

Assessing Consumer Preferences for Seafood Products in a North Carolinian Community-Supported Fishery

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I. Executive Summary

In recent years, Community Supported Fisheries (CSFs) have gained prominence in the North American seafood industry, with Walking Fish CSF in North Carolina being one of the pioneering efforts. Although several studies have focused on the growth and development of alternative fisheries such as CSFs, few have explored consumer preferences for seafood sourced from these outlets and whether such preferences differ from other consumer groups [5]. Understanding consumer demands and preferences is complicated, especially for a new industry with a sizable range of product species. Looking at broader trends for seafood consumption, it shows that 75% of retail sales by value are dominated by 3 species: salmon, shrimp, and tuna [7]. Other species outside of the big 3 such as oysters have relatively unknown consumption patterns. The research that has been done specifically on consumer preferences for purchasing seafood also indicates that consumer-facing attributes such as price, taste/smell, perceived health risks/benefits, and appearance were more highly valued than production-facing attributes such as whether the product is local, whether it is seen as sustainable, and or whether it is wild-caught or farm-raised [5][9][10]. There are cases where the opposite is true and production-facing attributes have a higher value than consumer-facing attributes [9][10][11][12]. Comprehending consumer preferences for seafood products and the differences between various groups is essential in informing the growth and development of CSFs. This project aims to investigate and compare the preferences of seafood products for Walking Fish customers and general consumers for seafood products within North Carolina.

My methods include using surveys created with the survey company Qualtrics to collect a representative sample of state residents and Walking Fish Customers. For state resident respondents, an equal number would come from coastal and non-coastal counties. The survey was fully deployed in 2021 after pre-testing and revisions. Requirements for survey participation include being a North Carolina resident, 18 years of age or older, and having consumed some amount of seafood in the past year. A total of 1040 responses from general consumers and 87 responses from Walking Fish customers were recorded. The survey included questions regarding demographic characteristics, purchasing patterns (frequency and location),

and preferences related to desired attributes of seafood (including farmed/wild distinctions). Eight species were included in the survey questions about quality attribution, wild vs farmed preferences, and consumption frequency in order to discern patterns. The attributes included in the survey questions were developed through reference to the literature. Statistical program R was used to conduct Student's T-test on the data to determine if the two groups were significantly different from each other.

The Results indicate that Walking Fish customers attached greater importance to production-facing attributes than general consumers. The importance of consumer-facing attributes was similar between the two groups with the exception of freshness having higher importance and affordability and ease of access having lower importance. This follows the trends noted in the previous studies, where increased access to direct marketing outlets and/or closer distance to the coast brings higher levels of importance to production-facing attributes. It indicates that CSF members such as Walking Fish customers have greater direct access to seafood than general consumers and that price is less of a concern for them. The results also demonstrated that Walking Fish customers strongly preferred wild-caught seafood products over farmed products compared to the general public, with exceptions for blue crabs, oysters, and clams. Blue crabs and clams had no significant difference while oysters had a slightly weaker association with wild-caught. A higher percentage of respondents did not know their preference for wild or farmed oysters. This could be due to the development of oyster aquaculture on the coastline of North Carolina and the spread of conflicting information. Additionally, Walking Fish customers exhibit similar patterns as general consumers in terms of associating specific attributes with wild-caught and farmed products, but with a more pronounced emphasis. Only sustainability and freshness had no significant difference between the groups. Lastly, Walking Fish customers consume all eight species listed much more frequently than general consumers. Compared to Walking Fish customers, a significant percentage of general consumers reported never having tried any of the species listed. This indicates that Walking Fish customers have easier access to or a greater willingness to seek out more unpopular species. All this provides important implications for how CSFs can develop in the future.

II. Introduction

As demand for seafood expands in North America, Community Supported Fisheries (CSFs) have emerged as a prominent form of seafood distribution [1]. CSF are based upon the Community Supported Agriculture (CSA) system, where producers directly market their products to consumers through regular, pre-arranged deliveries [1][2]. In direct marketing, fishermen tend to receive higher prices for fish, guarantee a stable income, and gain allies in the political and regulatory process through direct interactions with communities that can advocate for them [1][2]. For consumers, they are provided with access to novel high-quality fish and the benefits of building a relationship with producers. [1][2]. Many CSFs aim to re-localize food systems and, by extension, reduce the physical and social distance between consumers and producers by increasing face-to-face interactions [1][2]. The first CSF operation emerged in Maine in 2007 and the industry has only increased in number and geographic distribution [3]. The form that CSFs take is determined by local factors including local ecologies, pre-existing supply chain dynamics, histories, politics, and personal priorities [3]. Given the broad spread throughout the country and the non-homogeneity of the industry, operations, consumer behavior, and economics for CSFs can differ greatly between regions [3]. One such region where a CSF has developed is the state of North Carolina.

Within North Carolina, commercial fisheries landings in 2021 amount to 42.3 million pounds with an estimated value of \$89.7 million [4]. While the physical landing amount has decreased by 1.5% from the 2020 landings (43.0 million pounds) and 17.4% from the 2016-2020 five-year average (51.2 million pounds), its value has increased by 15.7% from the 2020 estimated value of \$77.6 million and 3.6% from the five-year average of \$86.6 million [4]. As fisheries are a major part of the economy, the emergence of various business plans, such as CSFs, would occur. A major CSF to develop within North Carolina is Walking Fish [1]. This CSF was the first of its kind in the area and was launched by Duke University's Nicholas School of the Environment graduate students in September 2009 [1]. While there have been a number of studies that directly looked at the growth of alternative fisheries practices like CSFs, relatively few examine the consumer preferences for seafood obtained from these outlets [5]. Due to the

fairly recent introduction of CSFs into the area, trends for CSF consumer preferences in North Carolina are still developing and are not entirely known.

Understanding consumer demands and preferences is complicated, especially for a new industry with a sizable range of product species [6]. On the other hand, broader trends are much easier to discern. US seafood consumption patterns indicate that around 75% of retail sales by value are dominated by 3 species: salmon, shrimp, and tuna [7]. Other species that are outside of the big 3 such as oysters have relatively unknown consumption patterns including local scale patterns. An illustration can be seen in a shellfish aquaculture industry report from North Carolina. The report stated that a better overall understanding of the market dynamics in North Carolina's oyster industry will be vital for the future of this nascent industry [8]. However, these markets are very state-specific and "(r)elatively little is known about the existing and potential markets for North Carolina shellfish mariculture products." ([8], pp.41).

Beyond the broad trends there is little comprehensive information regarding what attributes customers prefer in their seafood [6]. This includes whether the seafood in question is sourced from wild or farmed stocks [6]. Research that has been conducted in states such as North and South Carolina indicates that consumer-facing attributes are more highly valued than production-facing attributes [5][9][10]. Consumer-facing attributes include price, taste/smell, perceived health risks/benefits, and appearance while production-facing attributes include whether the product is local, whether it is seen as sustainable, and or whether it is wild-caught or farm-raised [9][10]. Murray et al (2023) showed that 8 out of 11 attributes included in their research were strongly associated with wild-caught products and that consumers preferred wild-caught products over farm-raised products.

Conversely, other studies have shown that a portion of consumers put more importance on production-facing attributes than consumer-facing attributes [9][10][11][12]. Factors like access to direct marketing outlets and distance from the coast can influence consumers to prioritize production-facing attributes such as sustainability and environmental effects and a greater preference for wild-caught products [5][6]. This trend can be seen in the Hawaiian fisheries where production-facing attributes such as wild vs farmed sourcing have a

major impact on how much consumers are willing to pay for a product [13]. Lastly, those intending to join a CSF or are already a CSF member tend to prefer wild-caught seafood products and have a greater emphasis on sustainability [5]. A 2014 survey conducted in North Carolina showed that CSF members believed that joining CSFs would allow them access to local, high-quality seafood while supporting local fishing communities [1].

Overall, findings from research on consumer preferences differ depending on the context. Product attributes such as origin, form, labeling, or production method all vary depending on the market [5][6][9][13][17][18]. In summary, information on seafood preferences and the distinction between regular consumers and consumers of CSF products is scarce within the North Carolinian context. Understanding consumer preferences and the distinction between consumer groups is important in determining the extent to which they might respond to changes in seafood products and identifying the species and qualities that would be most beneficial for the development of CSFs. This study aims to understand and compare consumer preferences and behavior between Walking Fish customers and general consumers.

III. Methods

In order to gather a representative sample of state residents, an online survey was developed using Qualtrics. The core focus area for this survey was coastal areas, specifically the 20 Coastal Area Management Act counties as defined by the NC Department of Environmental Quality. The survey has also taken into account other non-coastal counties in the state. Altogether, half the respondents came from coastal counties while the other half came from non-coastal counties. After pre-testing and revisions, the survey was fully deployed in 2021. In order to take part in the 20–30 minute online survey, respondents must be 18 years of age or older, a North Carolina resident, and have consumed some amount of seafood in the past year. A total of 1040 responses were collected after the survey was disseminated. To collect data on Walking Fish customers the survey was disseminated through the company’s subscription newsletter. A similar requirement for survey participation was implemented. A total of 87 responses were collected.

To investigate consumption patterns and preferences, the survey contained questions about demographic characteristics, purchasing patterns (frequency and location), preferences related to desired attributes of seafood, including farmed/wild distinctions. Eight species were included in the survey questions about quality attribution, wild vs farmed preferences, and consumption frequency in order to discern patterns (see Fig. 2, Fig. 3, Fig. 4). Salmon, shrimp, and tuna were included as they dominated consumption patterns. Blue crabs, flounders, oysters, and mullet were included as they are part of North Carolina’s highest landed species. Lastly, clams were included to determine how consumers would respond to shellfish. The attributes included in the survey questions (see Fig. 1, Fig. 3) were developed through reference to the literature (see sources in the introduction).

Data were entered into R for analysis. A Student’s T-test was conducted to test if the two groups were significantly different from each other (see Table 1, Table 2, Table 3).

IV. Results

To compare the differences between Walking Fish and general consumers' preferences on seafood, respondents were asked to assign a level of importance to several seafood attributes. The findings are summarized in figure 1.

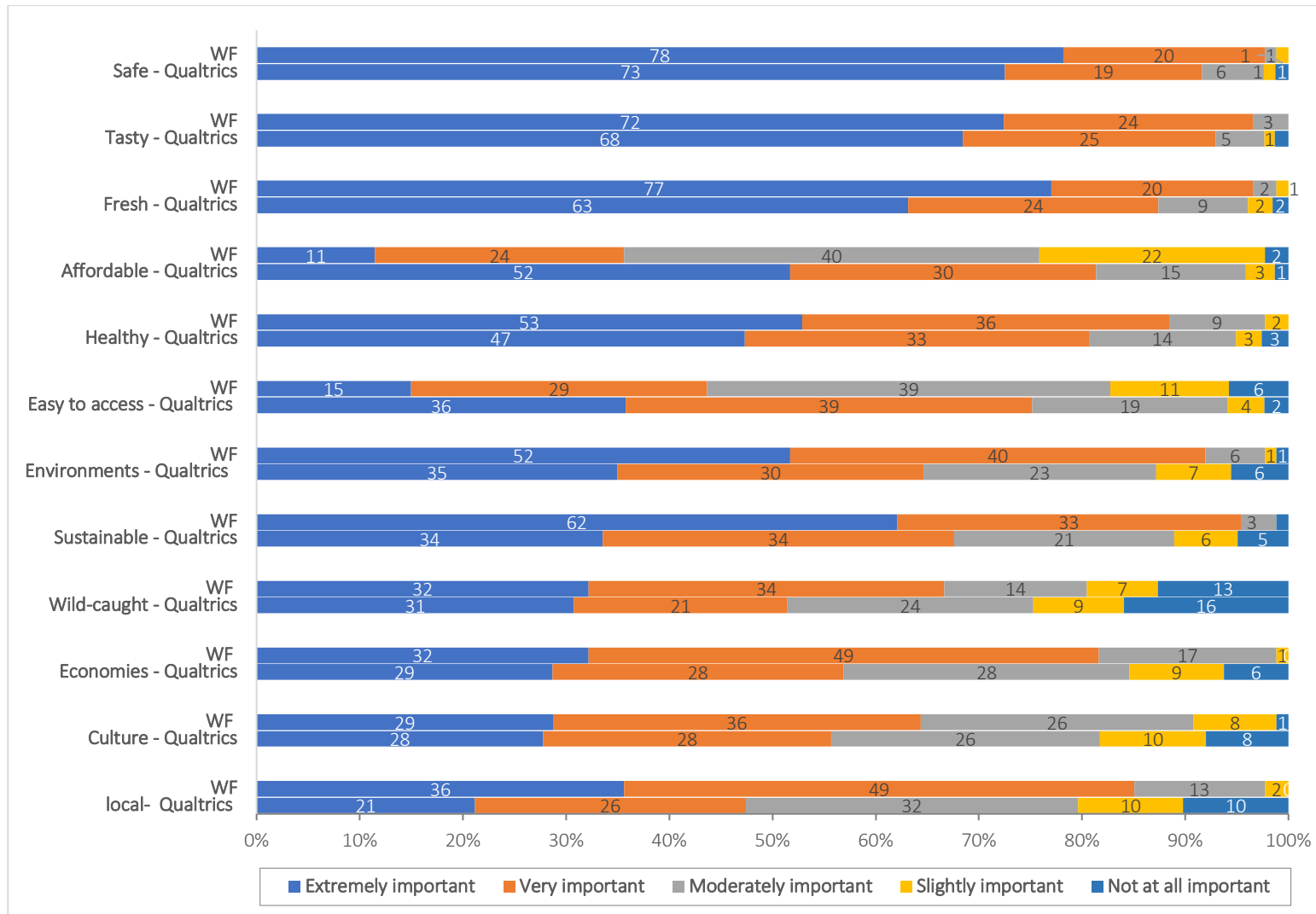


Figure 1: Consumer ratings of the importance of attributes when purchasing seafood. Figures show percentages in each category.

After the survey data was compiled and analyzed with R, results show that local, affordable, sustainable, ease of access, freshness, and impacts on local economy and environment were significantly different between Walking Fish Customers and general consumers. Results are summarized in table 1.

	Healthy	Local	Safe	Local economy	Tasty	Affordable	Local culture	Sustainable	Easy to access	Local environment	Fresh	wild-caught
WF	4.39	4.18*	4.75	4.13*	4.69	3.21*	3.83	4.55*	3.36*	4.40*	4.72*	3.67
Qualtrics	4.20	3.38*	4.60	3.64*	4.58	4.28*	3.57	3.85*	4.03*	3.81*	4.45*	3.42
<i>Differences</i>	<i>-0.19</i>	<i>-0.80</i>	<i>-0.14</i>	<i>-0.49</i>	<i>-0.11</i>	<i>1.07</i>	<i>-0.26</i>	<i>-0.70</i>	<i>0.67</i>	<i>-0.59</i>	<i>-0.27</i>	<i>-0.25</i>

Table 1. T Test significance for survey question on importance of qualities when purchasing seafood. Table shows the mean response for each respondent group across response categories where 1=Not at all important, 2=Slightly important, 3=Moderately important, 4=Very important, 5=Extremely important.

* indicates significant difference.

Results suggest that the majority of consumer-facing attributes like safety, taste, freshness, and affordability were ranked much higher than production-facing attributes for general consumers. Results also suggest that production-facing attributes were given higher importance by Walking Fish customers compared to general consumers.

Respondents were then asked to indicate preference for wild-caught vs farmed-raised origins for eight product species. The findings are summarized in figure 2.

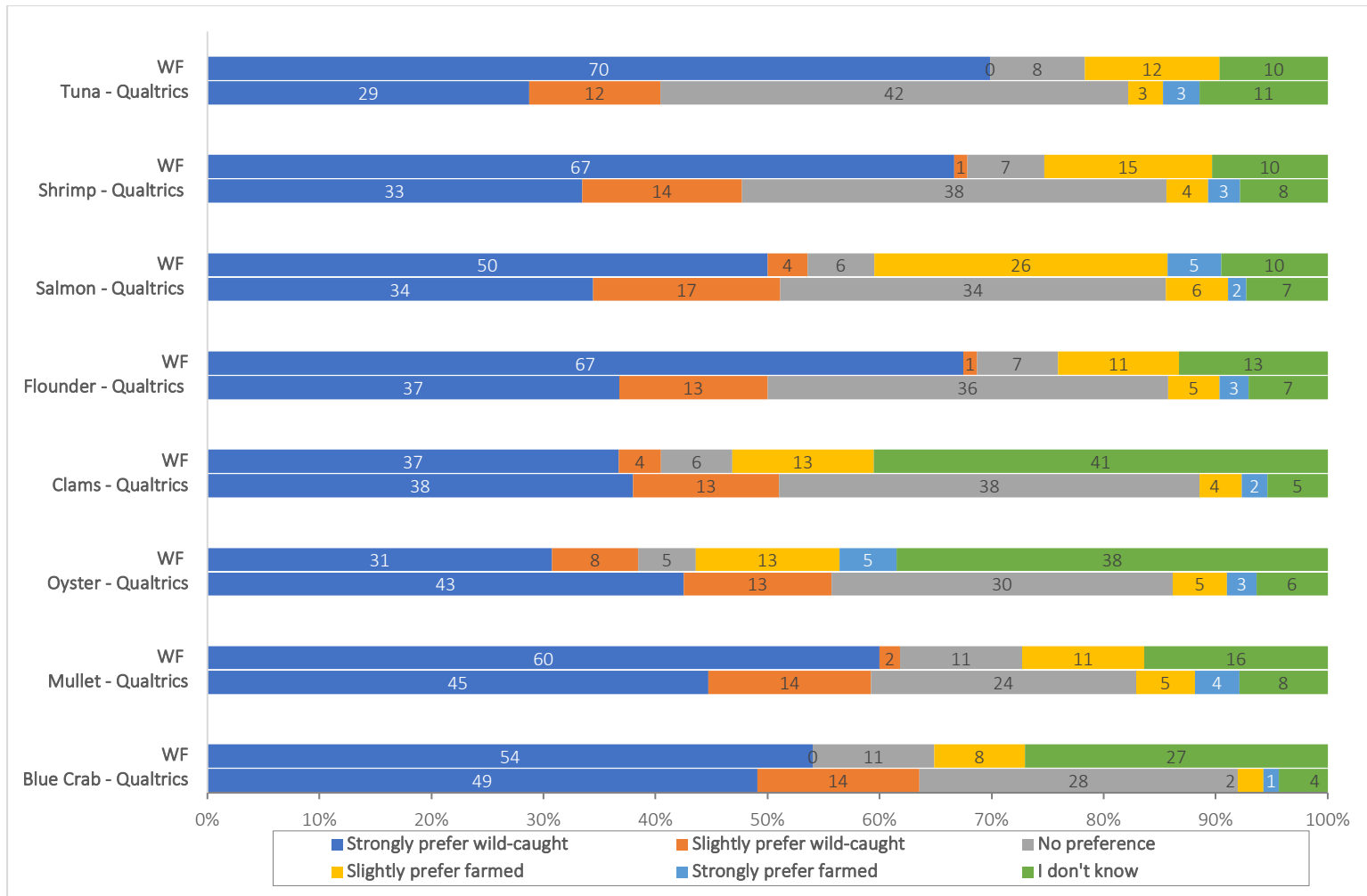


Figure 2. Consumer preferences for wild-caught vs farmed-raised seafood for eight species. Figures show percentages in each category.

After analysis with R, results show that wild vs farmed preferences for tuna, shrimp, salmon, flounder, oyster, and mullet were significantly different between Walking Fish customers and general consumers. Results are summarized in table 2.

	Tuna	Shrimp	Salmon	Flounder	Blue Crab	Clams	Mullet	Oysters
WF	1.34*	1.42*	1.80*	1.44*	1.70	2.16	1.57*	2.43*
Qualtric	2.33*	2.22*	2.17*	2.17*	1.88	2.15	2.01*	2.06*
<i>Differences</i>	<i>0.99</i>	<i>0.80</i>	<i>0.37</i>	<i>0.73</i>	<i>0.18</i>	<i>0.03</i>	<i>0.46</i>	<i>-0.35</i>

Table 2. T Test significance for survey question on preferences for wild-caught vs farmed-raised seafood for eight species. Table shows the mean response for each respondent group across response categories where 1=Strongly prefer wild-caught, 2=Slightly prefer wild-caught, 3=No preference, 4=Slightly prefer farmed, 5=Strongly prefer farmed.

* indicates significant difference.

For the general consumers, there is a clear and consistent preference for wild-caught product across all eight species while for Walking Fish customers it was six species (tuna, shrimp, salmon, flounder, blue crab and mullet). The total percent of respondents who answered “strongly preferred wild” and “slightly preferred wild” was no less than 50% for the eight and six species mentioned. Notably, oysters and clams had the highest percent (41% and 39% respectively) of Walking Fish respondents state “I don’t know”.

Following this, respondents were asked how strongly they associated an attribute described in figure 1 with a production method (farmed vs wild). The findings are summarized in figure 3.

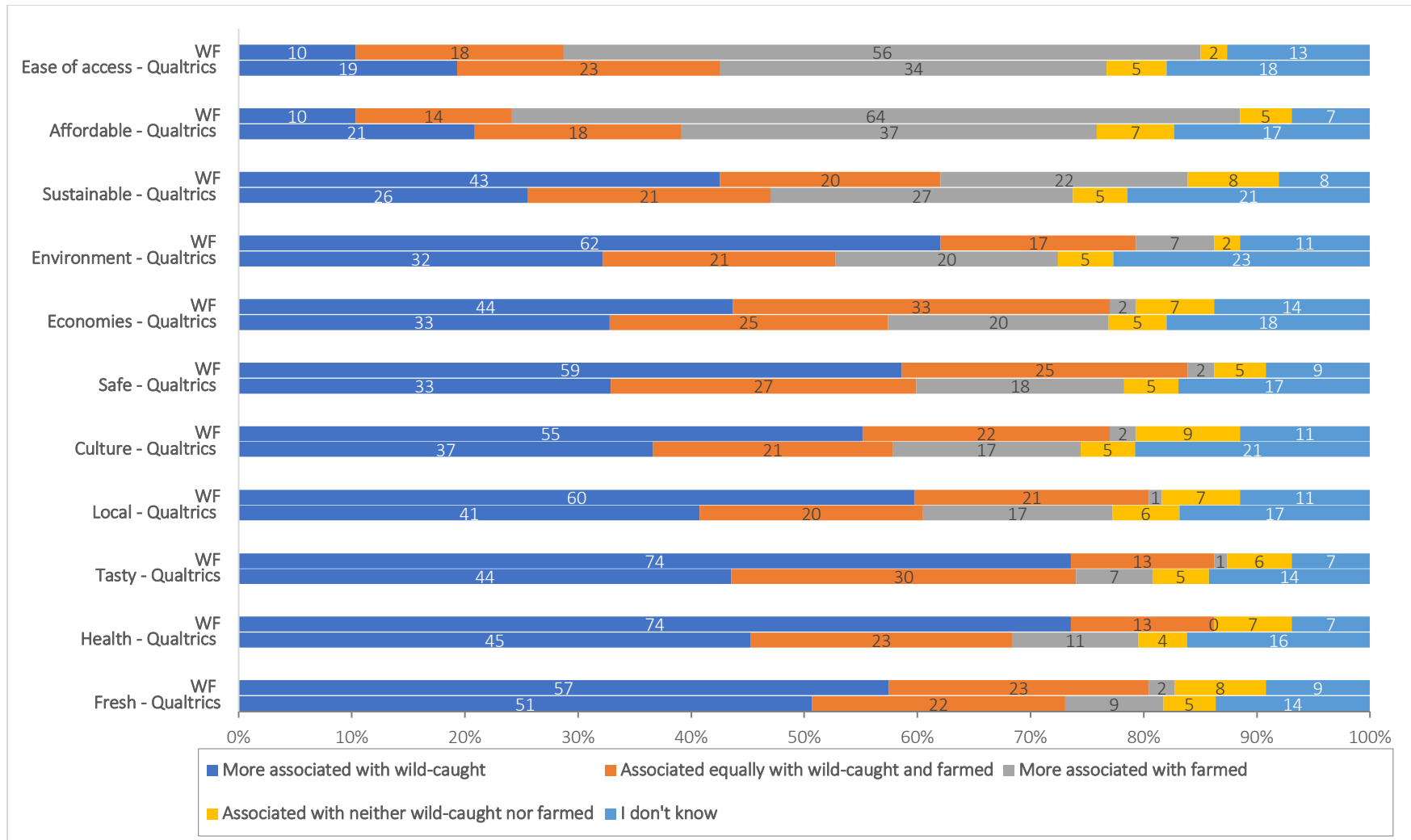


Figure 3. Percentage of consumers who associate different seafood qualities with either wild-caught or farm-raised products. Figures show percentages in each category.

After analysis with R, results show that association of health benefits, local, safety, taste, affordable, ease of access, and impacts on local culture, economies, and environment with wild or farmed products were significantly different between Walking Fish customers and general consumers. Results are summarized in table 3.

	Healthy	Local	Safe	local economies	Tasty	Affordable	local culture	Sustainable	Easy to access	local environments	Fresh
WF	1.36*	1.49*	1.48*	1.68*	1.35*	2.68*	1.61*	1.95	2.58*	1.43*	1.57
Qualtrics	1.70*	1.85*	1.94*	1.96*	1.69*	2.36*	1.87*	2.14	2.31*	1.96*	1.62
<i>Differences</i>	0.34	0.36	0.46	0.28	0.34	-0.32	0.26	0.19	-0.27	0.54	0.05

Table 3. T Test significance for survey question on associating seafood qualities with wild-caught or farm-raised products. Table shows the mean response for each respondent group across response categories where 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 nor farmed.

* indicates significant difference.

For both Walking Fish customers and general consumers, results suggest the attributes for healthy, local, safe, local economies, tasty, culture, and local environment had stronger association to wild-caught products than farm-raised product. Affordability and easy to access were more associated with farmed-raised products than wild-caught products.

Lastly, respondents were asked how frequently they consumed a certain product species. The findings are summarized in figure 4.

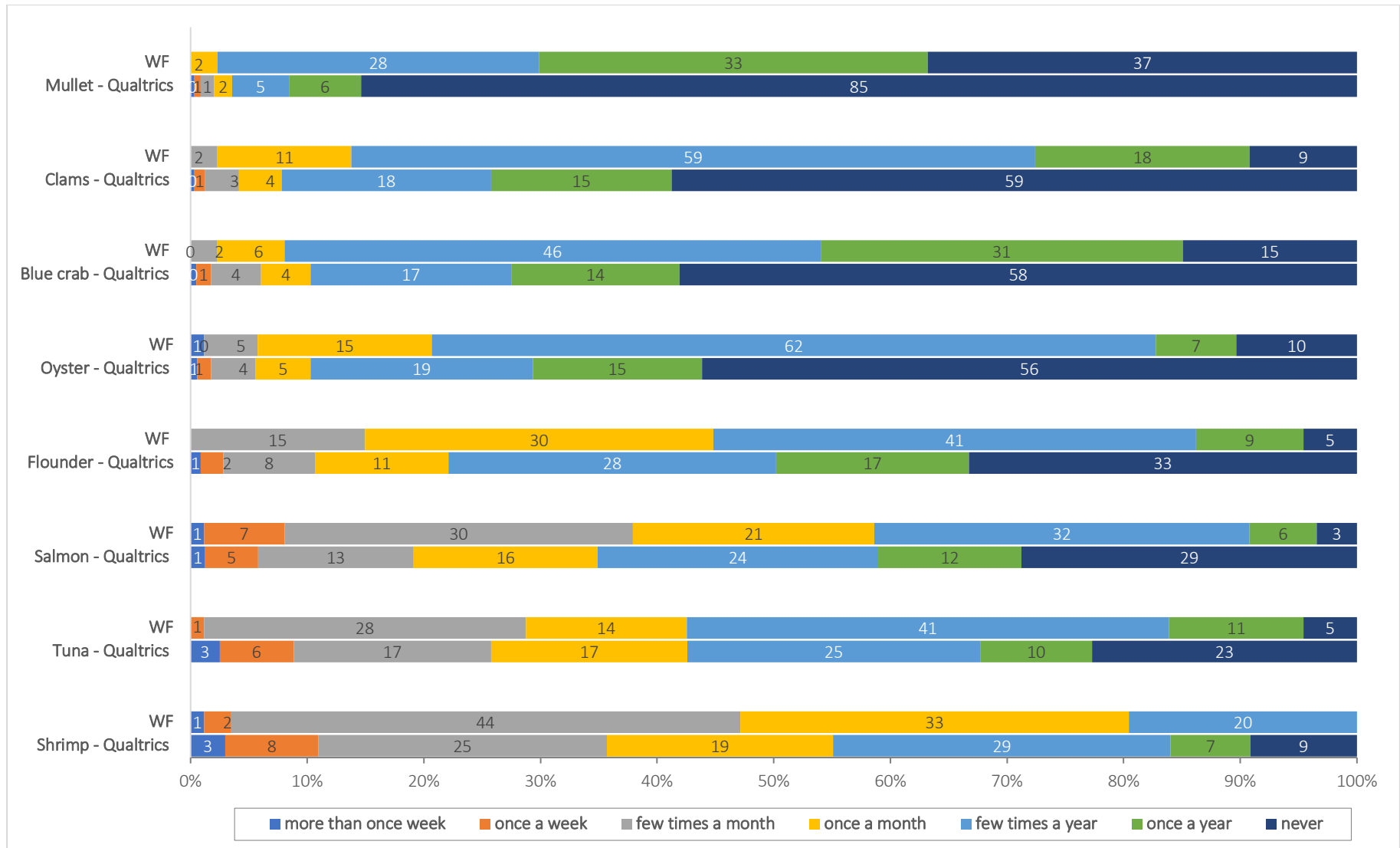


Figure 4. Frequency of consumption for eight species. Figures show percentages in each category.

The results suggest that tuna, salmon, and shrimp dominated consumption frequency as they have a larger percentage of respondents who consumed them “more than once a week” up to “a few time a month” compared to other species. Walking Fish customers also consume all species more frequently than their general consumer counterparts. Notably, general consumers have a larger percentage that report having never eaten certain product species compared to Walking Fish customers.

V. Discussion

Echoing previous studies for consumer preferences [5][6][9][10], general consumers ranked consumer-facing attributes such as safety, taste, freshness, affordability, and health benefits with a higher level of importance than production-facing attributes. On the other hand, Walking Fish customers gave higher importance to production-facing attributes such as local production, sustainability, and perceived positive impacts on the environment and local economies compared to general consumers (see fig. 1). The increase in importance for production-facing attributes for Walking Fish customers matches trends noted in previous studies, where increased access to direct marketing outlets and/or closer distance to the coast brings higher levels of importance to production-facing attributes [5][6]. In supporting this trend, Walking Fish customers put less importance on the consumer-facing attribute for ease of access compared to general consumers. This may indicate that Walking Fish customers have greater direct access to seafood supply and do not need to put a higher importance on this attribute. Given the direct marketing and delivery business model of CSFs this can be the case. An interesting result from this research is that Walking Fish customers did not significantly rank perceived impacts on local culture higher than general consumers. Initial expectations were that Walking Fish customers would have had greater emphasis on culture due to their more direct connection and interaction with fishermen, but this is not the case here. This may indicate that cultural impact in general is not a particularly important attribute to consumers as it is one of the lower-ranked attributes in importance between the two groups within this study.

Regarding consumer-facing attributes, there was no significant difference in the level of importance between Walking Fish customers and general consumers except for ease of access, freshness, and affordability. In comparison to general consumers, Walking Fish customers placed higher importance on freshness while affordability and ease of access were given less importance. Since Walking Fish source their products within the state and provides delivery to their customers, freshness would be significantly emphasized and expected by consumers. Furthermore, the extra services provided by Walking Fish, direct interactions, perceived higher quality, and cost of subscription would increase the perception of these products as being premium. In turn, this could decrease the importance

of affordability to consumers as they would be expected to pay more for these kinds of products from the beginning.

When comparing wild-caught as an attribute, there is no significant difference between Walking Fish customers and general consumers in the ranking of importance. In figure 1, both groups ranked wild-caught as an attribute relatively low in importance. Despite this, both displayed a strong preference for wild-caught over farm-raised products for all species listed irrespective of whether the species is commonly farmed or not (see fig. 2). Even though this response may be due to the survey design, it still implies that the consumers do not distinguish between specific species, or in other words, they display a firm and uniform inclination towards wild products regardless of the particular species. From this, it may be unlikely that consumers would pick products from aquaculture even though the industry is growing and developing in places such as North Carolina. This indicates that, even though recent conditions are favorable [8][14], producers such as Walking Fish should consider either refrain from using aquaculture methods due to the potential unpopularity of the product, or educate their customers about aquaculture products. If producers do start up aquaculture operations, they may need to build in-state demand or export outside of the state to consumers who prefer farmed products.

In comparison between Walking Fish customers and general consumers, Walking Fish customers have a significantly stronger wild-caught preference for all species except blue crab, clams, and oyster. Oysters are the only species where wild-caught preference is not as strong as the general consumers' preference but still leans towards wild-caught. Blue crab and clams had no significant difference in either direction. The development of oyster aquaculture in the state's coastal areas may contribute to the weaker preference for wild-caught species. In figure 2, around 39% of Walking Fish respondents answered "I don't know" when directly asked if they preferred farmed or wild oyster as opposed to the 6% of respondents for general consumers. This percentage is only surpassed by clams which are also a widely farmed product at 41% of respondents. As legislation changes and the local farming industry grows, new and often contradictory information is constantly being released by various parties for and against oyster aquaculture [8][14][19]. The dynamic and contentious conversations regarding this topic could lead to uncertainty for preferences, enough to cause a larger percent of respondents to answer "I don't know".

Following this, an interesting trend emerges when looking at the interaction between seafood attributes and preference for wild vs farmed products in figure 3. The majority of general consumer respondents associate 8 out of 11 attributes with wild-caught products. Walking Fish customers similarly associate 9 out of 11 attributes with wild-caught. These attributes include most of the consumer-facing attributes such as freshness, health, and taste. Both groups of consumers also attributed affordability and ease of access more to farmed products than wild-caught products. Some attributes such as safety and sustainability had a more mixed response. For the most part, Walking Fish customers follow the same trends that the general consumers follow but with stronger emphasis. Only sustainability and freshness had no significant difference between groups. Interestingly there is a consistent and similar amount of respondents who equally associate the attributes to farmed and wild-caught products for Walking Fish customers (13% – 33%) and general consumers (18%- 31%). The association of affordability and ease of access with farmed products by both groups would indicate that consumers perceive farmed products as being affordable and easily found.

The overall association of desired attributes with wild-caught products may have implications for fisheries' adaptability to events such as climate change. As climate and ocean condition changes, the range, supply, taste and texture of certain wild species would be altered [15]. North Carolina could be affected by this as temperate waters are most susceptible to changes [15][16]. This can make current sustainable harvesting methods unsustainable, increase cost of seafood products, and alter the product itself. Figure 1 shows most of Walking Fish consumers ranked sustainability (62%) and impact on local environment (52%) as extremely important while general consumers had a more mixed response. Similarly, figure 3 shows Walking Fish customers have a greater percentage of respondents associate sustainability (43%) and impact on local environment (62%) with wild-caught while general consumers had a mixed response. This stronger perception of importance and association of attributes indicate that Walking Fish customers may not be as flexible to changes as general consumers. If Walking Fish producers are unable to maintain the sustainability and environmental impact of their product, then consumers may go elsewhere.

Conversely, consumers may not truly prefer wild-caught product due to their attributes but instead pull from general perception of wild-caught vs farmed products. Information perpetuated by the media and wild-caught seafood marketers against aquaculture may make wild-caught products comparatively more attractive [6][19]. If this is the case, then consumers may continue to purchase and consume wild-caught products regardless of any changes to the attributes associated. Consequently, major changes may not be as negatively impactful to producers as once thought.

Lastly, the frequency of seafood consumption for both Walking Fish customers and general consumers matches that of previous studies [7][9]. The big 3 species of salmon, shrimp, and tuna still remain the most commonly consumed. They had the highest percentage of respondents for “once a week” and “few times a month” compared to other species. Given that the majority of shrimp and salmon consumed in North Carolina are most likely farmed, there is a notable disconnect between what consumers perceive about seafood products and the actual origins of what they purchase. These contradictory views may allude to a larger complexity behind consumer behaviors.

In comparing the two groups, Walking Fish customers generally eat seafood products more frequently than general consumers overall. For frequent consumption patterns, the frequency of “more than once a week” up to “a few times a month” were grouped together. Within this grouping Walking Fish customers generally had a higher percentage of respondents (0-47%) than general consumers (2-36%). Only blue crabs, clams, and mullets were eaten less regularly than general consumers within this frequency range. For infrequent consumption patterns, “once a month” up to “once a year” were grouped. Walking Fish had a consistently larger percentage of respondents who consume seafood products within this frequency range (53-89%) than general consumers (13-56%). For general consumers there is a larger percentage of respondents who responded “never” (9-85%) in comparison to Walking Fish customers (0-37%). The species with the largest percentages for “never” are part of North Carolina’s highest landed species which include blue crabs, flounders, oysters, and mullet. This indicates that general consumers may not have frequent or consistent access to some of the less popular seafood species that Walking Fish customers do. It may also indicate that willingness to eat a broader range of species relatively frequently is higher in Walking Fish customers.

VI. Conclusion

As previous research has mostly concentrated on characterizing preferences for one group of consumers, there has been a lack of information regarding the differences in seafood preferences and consumption patterns between CSFs and other groups. This study revealed interesting insights into consumer preferences and behavior for CSFs such as Walking Fish in comparison to general consumers. The findings highlight the importance of value and context on how preferences (both consumer-facing and production-facing) are formed and how they can be applied to the development objectives of the industry. Just as the development of the industry can influence consumers' perception and preferences for seafood products, understanding the diversity of consumer preferences can help inform the development of the industry. This study has also highlighted various disconnects between both groups of consumers in regards to seafood perception and preferences. If left unresolved it could lead to improper management and development objectives being implemented, slow growth in the industry, and inequitable situations. In the end, these nuances in consumer preferences could have a significant impact on sales and profitability. As such, this study provides valuable insights into the complex world of consumer behavior and opens up new avenues for further research and exploration.

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