Food Distribution Research Society

Journal of Food Distribution Research
Volume 47 Issue 3

Consumer Preferences for Delacata Catfish: A Choice Experiment with Tasting

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Abstract

This article investigates consumer preferences for *Delacata* catfish, a relatively new fillet of grade-A catfish, by conducting in-person choice experiments with tasting sessions. Panels were held at three white-tablecloth restaurants across the United States, featuring sample entrées of *Delacata* catfish along with sample entrées of other species of mild-tasting, white-fleshed fish. Results suggest that *Delacata* catfish may fare well in terms of search and experience attributes such as taste and texture, across all locations, but may face labeling challenges in certain locations. This study provides willingness-to-pay estimates and discusses possible marketing strategies to further increase market potential for the US fish industry.

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Keywords: catfish, choice experiment, conditional logit, taste panel, willingness to pay

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Introduction

Americans consume an average of fifteen pounds of seafood annually, including 0.56 pounds of US farm-raised catfish, making it the eighth-most consumed seafood in the United States (Hanson and Sites 2015). Catfish comprises 46% of the total value of US aquaculture production (Mississippi State University 2016). Since 2006, however, imports have seized a large portion of the catfish market share. Over the first seven months of 2006, catfish imports (mostly from Vietnam) totaled 14.8 million pounds, representing a 71% increase from 2005, and a 780% increase from 2004 (Harvey 2006). By 2014, imports of frozen catfish fillets totaled 239 million pounds, accounting for 80% of the total US sales (Hanson and Sites 2015).[1] Additionally, the influx of imports—coupled with an increase in feed costs—has led to a decrease in US catfish production, from a high of 196,760 water-surface acres in 2002 to 69,910 acres in 2015—a 64% decline (Hanson and Sites 2015).

In an effort to combat these market conditions, and find new and higher-value market opportunities for domestic catfish producers, the Catfish Institute developed and released a product known as *Delacata* (The Catfish Institute 2016a).[2] *Delacata* is a fillet of grade-A catfish that is larger, deep-skinned, and hand-trimmed. The goal of *Delacata* is to appeal to consumers looking for a high-quality, domestically- and sustainably-produced fish. Thus, the target customers for this product are higher-end restaurants and higher-income consumers who demand a consistent, high-quality cut of fish that can compete with other prime cuts of fish.[3]

Along these lines, several lines of research were initiated to better understand consumer preferences for catfish. Quagrainie and Engle (2006) conducted an in-person choice experiment on restaurant managers who serve catfish to determine preferences over alternative catfish products, focusing on the attributes of price, color, dryness, flavor, and texture. Kumar, Quagrainie, and Engle (2008) conducted a telephone survey of US households to obtain estimates of actual catfish purchase and consumption habits, and estimate a model of the factors influencing consumption frequency. Hill et al. (2013) conducted a series of taste-sensory panels, as well as in-store choice experiments on catfish nuggets, focusing on the attributes of price, color of breading, cooking method, and country of origin. Other research has been conducted to understand the factors that explain why consumers do or do not currently consume catfish (Hanson and Rose 2011; Drammeh et al. 2002; Engle 1998; Dellenbarger et al. 1992).

We are not aware, however, of any research conducted to understand the conditions under which current non-consumers of catfish *would* consume it, or if there are alternative catfish products that would be more appealing to such consumers. The focus of the present work is to ascertain the status of current perceptions and consumption of US catfish by consumers—specifically in a

[1] The USDA-FSIS Catfish Inspection Program, authorized by the 2014 Farm Bill, is expected to introduce a more frequent and rigorous inspection program for both domestic and imported catfish, compared with the inspection program currently in place (USDA 2015). The final rule, released in 2015, requires on-site inspections of catfish farms and processing plants for both domestic and foreign producers, to ensure they meet the same standards required in the United States (Salter 2015).
[2] The Catfish Institute also provides information to the public such as recipes, food safety education, and production practices by the US catfish industry (The Catfish Institute 2016b).
[3] Farmed US catfish, including blue and channel, are listed as “Best Choice” options on the Monterey Bay Aquarium *Seafood Watch* list, whereas catfish varieties imported from Vietnam are listed as options to “Avoid”.

restaurant setting—both within and outside of the Gulf region, and to ascertain the market potential for *Delacata* catfish. This approach is consistent with a now twenty-one-year-old report that suggests that the catfish industry should make changes that would improve the image of catfish to higher-income consumers (Dellenbarger et al. 1992).

To investigate consumer preferences, we conducted in-person choice experiments that included tasting sessions at three white-tablecloth US restaurants, featuring sample entrées of Delacata catfish along with sample entrées of two other species of lean, flaky, mild-tasting, white-fleshed fish. This type of value elicitation mechanism gives us more control relative to using non-experimental data (e.g. scanner data) and a richer context relative to data collected in a laboratory setting (Lusk and Shogren 2007). The panels assembled at each restaurant consisted of four tasting rounds / choice tasks that featured three fish species. The first two rounds were "blind" (panelists were not provided with information regarding any specifics of the sample entrées they were tasting), whereas the last two rounds were "labeled" (panelists were provided with the description of each fish, including its species (*Delacata* catfish, grouper, black drum, or walleye), production method (wild-caught or farm-raised), and place of origin). Catfish and walleye are freshwater species, whereas the rest of the fish used were saltwater species. Although the fish were prepared in a different way across rounds, the three fish species were prepared identically within each round, such that the only difference during each choice task was the fish species itself. Results from this study show that when served blind, consumers were either indifferent to the fish species or preferred *Delacata* catfish but, when served labeled, consumers preferred other fish species or had weakened preferences for *Delacata* catfish. These findings suggest that *Delacata* catfish may fare well in terms of search and experience attributes, such as taste and texture, across all locations, but may face labeling challenges in certain locations. Similar challenges have been faced by other fish species, such as Mahi Mahi and Chilean Seabass, which the industry ultimately renamed in order to improve consumer acceptance. In this paper, we provide willingness-to-pay estimates and discuss possible marketing strategies to further increase the market potential for the US fish industry.

Experimental Design

Three taste panels were conducted to collect data on consumer preferences for fish entrées at high-end seafood restaurants. The first was held on September 15, 2014, at Calcasieu in New Orleans, Louisiana, and consisted of 103 panelists. The second occurred on February 9, 2015, at Shaw's Crab House in Chicago, Illinois, and had sixty-seven panelists. The third was on March 22, 2015, at Fortify Kitchen & Bar in Clayton, Georgia, and had eighty-five panelists. Panel summaries are provided in Table 1. These locations were chosen based on the willingness of restaurants from different regions of the United States to participate; thus, they can be interpreted as a convenience panel.

The experimental design consisted of six choice sets that included three alternatives (fish A, fish B, and fish C) at a given price. Not all choice sets were seen by all individuals. Instead, the choice sets were divided into three blocks of two choice sets each, with a particular panelist facing one of these blocks per treatment. There were two treatments (discussed next), and the same design was used for both. Therefore, each panelist faced four choice sets (or rounds) in total. During the first treatment (rounds one and two), the fish were served blind (participants were not told which fish species they were evaluating), and the alternatives were simply labeled "A," "B," and "C." During the labeled treatment (rounds three and four), participants were provided information on the specific fish species of each alternative, as well as a brief description of each that mimicked the information one would normally find on a menu, including production method (wild-caught or farm-raised) and place of origin. This information depended, in part, on the fish products that the restaurants were able to procure (see Table 1).

Table 1. Taste Panel and Preparation Details

Panel Location ***Restaurant*** **Date** **(# Panelists)**	**Fish Species Tested** **(Descriptions provided to respondents during labeled rounds)**	**Preparation (All fish prepared same way each round)**
New Orleans, LA	*Delacata Catfish*	1) Smoked fish salad
Calcasieu	(Farm-raised from Yazoo City, Mississippi)	2) Blackened
Sept 15, 2014	*Grouper*	3) Baked with lemon beurre blanc
(103)	(Wild-caught from the Gulf of Mexico)	4) Courtboullion
	Black Drum	
	(Wild-caught from the Gulf of Mexico)	
Chicago, IL	*Delacata Catfish*	1) Mustard char glaze
Shaw's Crab House	(Farm-raised from Yazoo City, Mississippi)	2) Beer-battered fish tacos
Feb 9, 2015	*Grouper*	
(67)	(Wild-Caught from the coast of Virginia)	3) Sautéed with kale and dijon sauce
	Walleye	
	(Wild-Caught from Lake Erie)	4) Horseradish crust
Clayton, GA	*Delacata Catfish*	1) Fried
Fortify Kitchen & Bar	(Farm-raised from Yazoo City, Mississippi)	2) Crab-stuffed
March 22, 2015	*Grouper*	3) Asiago-crusted
(85)	(Wild-Caught from the Florida Gulf Coast)	4) Cajun-grilled
	Black Drum	
	(Wild-Caught from Lake Pontchartrain, Louisiana)	

The design utility function was linear, with a single price variable and two binary indicators for fish species (catfish served as the omitted base). The experimental design was generated using NGene software, and optimized according to s-efficiency (Choice Metrics 2012). S-efficiency requires the specification of estimates of coefficient parameters: we used 0.10 for price and 0.25 for each binary fish indicator.[4] The same design was used in all three panel locations, with the exception of the assigned prices, which were shifted monotonically. In other words, we scaled prices up or down to be at parity with fish prices in each location. Thus, relative price differences did not change.

At the request of the participating restaurant staff, and in order to minimize mistakes during preparation, the order of fish served was not varied throughout the panels. Thus, Fish A was fixed as the *Delacata* catfish, and fish B was fixed as grouper. Fish C was fixed as black drum

[4] Although specification of coefficient values is somewhat arbitrary because they are unknown, we assumed a $2.50 price premium for grouper, black drum, and walleye relative to *Delacata*. Thus, we specified the coefficient on each fish species as 0.25, and the price coefficient as 0.10, given that WTP is defined as the ratio of the non-price coefficient to the price coefficient: 0.25 / 0.10 = $2.50.

for the New Orleans and Clayton panels and, due to availability constraints, was fixed as walleye for the Chicago panel. Randomly-assigned prices were chosen to reflect prevailing fish entrée prices in each panel's market and were set as $15, $17, $19, $21, $23, and $25 per entrée during the New Orleans panel; $18, $21, $24, $27, $30, and $33 during the Chicago panel; and $15, $18, $21, $24, $27, and $30 during the Clayton panel.

For the New Orleans panel, panelists were recruited using printed advertisements in local newspapers, and digital advertisements in social media and food blogs. For the Chicago and Clayton panels, the host venue was allowed to recruit participants from each restaurant's own customer base as a promotional event. Participants were asked to review and sign an IRB-approved consent form upon arrival at the event site. They were then allowed to sit anywhere they liked as long as they remained in the same seat throughout the panel. Participants were asked to treat the event as they would a regular trip to a restaurant. Thus, they were allowed to drink and converse as they normally would, with the exception of discussing the fish being evaluated (and their opinions of them) once the tasting began. Session monitors helped ensure that participants adhered to these rules. Participants were not allowed to amend the dishes, with the exception of salt and pepper.

As a means to garner interest to participate and gain experience with the fish being tested, restaurant chefs were given the freedom to prepare the fish using recipes they would typically offer to a consumer in their region; the only restriction being that the fish be prominent in each dish (i.e., with minimal amounts of other ingredients or without ingredients that would overwhelm the taste of the fish itself). See Table 1 for a summary of how the fish were prepared during each round of each panel. As noted earlier, each fish alternative was prepared identically within the same round, such that the only difference across the alternatives presented during each round was the species of fish being served.

After participants were seated, an introduction was given by the session moderator to provide general information about the reason for the taste panel, expectations from participants during the panel, and an explanation of the vote cards. For the latter, the vote cards for the first round were handed out to facilitate explanation. Participants were then given the opportunity to ask any clarifying questions. After all participants' questions and concerns were addressed, the first round of fish was served.

Each panel consisted of four rounds, and each round consisted of three fish alternatives. After tasting 1.5 oz. entrée samples of each fish, participants filled out a vote card for that round (see example in Figure 1). The vote card indicated a posted (hypothetical) price per entrée for each alternative.[5] Panelists were also invited to write down any additional comments on the vote card. At the conclusion of the four rounds, participants were asked to complete a short questionnaire that collected additional behavioral and demographic information.

On each vote card, participants indicated which of the three alternatives they were "most likely to buy" at the posted prices, and which of the three alternatives there were "least likely to buy" at the posted prices. This response elicitation format is a form of best-worst scaling (BWS) (Louviere, Flynn, and Marley 2015). BWS has recently emerged as an alternative to the format of having respondents indicate only their first-best choice (Flynn and Marley 2014; Flynn et al. 2007; Marley and Louviere 2005; Potoglou et al. 2011; Rigby, Burton, and Lusk 2015; Scarpa et

[5] Vote cards specified that an entrée would consist of a 6 oz. fillet of fish and two sides.

al. 2011). The BWS format asks respondents to indicate the “best” alternative (in the present case, “Most Likely to Buy”) and then to indicate the “worst” alternative (“Least Likely to Buy”), and then, of the remaining alternatives, to indicate the “best” of those remaining, then the “worst”, etc., until a full ranking is achieved. The argument is made that choosing “bests” and “worsts” is a relatively easy task for respondents, and yields more information per choice set than the standard question format. Thus, it represents an extension of the discrete-choice experiment format with the potential to increase cost efficiency of survey administration.

Blind Round

INSTRUCTIONS: After sampling all 3 fish, *first* indicate the fish entrée you are MOST LIKELY to buy given the posted prices, *and then* indicate the fish entrée you are LEAST LIKELY to buy given the posted prices.

ID# ______	***Price per entrée****	**I am MOST LIKELY to buy: (check only ONE)**	**I am LEAST LIKELY to buy: (check only ONE)**
A	**$15**	☐	☐
B	**$27**	☐	☐
C	**$27**	☐	☐

Labeled Round

INSTRUCTIONS: After sampling all 3 fish, *first* indicate the fish entrée you are MOST LIKELY to buy given the posted prices, *and then* indicate the fish entrée you are LEAST LIKELY to buy given the posted prices.

ID# ______	***Price per entrée****	**I am MOST LIKELY to buy: (check only ONE)**	**I am LEAST LIKELY to buy: (check only ONE)**
Delacata Catfish *Farm-raised from Yazoo City, Mississippi*	**$21**	☐	☐
Grouper *Wild-caught from the Florida Gulf Coast*	**$24**	☐	☐
Black Drum *Wild-caught from Lake Pontchartrain, Louisiana*	**$18**	☐	☐

*** An entrée includes a 6 oz. fillet of fish and 2 sides.**

Figure 1. Example vote cards, blind, and labeled rounds

The present format is an application of "Case III" BWS (the multi-profile case; see Flynn and Marley 2014), and included a single question with three alternatives, eliciting the "best" and "worst" choice of the three alternatives, thus yielding a full ranking. This ranking was then decomposed following the method of rank-order explosion proposed by Chapman and Staelin (1982), which, in our case, yields two choice observations for each choice set evaluated: a three-alternative observation (first-best case) and a two-alternative observation (second-best case).[6]

Conceptual and Econometric Models

It is assumed that respondent *i* chooses alternative *j* if, and only if, the level of utility associated with alternative *j* is greater than the level of utility associated with the remaining alternatives *~j*. We adopt a random-utility framework wherein utility comprises two components: 1) observables, which in this case are the attribute levels of the given alternatives; and 2) unobservables, which are those factors known to the respondent that affect utility but are unknown to the researcher. We specify the observable part of utility to be a linear function of attributes for the alternatives. To control for any further differences across fish species, between blind and labeled rounds, and across taste panel locations, we specify binary indicators for each and then interact them. Thus, observable utility for alternative *j* was specified as:

$$
\begin{aligned}
(1) \quad U_j = {} & [\beta_G + \beta_{GN} I_N + \beta_{GC} I_C + (\beta_{GNL} I_N + \beta_{GChL} I_{Ch} + \beta_{GCL} I_C) I_L] I_G \\
& + [\beta_D + \beta_{DC} I_C + (\beta_{DNL} I_N + \beta_{DCL} I_C) I_L] I_D \\
& + (\beta_W + \beta_{WL} I_L) I_W + \beta_P P
\end{aligned}
$$

where I_k, $k = G, D, W$ are binary indicators for fish species Grouper, Drum, and Walleye, respectively, $k = N, Ch, C$ are binary indicators for New Orleans, Chicago, and Clayton taste panel locations, respectively, and where $k = L$ is a binary indicator for Labeled treatment. The omitted base categories were Catfish (for fish species), Chicago (for taste panel locations for Grouper), New Orleans (for taste panel locations for Black Drum), and Blind (for choice set treatment). Price is specified as a continuous variable, P. Therefore, the coefficients β_m, $m = G, GN, GC, GNL, GChL, GCL, D, DC, DNL, DCL, W, WL, P$ capture the estimated contribution of each variable to utility, according to the same subscript notation above. For example, β_G captures the contribution of grouper and β_{GNL} captures the contribution of the interaction effect of grouper x New Orleans x Labeled. Thus, the model allows for the full range of coefficient differences according to all possible combinations of fish species, taste panel location, and labeling treatment.

The regression model, a conditional logit, was estimated using NLOGIT's "clogit" routine with a cluster correction to account for the panel (i.e., repeated-choice) nature of the data. This correction leaves the coefficient estimates unchanged but makes an adjustment to the estimated asymptotic covariance matrix (Greene 2012).

[6] Let A and B represent a pair of alternatives in a choice set. The second-best case operates under the assumption that the probability of A being chosen as "worst" is equal to the probability of B being chosen as "best".

Results

Table 2 reports responses from panelists describing their eating habits pertaining to fish. Frequency of eating fish was fairly consistent across panels, with those responding "once a week" comprising 42–47% of the sample. Panels in more populated cities, such as New Orleans and Chicago, had larger proportions of panelists responding "more than once a week" than did the Clayton panel. Relative to the other locations, the Chicago panel had a higher proportion of panelists who usually purchase fish at restaurants, whereas more New Orleans panelists usually purchased fish at a seafood market. Perhaps because of its proximity to the Gulf Coast, about 21% of New Orleans panelists indicated that they harvest their own fish. The New Orleans panel also had, by far, the largest proportion of panelists that currently eat catfish, whereas the Chicago panel had the lowest.

Table 2. Panelist Responses to Post-Choice-Experiment Questions

	New Orleans		Chicago		Clayton	
	Freq.	*%*	*Freq.*	*%*	*Freq.*	*%*
How often do you eat fish?						
More than once a week	30	0.29	22	0.33	10	0.12
Once a week	44	0.43	28	0.42	39	0.47
Once a month	24	0.23	15	0.22	24	0.29
Rarely / Special occasions only	5	0.05	2	0.03	10	0.12
Where do you usually get your fish?*						
Restaurant	61	0.59	51	0.76	46	0.54
Seafood Market	32	0.31	12	0.18	19	0.22
Grocery	41	0.40	37	0.55	50	0.59
Self-harvest	22	0.21	0	0.00	7	0.08
Other	0	0.00	5	0.07	5	0.06
What species of fish do you eat?*						
Catfish	*72*	0.70	*17*	0.25	*42*	0.49
Bass	24	0.23	12	0.18	21	0.25
Drum	65	0.63	0	0.00	5	0.06
Flounder	46	0.45	15	0.22	33	0.39
Grouper	50	0.49	40	0.60	57	0.67
Mahi-Mahi	53	0.51	46	0.69	35	0.41
Salmon	69	0.67	61	0.91	70	0.82
Sea Bass	24	0.23	29	0.43	23	0.27
Tilapia	52	0.50	40	0.60	41	0.48
Trout	72	0.70	17	0.25	45	0.53
Tuna	73	0.71	55	0.82	48	0.56

Note. * Because panelists could select more than one response, proportions do not sum to one

Tables 3 and 4 report the panelists' responses to questions about their perceptions and preferences for various fish attributes, as well as some demographic indicators (gender and age).

Table 3. Panelist Responses to Post-Choice-Experiment Questions–*continued*

	New Orleans		Chicago		Clayton	
	Freq.	*%*	*Freq.*	*%*	*Freq.*	*%*
Knowing whether the fish I eat is locally-caught or produced is very important to me when buying fish.						
Strongly Disagree	0	0.00	4	0.06	1	0.01
Disagree	5	0.05	8	0.12	5	0.06
Neutral	21	0.20	17	0.25	21	0.25
Agree	38	0.37	25	0.37	30	0.36
Strongly Agree	39	0.38	13	0.19	27	0.32
Knowing whether the fish I eat is domestic (U.S.) or imported is very important to me.						
Strongly Disagree	1	0.01	4	0.06	0	0.00
Disagree	5	0.05	11	0.16	2	0.02
Neutral	18	0.17	19	0.28	11	0.13
Agree	24	0.23	19	0.28	21	0.25
Strongly Agree	55	0.53	14	0.21	51	0.60
Knowing whether the fish I eat are wild-caught or farm-raised is very important to me.						
Strongly Disagree	4	0.04	3	0.05	0	0.00
Disagree	5	0.05	5	0.08	1	0.01
Neutral	33	0.33	13	0.20	18	0.21
Agree	34	0.34	27	0.41	29	0.34
Strongly Agree	24	0.24	18	0.27	37	0.44
In general, do you prefer to buy wild-caught or farm-raised fish?						
Wild-caught	74	0.81	55	0.83	67	0.85
Farm-raised	17	0.19	7	0.11	12	0.15
No preference / other	0	0.00	4	0.06	0	0.00
Knowing whether the fish are organically grown is very important to me when buying farm-raised fish.						
Strongly Disagree	3	0.03	3	0.05	1	0.01
Disagree	15	0.15	6	0.09	2	0.02
Neutral	40	0.40	20	0.30	19	0.23
Agree	23	0.23	22	0.33	39	0.46
Strongly Agree	19	0.19	15	0.23	23	0.27

Knowing whether fish was locally-caught or produced was relatively more important for panelists in southern locations, like New Orleans and Clayton, compared to Chicago panelists, and the same pattern held for knowing whether fish was domestic or imported. Knowing whether fish was wild-caught or farm-raised was relatively more important among Clayton panelists compared to New Orleans and Chicago panelists. Responses in favor of wild-caught fish over farm-raised fish were consistent across panels, with over 80% preferring wild-caught fish. At the same time, however, knowing whether fish were organically grown and whether fish were caught or farmed in ways that cause little or no harm to habitats and other wildlife was relatively more important among Chicago and Clayton panelists, with relatively more New Orleans panelists remaining neutral or disagreeing with these statements. The importance of knowing the species of fish being consumed was fairly consistent across panels, as was the importance of price for buying fish. In terms of demographic indicators, panels were slightly biased toward females, which are typically a household's primary grocery shoppers. The Chicago panel had the youngest mean panelist age (36-years-old), whereas the Clayton panel had the oldest (57-years-old), with 92% in Chicago and 78% in Clayton indicating a willingness to take risks when trying new foods.

Table 4. Panelist Responses to Post-Choice-Experiment Questions–*continued*

	New Orleans		**Chicago**		**Clayton**	
	Freq.	*%*	*Freq.*	*%*	*Freq.*	*%*
Knowing whether the fish I eat were caught or farmed in ways that cause little or no harm to habitats and other wildlife is very important to me.						
Strongly Disagree	2	0.02	1	0.02	0	0.00
Disagree	7	0.07	1	0.02	0	0.00
Neutral	21	0.21	9	0.14	9	0.11
Agree	39	0.39	35	0.53	34	0.41
Strongly Agree	31	0.31	20	0.30	40	0.48
Knowing which species of fish I eat is very important to me.						
Strongly Disagree	0	0.00	1	0.02	0	0.00
Disagree	5	0.05	2	0.03	1	0.01
Neutral	20	0.20	11	0.17	10	0.12
Agree	36	0.36	27	0.41	44	0.52
Strongly Agree	39	0.39	25	0.38	30	0.35
Price is the most important factor for me when buying fish.						
Strongly Disagree	5	0.05	9	0.14	7	0.08
Disagree	49	0.49	26	0.39	23	0.27
Neutral	20	0.20	16	0.24	28	0.33
Agree	18	0.18	12	0.18	21	0.25
Strongly Agree	8	0.08	3	0.05	5	0.06
In general, rate your willingness to take risks when trying new foods:						
Unwilling	9	0.09	1	0.02	5	0.06
Middle of the Road	8	0.08	4	0.06	14	0.16
Willing	82	0.83	61	0.92	66	0.78
Male	41	0.40	30	0.45	37	0.44
Age (Mean)	46.8		36.2		57.0	

Table A1 (see Appendix) reports the proportions of responses for each panel, separated by label treatment (blinded or labeled). Although these results do not account for price effects (which are statistically significant in the regression model in Table 5), they provide some preliminary indication of preferences. During the New Orleans panel, there were no indications of strong preferences during the blind rounds, whereas we see a substantial proportion of "Least likely to buy" votes for *Delacata* catfish (0.50) and "Most likely to buy" votes for black drum (0.49) during labeled rounds. During the Chicago panel, we saw a substantial proportion of "Least likely to buy" votes for grouper and "Most likely to buy" votes for walleye during blind rounds. These preferences appear to change during labeled rounds, however, where we observe a substantial proportion of "Least likely to buy" votes for *Delacata* catfish (0.58) and "Most likely to buy" votes for grouper (0.56). During the Clayton panel we see a substantial proportion of "Most likely to buy" votes for *Delacata* catfish (0.52) and "Least likely to buy" votes for grouper (0.57), whereas during labeled rounds we observe a substantial proportion of "Most likely to buy" votes for grouper (0.41) and "Least likely to buy" votes for black drum (0.50). Again, these results do not account for price effects and are reported only to provide the reader with a general sense of the distribution of consumer choices.

Econometric Regression Model

Table 5 contains the results of the conditional logit regression model. The main coefficients on each fish species should be interpreted relative to the omitted base, *Delacata* catfish. None of the main fish species coefficients is significant, indicating that any significant differences regarding choice of these fish relative to *Delacata* are not attributable to the fish species themselves; rather to location and/or labeling effects. Grouper appeared in all three taste panels. The Grouper x Clayton interaction term is significant and negative, indicating that Grouper was significantly less likely to be chosen over *Delacata* during the Clayton panel relative to Chicago, which was the omitted base location. The Grouper x New Orleans interaction term is not significant, indicating no preference for one species over the other in New Orleans, relative to Chicago. Black Drum appeared in the Clayton and New Orleans taste panels only. The Black Drum x Clayton interaction term is significant and negative, indicating that Black Drum was significantly less preferred to *Delacata* during the Clayton panel relative to the omitted base location, New Orleans.

Table 5. Conditional Logit Regression Results.

	Coefficient		**Std. Error**
Grouper	0.112		0.164
x Clayton	-0.489	**	0.219
x Clayton x Labeled	0.297		0.223
x New Orleans	-0.253		0.224
x New Orleans x Labeled	0.403	**	0.200
x Chicago x Labeled	1.007	***	0.232
Black Drum	0.228		0.158
x Clayton	-1.250	***	0.232
x Clayton x Labeled	0.416	*	0.234
x New Orleans x Labeled	0.575	***	0.210
Walleye	-0.216		0.149
x Labeled	0.890	***	0.226
Price	0.019	***	0.006
Log Likelihood= -1712.184			
N=2006			

***, **, * indicate significance at the 99%, 95%, and 90% confidence levels, respectively.

Regarding labeling effects, the Grouper x Clayton x Labeled interaction term is not significant, indicating that labeling had no effect on consumer choice of Grouper relative to *Delacata* during the Clayton panel. However, the same interaction terms for New Orleans and Chicago are significant and positive indicating that, when the fish species were labeled, Grouper was significantly more likely to be chosen over *Delacata* at these locations. Similarly, the corresponding interaction terms for Black Drum are significant and positive, indicating that during the Clayton and New Orleans panels, Black Drum was significantly more likely to be chosen over *Delacata* when labeled. Note, however, that the magnitude of the Black Drum x Clayton coefficient is greater than that of the Black Drum x Clayton x Labeled coefficient meaning that, although Clayton panelists had a strong preference for *Delacata* relative to Black Drum overall, this preference was somewhat weakened by labeling. Finally, Walleye appeared only in the Chicago panel. The interaction term Walleye x Labeled is significant and positive, indicating that, when labeled, Walleye was significantly more likely to be chosen over *Delacata* at this location.

In sum, when served blind, panelists tended to be indifferent to fish species (as in the cases of New Orleans and Chicago) or to prefer *Delacata* catfish (as in the case of Clayton) but, when served labeled, panelists tended to prefer Grouper, Black Drum, and Walleye over *Delacata* catfish (as in the case of New Orleans and Chicago) or to have weaker preferences for *Delacata* catfish (as in the case of Clayton).

Welfare Estimates

Estimates of willingness-to-pay (WTP) for each fish alternative relative to *Delacata* catfish were calculated based on the results of the conditional logit regression. We report sample-weighted mean WTP for each fish, under the blind and labeled treatments, respectively.[7] That is, the welfare estimates are reported as weighted-average WTP across taste panel locations. Confidence intervals are calculated using the Delta method following Bliemer and Rose (2013).

Table 6 reports the willingness-to-pay estimates. Because *Delacata* catfish served as the base, each should be interpreted as a willingness to pay a premium (if the sign is positive) or as a required price discount (if the sign is negative), relative to *Delacata* catfish. Under the blind treatment, we estimate a price discount of -\$8.24 for a fish entrée containing grouper relative to *Delacata* catfish. We calculate similar prices discounts for Black Drum (-\$26.08) and Walleye (-\$11.26).

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[7] Following the notation of Equation 1, WTP for grouper under the blind treatment is defined as $WTP_G = \left[\beta_G + \beta_{GN}\left(\frac{p_{GN}}{p_G}\right) + \beta_{GC}\left(\frac{p_{GC}}{p_G}\right)\right] / \beta_P$, where p_{GN} and p_{GC} are defined as the proportions of grouper observations served at the New Orleans and Clayton panels, respectively; and p_G is defined as the proportion of grouper observations. WTP for grouper under the labeled treatment is defined as $WTP_{GL} = \left[\beta_G + \beta_{GN}\left(\frac{p_{GN}}{p_G}\right) + \beta_{GC}\left(\frac{p_{GC}}{p_G}\right) + \beta_{GNL}\left(\frac{p_{GNL}}{p_{GL}}\right) + \beta_{GCL}\left(\frac{p_{GCL}}{p_{GL}}\right) + \beta_{GChL}\left(\frac{p_{GChL}}{p_{GL}}\right)\right] / \beta_P$, where p_{GNL} , p_{GCL}, and p_{GChL} are defined as the proportions of labeled grouper observations that were served at the New Orleans, Clayton, and Chicago panels, respectively; and p_{GL} is defined as the proportion of labeled grouper observations. WTP for the other fish species are defined similarly.

Table 6. Blinded and labeled treatments: WTP and 95% confidence intervals for fish species relative to catfish entrée.

	Blind treatment		Labeled treatment	
	Mean WTP relative to Catfish	95% Confidence Interval	Mean WTP relative to Catfish	95% Confidence Interval
Grouper	-\$8.24	(-\$18.36, \$1.87)	\$18.31	(\$3.43, \$33.19)
Black Drum	-\$26.08	(-\$43.04, -\$9.13)	-\$0.20	(-\$11.69, \$11.28)
Walleye	-\$11.26	(-\$28.56, \$6.04)	\$35.03	(\$6.55, \$63.51)

For labeled treatments, we estimate a price premium of \$18.31 associated with Grouper relative to *Delacata* catfish when labeled. We calculate a similar price premium for Walleye (\$35.03). For Black Drum, however, we calculate a very slight price discount, i.e., a mean WTP of -\$0.20. In summary, we find price discounts needed for Grouper, Black Drum, and Walleye relative to *Delacata* catfish when the tasting was blind, but find price premia for Grouper and Walleye relative to *Delacata* catfish when the alternatives were labeled.

Conclusions

This paper reports the results of what we believe to be the only consumer study that compares preferences for catfish directly to other fish species in a choice experiment with tasting sessions. The use of tasting sessions in seafood restaurants at several locations in the United States served to increase the experimental context of the study. Furthermore, this is the first study, to our knowledge, that tests consumer preferences for *Delacata* catfish, a relatively new cut of catfish developed with the specific goal of competing with other premium cuts of fish.

Our results indicate that *Delacata* catfish may fare well in terms of search and experience attributes such as entrée appearance, taste, texture, and similar characteristics. Under blinded choice tasks (i.e., when panelists were not provided information on the sample entrées they were tasting), it fared equally well or better than the other fish species tested against it. The results indicate, however, that *Delacata* catfish faces some perception challenges when consumers are aware of the fish they are evaluating. During the labeled rounds (i.e., when panelists were provided with information on fish species, production method, and place of origin), all of the alternative fish species were preferred to *Delacata* catfish in two of the three taste panels, and the presence of labeling weakened preferences for *Delacata* catfish in the third panel.

The labeling effect could be a function of several things, which the current study was unable to identify specifically. First, consumer choices could have been driven by the species of fish or by the production method (wild-caught vs. farm-raised), or by both, with potentially conflicting effects. For example, *Delacata* catfish was the only farm-raised fish used in the study; all others were wild-caught. Based on panelists' responses to questions about general fish-buying habits, wild-caught fish are very strongly preferred. The same applies to origin. Although all fish used during the panels were domestically-caught, panelists indicated a preference for locally-caught fish in their responses about their purchasing habits. During the New Orleans panel, both wild-caught species (grouper and black drum) were originally from the Gulf of Mexico, whereas the *Delacata* catfish was farm-raised in Yazoo City, Mississippi. It is unknown how panelists perceived these origins, but it is possible that the *Delacata* may have been perceived as "less-local" than the other two. In the Chicago panel, the grouper was originally from coastal Virginia, while the walleye was from Lake Erie. In this case, the walleye was likely the "local" alternative, with the others perceived as equally non-local. In the Clayton panel, *Delacata* catfish came from Mississippi, whereas the grouper and black drum were from Florida and Louisiana, respectively. In this case, these may have been perceived as equally non-local. These attributes depended on the specific fish fillets that the restaurants were able to procure and, thus, constitutes a limitation of the study. Additionally, our study focused on preferences in a high-end restaurant setting only; therefore our results may not reflect the preferences for these same products in other settings. Future research could focus on an experimental design that disentangles the species effects from that of production method, origin, and other key attributes, as well as expands into additional purchase points, such as groceries and seafood markets.

Overall, the findings here signal both challenges and opportunities in terms of expanded market potential for *Delacata* catfish. Possible avenues to increase its market potential could include marketing strategies that highlight the fact that catfish is considered a "Best choice" (see Footnote 1), in terms of sustainability and is domestically-produced. On the other hand, the findings also highlight some potential challenges, such as overcoming the apparent consumer preference for wild-caught fish. Another challenge seems to be implied by our finding that preferences for catfish were relatively strong when panelists were not aware of the species they were tasting, but declined when panelists were informed about the species of fish. It is unclear whether this is because panelists simply have strong preferences for the other fish species, or because they have strong preferences against catfish. Our results do provide some evidence, however, that the name of the fish may play an important role in consumer perceptions. Marketing strategies such as renaming a product, which was done with Mahi Mahi and Chilean Seabass, have shown to be successful in repositioning products that have consumer perception challenges.

Acknowledgments

The authors thank Katy Simmons Prosser, Ken Hood, Bill Herndon, Hannah Wright, Kwabena Krah, and Eugene Frimpong for their assistance with the project. This work was supported by a 2014 Mississippi Agricultural and Forestry Experiment Station (MAFES) Strategic Research Initiative grant, USDA Agricultural Research Service Cooperative Agreement 58-6402-3-042, and the National Institute of Food and Agriculture and MAFES via Multistate Project W-3133 "Benefits and Costs of Natural Resources Policies Affecting Ecosystem Services on Public and Private Lands" (Hatch Project MIS-033140).

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Appendix

Table A1. Proportions of Responses by Fish Species at Each Panel.

	New Orleans				Chicago				Clayton			
	Blind		*Labeled*		*Blind*		*Labeled*		*Blind*		*Labeled*	
	MLTB	**LLTB**	**MLTB**	**LLTB**	**MLTB**	**LLTB**	**MLTB**	**LLTB**	**MLTB**	**LLTB**	**MLTB**	**LLTB**
Delacata Catfish	.39	.38	.29	.50	.34	.31	.18	.58	.52	.19	.37	.22
Grouper	.38	.24	.22	.33	.25	.40	.56	.19	.14	.57	.41	.29
Black Drum	.23	.39	.49	.17					.28	.24	.22	.50
Walleye					.42	.29	.26	.23				
N =	194		205		134		134		169		167	

Note. MLTB=Most Likely to Buy; **LLTB**=Least likely to Buy