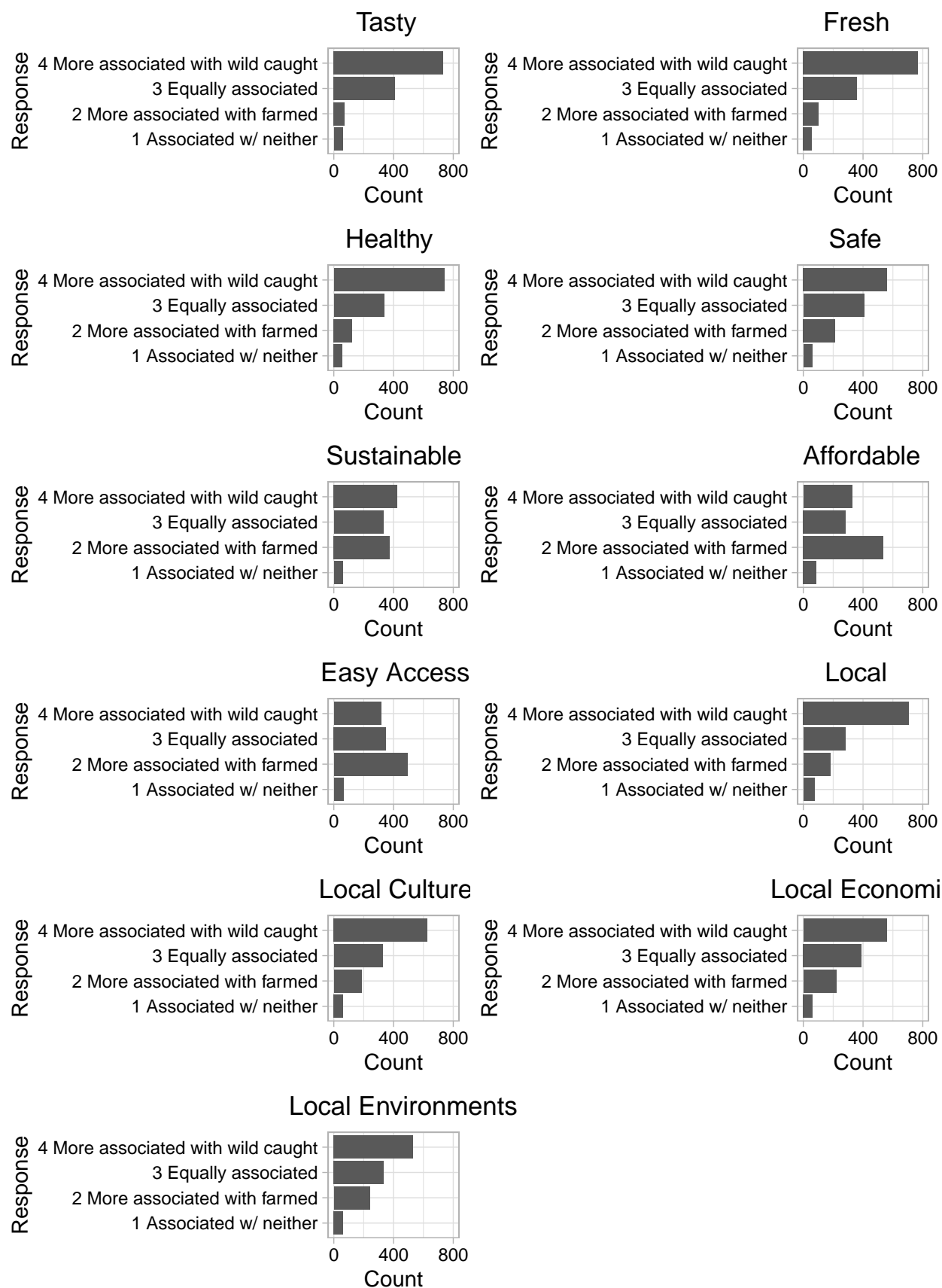


Figure 5: How do you associate the following qualities with wild vs. farmed seafood?

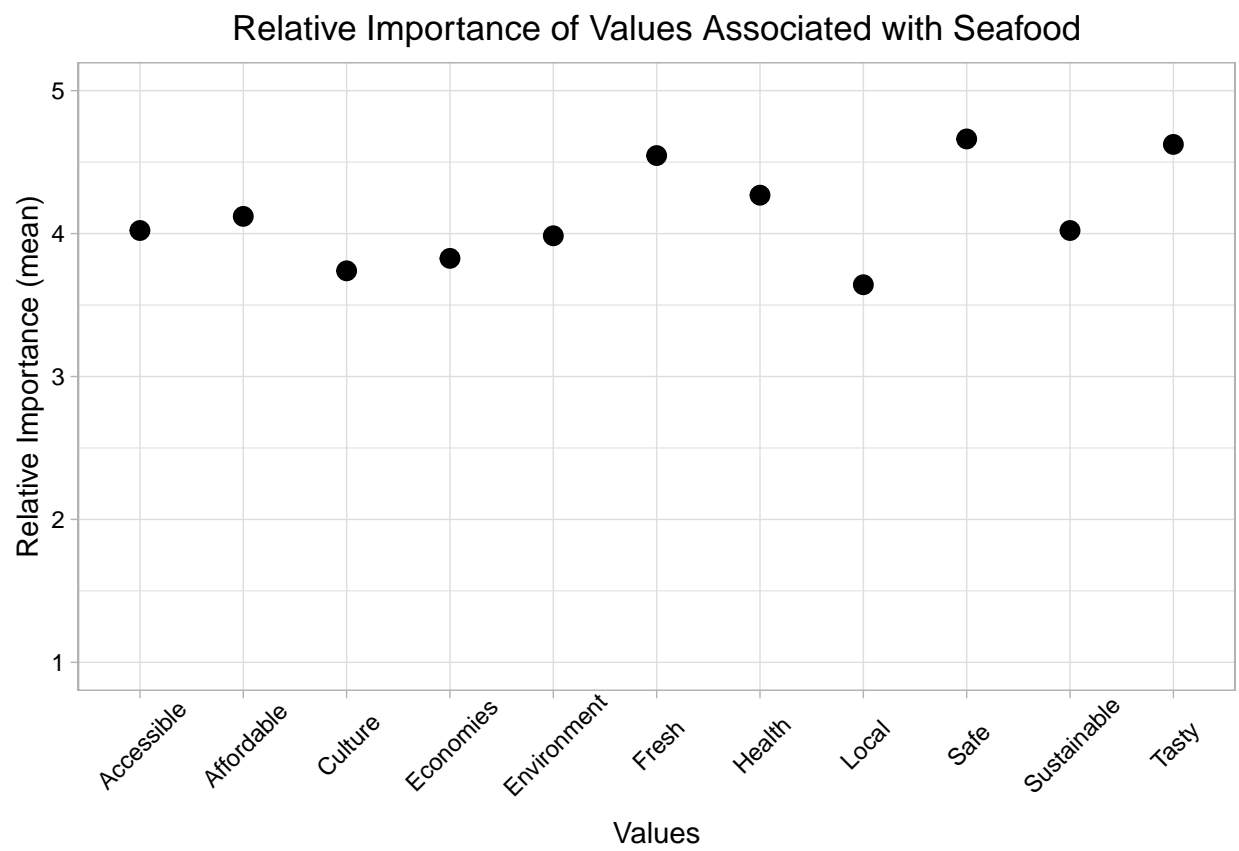


Figure 6: How important are the following qualities?

4.4 Question 3: Are valued seafood qualities predicted by demographic variables such as age or education level?

Age is a predictor of the value respondents placed on the freshness of their seafood, with folks older than 19 placing more value on the freshness of their seafood. The low p-value ($<.05$) indicates that this association is statistically significant. However, the low r squared value means that age explains only $\sim 3.69\%$ of the variability in the data. Education is also a predictor of how a respondent values freshness. The low p-value again indicates that this association is statistically significant, though the r squared of 2.07% means that it doesn't explain much variability in the data. Political party is not a significant predictor of the value a respondent places on the freshness of their seafood as told by the high p-value of $.4211$.

Age is a predictor of the value respondents placed on the local nature of their seafood. The low p-value ($<.05$) indicates that this association is statistically significant. However, the low r squared value means that age explains only $\sim 1.78\%$ of the variability in the data. Education is also a predictor of how a respondent values the local nature of their seafood. The low p-value again indicates that this association is statistically significant, though the r squared of 1.48% means that it doesn't explain much variability in the data. Political party is not a significant predictor of the value a respondent places on the local nature of their seafood as told by the high p-value of $.2403$.

Age is a predictor of the value respondents placed on the taste of their seafood. The low p-value ($<.05$) indicates that this association is statistically significant. However, the low r squared value means that age explains only $\sim 1.41\%$ of the variability in the data. Education is also a predictor of how a respondent values the taste of their seafood. The low p-value again indicates that this association is statistically significant, though the r squared of 0.98% means that it doesn't explain much variability in the data. Political party is not a significant predictor of the value a respondent places on the taste of their seafood as told by the high p-value of $.1333$.

Age overall was not a significant predictor of how respondents valued health ($p>0.05$). However, the age ranges of 50-59 and 60-69 were significant and the estimates were positive, indicating that respondents in these age ranges valued health as a quality of seafood more than teenagers. Education was a significant predictor of how respondents valued health ($p = 0.007$). All estimates were positive, indicating that a high school education or more predicted that respondents would value health in their seafood more highly. Political party was not a significant predictor of how respondents valued health ($p>0.05$).

5 Summary and Conclusions

This analysis communicates several key findings—findings that (1) should inform future inquiries as researchers aim to better understand community and consumer understandings of seafood and sustainability issues, and (2) may help researchers make positive strides toward pursuing education and engagement efforts on these issues.

First, respondents tend to consume certain species of seafood in larger volumes and at higher frequencies than other species. Shrimp, Tuna, and Salmon top the list. Meanwhile, respondents do not consume as much Mullet, Blue Crab, Oyster, or Clams. These consumption practices and patterns are important because they substantiate broader trends within fisheries management; certain species are subject to the bulk of over-fishing concerns because of their marketability to consumers. Therefore, addressing over-fishing concerns and pursuing education and engagement efforts may be most effectively targeted at only a handful of species.

Second, respondents noted some preference for wild-caught seafood across all species, though many respondents noted that they didn't have a preference between wild-caught and farmed seafood. The preference for wild-caught seafood was stronger for species respondents tend to consume less often, meanwhile a lack of preference was more prevalent for species respondents consumed more often. These results have bearing on education efforts surrounding the pros and cons and relative sustainability of farmed versus wild-caught seafood.

Third, respondents associated different qualities more and less heavily with farmed and wild-caught seafood. For instance, respondents tend to think of wild-caught seafood as more associated with tastiness, freshness, safety, and health. Furthermore, respondents associate wild-caught seafood with local culture, local economies, etc. Meanwhile, Respondents identified farmed seafood as having a stronger relationship with sustainability, easy access, and affordability. The association respondents have between farmed seafood and sustainability is particularly interesting and reflects a substantial opportunity for education & outreach. Furthermore, respondents prioritize qualities such as safety, tastiness, freshness, and health but don't prioritize whether the seafood is farmed or wild-caught. Again, these priorities are worthy of further exploration.

Finally, statistical analysis substantiates this visual inspection of the data; it indicates that respondents most heavily associate the qualities of taste, health, and local with wild-caught seafood. Furthermore, statistical analysis indicates that political party plays a statistically significant role in determining if a respondent prioritizes health in seafood selection. Respondents with some level of college education place a higher value on health.

6 References

Pauly, D., & Zeller, D. (2016). Catch reconstructions reveal that global marine fisheries catches are higher than reported and declining. *Nature Communications*, 7(1), pp 1-9.