

Project Title: Choice of Seafood: An Analysis of the North Central Region Market for Farm-Raised Seafood [Termination Report]

Total Funds Committed: \$125,569

Initial Project Schedule: July 1, 2019 to June 30, 2021

Current Project Year: July 1, 2019 to June 30, 2021

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Reason for Termination: Completion of project objectives.

Project Objectives

1. To design survey questions to identify, consumers' choice:
 - i. consumer's preferred species,
 - ii. consumer's perception and willingness to pay for alternative forms of seafood: fresh, refrigerated, frozen, processed (fillet, smoked and canned),
 - iii. consumer's quality expectations,
 - iv. factors influencing consumer purchase of aquaculture products,
 - v. other possible benefits and attributes NCR aquaculture products can offer to consumers, and
 - vi. niche market location and potential for specific/unique aquaculture species.
2. To compare consumer perception and preference for locally originated versus out-of-the NCR-region and out-of-country;
3. To identify consumer willingness to pay a premium price for a local/regional brand;
4. To identify preferred forms of seafood: fresh, refrigerated, frozen, processed (fillet, smoked and canned);
5. To identify consumer quality expectation;
6. To identify factors influencing consumer purchase of farm-raised seafood versus wild catch;
7. To identify other possible benefits and attributes NCR aquaculture products can offer to consumers;
8. To identify niche market location and potential for specific/unique aquaculture species;
9. To disseminate research results in a multi-regional format using tangible technique-centered bulletins for conversion of farm structure or production methods, if our research identifies production systems, species or best practice certification labels required by market players.

Project Summary

U.S. aquaculture production struggles to grow despite increasing per capita consumption of seafood since 2004. Consequently, domestic demand is greatly met by imports. Due to constraints on wild catches, aquaculture is expected to be the primary source of increased supply of the global seafood market (Natale et al. 2015; Engle et al. 2017). This project developed market assessments through two surveys targeting U.S. consumers and restaurants that purchased or served seafood in the year 2019. Results provide the domestic aquaculture

production sector and seafood market participants with information about consumer preferences for Midwest farmed seafood species sold in various processed forms or in live markets, ultimately contributing to industry growth. Both surveys were distributed in 2020 and therefore bring further insights into the impact of the COVID pandemic.

Consumer stated preferences were obtained for sixteen species of finfish, three species of shellfish and four mollusks, which included their choices of form, preferred market channels, frequency of purchase, seafood origin and production system, whether wild-caught or farmed. Two choice experiments were designed for estimating willingness to pay for species produced in the North Central Region (NCR) in both processed and live markets. Survey results captured demand demographics and brought insights into ethnic preferences for specific/unique aquaculture species at national and regional levels. These results are of particular interest to NCR states where demographics have changed significantly between the 2000 and 2010 census datasets (MarketMaker™ 2018). These changes included acute changes in population cultural background, significant increase in income and changes in household characteristics, all drivers of consumer choices. The survey instruments designed for restaurants captured their preferences for the same list of finfish, shellfish and mollusks as the consumers survey, the same form of product, frequency of purchase, seafood origin and production system, whether wild-caught or farmed, and enquired about restaurants strategies for selecting suppliers. Responses were normalized by size and type of restaurants.

Novel to this study was the inclusion of species that are produced in the NCR in addition to commonly known species. The information provided will serve to estimate market potential for specific species, niche markets, direct industry priorities and decision making towards production of more marketable species, possibly refocusing and redirecting marketing and value-adding efforts, particularly for the NCR aquaculture industry. Results also identified benefits and attributes sought by consumers, which NCR farms can offer. To our knowledge, the last seafood marketing channel-specific survey was published in 1999, using data from 1996-1997 (Riepe 1999a; Riepe 1999b) of the electronic media.

Anticipated Benefits

Survey questions will be designed to identify factors influencing marketing channels' choice of purchase of aquaculture products and other possible benefits and attributes NCR aquaculture products can offer. This survey will also identify, through seafood marketing channels' choice, their consumers' revealed preferences for species and their perception and willingness to pay for alternative forms of seafood, such as fresh, refrigerated, frozen, processed (fillet, smoked and canned), as well as their consumers quality expectations. Results will also indicate niche markets and market potential and ethnic preferences for specific/unique aquaculture species.

Survey question will also identify reasons for elected preferences. For example, low sales of trout at supermarkets could be related to inferior product quality (Kinnunen 2000). The extended benefit from the results of this survey will be to (i) provide advice on best marketing strategies, such as educating sales managers on the qualities of purchasing locally farmed seafood, (ii) to identify preferences for value added products such as smoked seafood, (iii) compare and contrast the needs of customers for fresh and processed seafood, (iv) identify

current players in the supply chain, their location and size, and by that, identify niche market location and potential for specific/unique aquaculture species, (v) Comparative analysis of consumer perception and preference for locally originated versus out-of-the-NCR-region and out-of-country. The latter will indicate consumer perception and willingness to pay a premium price for a local/regional brand.

The information provided will serve to direct industry priorities and decision making towards production of more marketable species, possibly refocusing and redirecting marketing and value-adding efforts. These results will be disseminated through outreach programs such as educational fact sheets and data bulletins, presented in workshops, and published in refereed journals. Papers will also be produced for the NCRAC Fact Sheet Series.

Technical Summary and Analysis

Two survey instruments were developed. One to collect direct consumer perspectives and demand for seafood, and another to identify restaurants needs and preferences for serving seafood. Surveys were distributed countrywide through Qualtrics. The consumer survey was distributed from October to November 2020. By the end of data collection, a total of 1,400 high-quality responses were obtained from consumers in all US states, with balanced demographic and socio-economic characteristics (Table 1).

The consumer survey consisted of three parts. Stated preferences were produced through, first directly asking consumers about preferred market channels, frequency of purchase, origin of seafood segmented by states and between NCR or USA produced or imported, type of production, distinguishing wild-caught from farm-raised, and form of product, distinguishing between frozen or fresh, whole or filleted, live or prepared. A second procedure involved a discrete choice experiment (DCE) designed specifically for NCR produced species, through which survey respondents faced a simulation of a real-life purchasing experience having to choose between three hypothetical choice scenarios and one no-buy option. Employing a simultaneous orthogonal factorial design, a sub-sample of the survey containing 1,151 respondents answered, each six choice scenarios, randomly assigned from four different blocks. Three species of fish (i.e., trout, yellow perch and walleye) sold in the processed market (see Publications) had price, form, source and production systems randomly alternated. Willingness to pay was estimated using random utility model (RUM) and a multinomial logit model, described in detail in the publication listed below under Publications. Finally, the third part of the survey was design to measure the potential of the live markets niche. A second DCE model using a sub-sample of 215 consumers who declared having purchased live fish in the past year were asked to choose between four labeled alternatives and a no-buy option, simulating a real purchasing experience. Employing a simultaneous orthogonal factorial design, each individual was presented with six randomly allocated alternative scenarios. In this DCE individuals had the option to purchased largemouth bass, hybrid striped bass, bluegill and barramundi sold live, with varying prices and labels of NCR state-produced or non-NCR state produced. Willingness to pay (WTP) was estimated using random utility model (RUM) and a multinomial logit model, described in detail in the publication listed below under Publications.

The restaurant survey was also distributed countrywide, between August 2020 and February 2021. A total of 549 responses were collected. Restaurant sizes, considered as annual gross revenues, were evenly distributed (see Table 1), and included various types of restaurants. Fast-

food franchise chains were purposely excluded from the target sample, due to their purchasing policies and volume required. The survey consisted of four blocks. First, stated preferences and choices were solicited through 30 questions, including what type of seafood were purchased in the previous year (2019). Sixteen species of finfish, three of shellfish and four mollusks were listed. Other questions asked about form of seafood, whether frozen, fresh, live or processed, whole, fillets, or tails, as well as preferred market channels, frequency of purchase, seafood origin and production system, whether wild-caught or farmed. Survey data was analyzed using frequency tables procedure, which produces tables of frequency counts and percentages for categorical and continuous variables.

Principal Accomplishments

Objective 1.— To elicit purchase behavior in their preferred market channels, consumers were first asked which species they frequently purchased in 2019. Respondents chose from sixteen species of finfish. Cod was the top ranked purchase, chosen by 46% of respondents, followed by tilapia, with 43% and catfish and Atlantic salmon with 34% of choices. A second question explicitly asked what species consumers would have bought if all which were listed were made available. Opportunities were elicited here in relation to a potential to expand smaller markets as consumers stated willingness to purchase Midwest-produced species instead of tilapia, cod or catfish if made available at their chosen market channel. Rainbow trout led the national list as 32% of respondents stated their choice for the species if made available at their choice of retailer, followed by the Great Lakes whitefish and lake trout, both chosen by 31%, and Pacific salmon at 30% of selected choices. Midwest-produced or caught species such as lake and rainbow trout, Great Lakes whitefish, yellow perch, walleye and bluegill appear to have a greater demand than currently estimated by suppliers, indicating an underserved market for these species. This survey also provided further insight into consumers preferred market channel, shopping style and frequency. Supermarkets remain the most frequently used channel, followed by mass merchandisers. Only a third of these consumers chose to buy their seafood online, most of them prefer to visit the store. Almost a third of them consume seafood 1 to 2 days a week and another third, 2 to 3 times a month.

Results from the restaurant survey showed 92% serving finfish and 84% serving shellfish in 2019. About half of restaurants identified themselves as casual dining, a third as family style and another third as fine dining. Only 17% adopted take out. Different from consumers, restaurant owners and managers were less inclined to change their seafood choices. When asked what species they plan to serve in the near future cod, Atlantic salmon and tilapia remained their top choices, in this order, compared to what they served in 2019. However, about 10% less would be serving cod and 8% less, tilapia. Atlantic salmon remains chosen at the same level, about half of these restaurants. Purchases of NCR species such as rainbow trout, walleye, bluegill and hybrid striped bass would increase by 2 to 3%. Great Lakes whitefish and lake trout would increase by 1%. Yellow perch choices reduced by 1% in the future purchase question. In terms of shellfish, purchases of lobster, freshwater prawn and crayfish would increase between 4 and 5%, while saltwater shrimp would reduce by a third. Mollusks purchases would increase overall by 15%. These species are mostly bought on a weekly basis from wholesalers/retailers/distributors and brokers (70%) and 2-3 times a week from live markets (36%).

Objective 2. — U.S. seafood consumers preferred NCR-sourced fish to those sourced outside the region. NCR residents showed a slightly lower WTP for fish from within their region than

those outside the area. In the context of restaurants, the origin of their purchases was mostly from states other than NCR states.

Objective 3. — It is possible that non-NCR residents have stronger preferences for U.S. products than those in the NCR; we found evidence that fish-related “locavore” preferences extended beyond state lines or regional categories for seafood products, especially for species known to originate elsewhere in the U.S. To NCR aquaculture producers, these results indicate that NCR consumers comprise their niche market for trout, yellow perch and walleye, while NCR fisheries will have non-NCR residents willing to pay a premium for wild-caught fish. Nonetheless, this indicates that seafood consumers at the NCR, non-NCR, or national level are willing to pay a premium, even if small, for fish either farmed or caught within NCR states. Restaurant managers and owners were strong supporters of locally sourced seafood.

Objective 4. — For each of the species purchased in the previous year, consumers were asked to select between their choice of form of seafood. Five main categories included “frozen”, “fresh”, “live”, “smoked” or “shelf-stable”. Frozen and Fresh were subdivided into “whole”, “fillets”, “frozen-breaded”, and “fresh-prepared”. Shellfish had the option for “whole” or “tails”. Survey data analysis using frequency table procedure identified no significant difference between consumers’ preferences between frozen or fresh fish, possibly reflecting consumers’ acceptance of new flash-freezing technologies. Individuals who bought fish have their preferences, on average between all species tested, almost evenly divided between frozen and fresh filleted with a 1% advantage to frozen, possibly due to the convenience factor. Only a quarter of respondents chose a value-added option of either frozen-breaded or fresh-prepared fish, showing a preference for fresh. A clear preference for fresh was observed between individuals who bought shellfish, with 69% choosing fresh and 61% choosing frozen shellfish when sold whole. In the case of shellfish sold in tails, frozen is preferred with 39% of choice. Mollusks are also preferred fresh rather than frozen. Value-added options such as smoked or shelf stable seafood, were the least popular choice, representing less than 3% of their purchases. Restaurants seem to prefer fillet to whole but a third still purchases whole dressed or undressed finfish, mostly indifferent between fresh and frozen. Shellfish, on the other hand, was preferred whole.

Objective 5. — Consumer quality expectation was analyzed under the optics of quality being defined as a collective preference for seafood attributes. Quality perception becomes a “bundle of characteristics” composed by search, experience and credence attributes. Through the survey instrument, consumers were asked “*How important are these attributes for you when choosing seafood?*” in two sets of attributes, combined to measure the importance consumers ascribe to labels of ‘wild-caught’, ‘farm-raised’, ‘3rd party certification’, ‘non GMO’, ‘no added hormones’, ‘safe’ and ‘presentation’, separately from their personal values attributed to ‘fresh’, ‘healthy’, ‘sustainable’, ‘produced in the USA’, ‘locally sourced’, ‘traceable’ and finally how important ‘price’ is when purchasing seafood. At aggregated level, consumers showed awareness about the importance of food safety guaranteed by a regulatory system they trust, along with maintaining a healthy diet and freshness. Detailed summary of these preferences will be available in a Choices Magazine article (see Publications).

Similar ranking of importance ascribed to attributes of seafood was observed from restaurant managers and owners. “Safe” was the most important attribute, described as “very important” by 84% of respondents, followed closely by “freshness” (83%) and “healthy” (66%). The least important attributes were regarding production systems. The claim “produced in the USA” was “very important” to 38% and “important” to another 31% of respondents.

Objective 6. — For each of the species purchased in the previous year, consumers stated whether the seafood they bought was wild-caught or farm-raised. On average including all species, a third of mollusks and shellfish consumers and a quarter of individuals who had bought finfish were uncertain about the type of production system of their choice of seafood, which could express indifference toward production systems. The scenario for fish purchasing choices differs among species. Hybrid striped bass, grass carp and barramundi were more frequently chosen as farm-raised. Cod, Pacific and Atlantic salmon, and walleye were bought as wild caught almost twice as much as farm raised. Yellow perch, rainbow trout, bass (including smallmouth and largemouth), lake trout and bluegill were preferred wild caught to farm raised by about 10% more.

Once clustered with demographics, results showed that high-income earners, male and aged 35-44 find very important their seafood to be wild caught. The younger generations, on the other hand, were indifferent between the two labels. Between ethnic groups, Native Americans and Hispanic place the highest value on wild-caught as a characteristic of their seafood. Regional differences were observed. For example, while a wild-caught label attracted some price premium overall, NCR residents valued the label less than other Americans did. At the same time, consumers residing in non-NCR states showed a significantly larger preference for wild-caught fish than consumers who live in the NCR. Restaurants purchases varied between species but skewed towards wild-caught fish. When asked to compare attributes, production systems rated the lowest in importance. Farm raised was considered not important by 18% while 35% of respondents were indifferent to the claim. Wild caught claims were not important to 9% and 29% were indifferent.

Objective 7. — The most important benefits NCR aquaculture can offer to their consumers were found to be associated with how their seafood product is prepared and labeled. In terms of the three categories studied here, finfish, shellfish and mollusks, finfish is preferred sold in fillets, either fresh or frozen, shellfish is preferred when sold whole and frozen, and mollusks are preferred fresh. Labels must contain information to consumers about food safety, health benefits and freshness, as these are the most important factors defining quality of seafood. Another finding relates to production system. Although this study showed consumers willing to pay a small premium for wild-caught finfish, food safety ranked the most important attribute for consumers while production systems ranked at the least important attributes. An opportunity exists for the industry to design labels with detailed information about food safety measures taken in production and healthy contents of their product, and to target fresh fillet markets while effectively operating the supply chain to access additional markets.

Restaurants appear to look for product consistency, as this characteristic of a supplier is considered “very important” by 78% of respondents. The second most important attribute of suppliers was “consistency of supply”, followed by “delivery schedules”. When asked about strategies to cope with supply problems, the higher-ranking option was to switch suppliers temporarily, closely followed by switch from fresh to frozen.

Objective 8.— As presented in objective 3, NCR consumers comprise their niche market for trout, yellow perch, and walleye, while NCR fisheries will have non-NCR residents willing to pay a premium for wild-caught fish. The hypothetical question identified trout as the preferred species at national level, and suggested that Great Lakes whitefish, yellow perch, walleye, and bluegill may have a greater demand than currently estimated by suppliers, indicating an underserved market for these species.

Project researchers also investigated the potential for the live fish market. Willingness to Pay (WTP) estimates informed about preferred species and their origin. In this study, consumers preferred fish sourced from NCR states. Without considering consumer demographics, the most preferred fish species was hybrid striped bass, followed by bluegill, largemouth bass and then barramundi. This relative ranking defines market potential for these species in that order. Considering demographics, consumers who are male, young (less than 45 years) and high-income (\$75,000+) are more likely to purchase live fish and willing to pay more, on average.

Objective 9. — Results dissemination through extension and outreach programs were impaired by travel restrictions imposed by all partnering universities and state governments during the COVID-19 pandemic. The team was able to present results in six conferences, either online or face-to-face. These results will nevertheless be part of our future outreach program as travel restrictions are lifted. Extension articles and social cards were developed for distribution through NCRAC, Michigan State University, Purdue University and Southern Illinois University social media channels (i.e., Twitter, Instagram, and Facebook).

Impacts

- These results identified a national trend in consumer preferences for NCR-produced species, informed about the potential for live market and other markets niches for species and form of product, identify underserved markets, and allowed for comparisons between NCR and non-NCR consumer and restaurant perceptions about eating, preparing, and serving seafood and their preferences for species and forms. Specifically, opportunities for the industry arise from:
 - Consumers are indifferent between fresh and frozen forms of seafood, but they have a strong preference for fillets rather than whole fish.
 - U.S. seafood consumers prefer NCR-sourced fish to those sourced outside the region. NCR residents show a slightly lower WTP for fish from within their region than those outside the area.
 - Wild-caught labels command higher prices outside the NCR than within the region. However, when compared to other attributes, least importance to claims of farm-raised and wild-caught production were observed, with large segments reporting indifference or a lack of importance from production system labels.
 - Estimates of willingness to pay for finfish sold in both processed and live markets inform not only the NCR industry about both national and regional seafood markets but also inform restaurants and retailers about their customers' interests and pricing strategies. These estimates serve as a guide for designing pricing strategies, which can enable the growth of the live fish market in the U.S. The processed market study identified a pronounced preference for yellow perch and walleye in the NCR region and a national preference for trout, in relation to walleye and yellow perch.
 - When asked what species they would have bought if available, rainbow trout, Great Lakes whitefish and lake trout became the most selected. Midwest-produced or caught species such as lake and rainbow trout, Great Lakes whitefish, yellow perch, walleye, and bluegill appear to have a greater demand than currently estimated by suppliers, indicating an underserved market for these species.

- An opportunity exists for the industry to design labels with detailed information about food safety measures taken in production and healthy contents of their product, and to target fresh fillet markets while effectively operating the supply chain to access additional markets.
- Restaurant owners and managers demonstrated some level of risk averse in switching species of finfish offered in their menus but did show an interest in selling more of the NCR produced or wild caught species. In terms of supply, they value most product consistency and consistency of supply.

Recommended Follow-up Activities

Residents in the NCR value wild-caught fish less than other Americans, but analysis into the drivers of these regional differences require future research. Also, this study offered respondents choice scenarios for alternatives defined as “fresh fillets” or “frozen fillets”. In reality, fish processors employ various processing, packaging, freezing, and thawing technologies that can affect the palatability, texture, and other quality cues of the product. Further, there may be a contingent of consumers keen to the differences between fresh never frozen, previously frozen, and frozen for NCR-produced species, which presents another opportunity for future research.

This study was designed and distributed before and during the event of the pandemic, so responses reflect consumers and restaurant behavior prior to the shock. Future research is needed to identify changes in the behavior patterns after the COVID-19 pandemic, particularly in relation to restaurants.

References

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Riepe, J. R. 1999a. Supermarkets and seafood in the North Central Region. NCRAC Technical Bulletin Series #112. NCRAC Publications Office, Iowa State University, Ames, IA.

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Publications, Manuscripts, Workshops, and Conferences

See the Appendix for a cumulative output for all NCRAC-funded Marketing activities.

Table 1: Summary of data demographics and regional distribution

| Consumer Survey | | Restaurant Survey | |
|--------------------------------|----------------|------------------------------|----------------|
| Description | % of responses | | % of responses |
| Race | | Type of Restaurant | |
| White | 72.9 | Fine Dining | 26.4 |
| Black | 9.7 | Casual Dining | 49.3 |
| Hispanic | 9.7 | Contemporary Casual | 14.3 |
| Asian | 5.2 | Family Style | 26.9 |
| Native American | 1.0 | Fast Casual | 15.4 |
| Other | 1.2 | Cafe | 6.9 |
| | | Buffet | 3.6 |
| | | Food Trucks / Conc. | 3.4 |
| | | Stands | 1.4 |
| | | Ghost kitchen restaurant | 16.6 |
| | | Take out | |
| Age | | Respondent | |
| 18 – 24 years old | 13.6 | Restaurant Owner | 26.2 |
| 25 – 34 years old | 27.2 | Restaurant Manager | 73.7 |
| 35 – 44 years old | 26.6 | | |
| 45 – 54 years old | 13.6 | | |
| 55 – 64 years old | 10.0 | | |
| 65 years old or older | 7.8 | | |
| Gender | | | |
| Female | 54.9 | | |
| Male | 44.7 | | |
| Prefer not to identify | 0.4 | | |
| Regional Distribution | | Regional Distribution | |
| North East Region | 17.4 | North East Region | 12.8 |
| North Central Region | 20.4 | North Central Region | 16.9 |
| West Region | 19.5 | West Region | 18.2 |
| South Region | 42.4 | South Region | 33.0 |
| Household annual Income | | Annual Gross Revenue | |
| Less than \$25,000 | 22.1 | up to \$250,000 | 17.3 |
| \$25,000 - \$49,999 | 27.0 | \$250,000 - \$499,999 | 25.3 |
| \$50,000 - \$74,999 | 18.4 | \$500,000 - \$999,999 | 24.9 |
| \$75,000 - \$99,999 | 11.4 | \$1,000,000 - | 22.4 |
| \$100,000 - \$149,999 | 13.0 | \$2,999,999 | 9.8 |
| \$150,000 + | 7.9 | \$3,000,000 or more | 0.2 |
| | | Did not respond | |
| Total Responses | 1,416 | Total responses | 549 |



Figure 1. Information cards.