Staff Paper

Consumer Perceptions of Seafood Industries in the Wake of the Deepwater Horizon Oil Spill and Fukushima Daiichi Nuclear Disaster

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Abstract

The impact of environmental disasters on consumers' perceptions and preferences for specific food items has seldom been studied in the applied economics literature. Recent aquatic disasters, namely the Deepwater Horizon Oil Spill and Fukushima Daiichi Nuclear Disaster, have had profound impacts on fisheries serving US consumers and on agribusinesses within the aquaculture industry. This study explores consumer preferences using a nation-wide representative sample, and finds that twenty-nine percent of US consumers sought to reduce their seafood consumption due to the Deepwater Horizon Oil Spill and one-third of respondents indicated they sought to reduce their seafood consumption in the wake of the Daiichi nuclear disaster Additionally, over 50% believed that Asian seafood poses a consumer health risk because of the Japanese nuclear disaster. Understanding key factors that influence consumer behavior in the wake of environmental disasters can make fisheries, seafood industries and agribusiness more resilient when facing such catastrophic events. Our results find that key socio-demographic variables affect consumer behavior including gender, age, food safety concerns, value for country of origin labeling, and geographic location. Careful and efficient response by the seafood supply chain will enable effective communication with consumers and allow for optimal policy decision-making.

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Introduction

The effects of environmental disasters on consumer perceptions and preferences for food items have been seldom studied in the literature. Recently, two environmental disasters, the Deepwater Horizon Oil Spill and the Fukushima Daiichi Nuclear Disaster, have strongly impacted the seafood industry by affecting consumer confidence. The Deepwater Horizon Oil Spill, which began on April 20, 2010, is the largest accidental marine oil spill in the history of the petroleum industry. It is estimated that approximately 4.9 million barrels of crude oil were released into the Gulf of Mexico causing extensive damage to marine life and wildlife as well as the Gulf's fishing and tourism industry. The Fukushima Daiichi Nuclear Disaster was a nuclear meltdown following the 9.0 magnitude Tōhoku earthquake and tsunami on March 11, 2011. This ongoing nuclear meltdown has led to trace amounts of radiation (particularly iodine-131, caesium-134 and caesium-137) being observed around the world, most notably the East Asia Pacific Region and the West Coast of the United States (US) including Hawaii and Alaska. Both of these incidents have received unprecedented news coverage and exact estimates of economic losses have not been fully calculated given the magnitude and scale of these events[1].

The Gulf oil spill has affected markets in the surrounding areas. The impacts on specific markets vary depending on the magnitude of changes along the supply chain, the scope of the market and the availability of alternative supplies (Upton, 2011). Many in the Gulf seafood industry fear that it will be difficult to regain consumer trust in their products; however, the extent of how consumers' perceptions have changed has not been studied. A preliminary study commissioned by the Louisiana Seafood Promotion Board found that consumer concerns with seafood safety have caused a decrease in the demand for seafood, especially from the Gulf region (McGill, 2011). Unlike the Gulf oil spill,

[1] Smith, Smith and Ashroft (2010) have estimated the damages from the Deepwater Horizon Oil Spill to be $36.9 billion.

studies or preliminary findings on changes of consumer attitudes and perceptions on imported seafood due to the Fukushima Daiichi Nuclear Disaster are currently absent in the literature.

Empirical studies of environmental disasters, most notably the Exxon Valdez Oil Spill in 1989, focus on contingent valuation methods to evaluate passive use value loss as well as ecosystem response (Carson et al 2003; Peterson et al 2003). However food safety scares and their effects on consumer behavior, such as bovine spongiform encephalopathy (BSE) in beef and *E. coli* in spinach, have been studied in the literature. Schroeder, Tonsor, Pennings and Mintert (2007) found that variation in beef consumption is related to beef food safety risk perceptions and attitudes. Additionally, even if actual risk levels are not high, but consumers perceive high levels of risk, product demand will be reduced (Schroder et al., 2007). Food safety perceptions could also vary by type of product; Onyango, Miljkovic, Hallman, Nganje, Condry, and Cuite (2007) discovered differences in perceptions of frozen and canned spinach compared to perceptions of bagged fresh spinach. Furthermore, trust in the institution, regulatory agency or corporations (processors, transporters or retailers) that handle the food plays a role in food safety perceptions (Onyango et al., 2007).

This study expands on the available literature by providing an overview of survey responses surrounding consumers' seafood purchasing behavior and the impact of environmental disasters on their preference structure. We employ logit models to provide insight into the factors influencing behavioral changes surrounding purchasing of seafood from environmentally devastated seafood producing regions. We will discuss the potential impacts of environmental disasters on consumer behavior and the implications for agribusinesses in the seafood industry.

Data Collection and Consumer Survey

An online survey with a sample representative of US households was conducted to assess consumer perceptions of seafood in the wake of the two environmental disasters. The survey instrument was designed to elicit respondents' socio-demographic characteristics, seafood-

shopping behavior, preferences for food safety verification claims of domestic and imported seafood, and impact of the two events on their seafood preferences. Decipher Inc., a market research services provider, administered the survey online in the summer of 2011. Because of their relatively low costs, quick completion times and absence of nonresponse bias, online surveys are becoming more popular among applied economists and market researchers (Louviere et al., 2008; Gao and Schroeder, 2009). The survey took place approximately three months after the Tōhoku earthquake and tsunami that lead to the Fukushima Daiichi nuclear fallout and one year after the Deepwater Horizon Oil Spill. Participants were recruited from a large opt-in panel by Survey Sampling International to be representative of the US population[2] at least 18 years of age and familiar with the food consumption patterns of their household (Louviere et al., 2008; Olynk, Tonsor, and Wolf, 2010). A total of 1,004 respondents completed the survey (Table 1). Survey respondents averaged 45 years of age, were mostly women (52%) with a pre-tax household income of less than $60,000 annually, and averaged two adults and 0.6 children in the household[3].

Modeling Preferences Following Aquatic Disasters: Logit Models

We model consumer preference for seafood products following these two events using logistic regression models. Logistic regressions are a useful way of expressing the relationship between explanatory variables and a binary response variable, expressed as a probability, which takes two values, often zero and one.

$$f(z) = \frac{e^z}{e^z+1} \quad (1)$$

The variable z represents the exposure to some set of independent variables, $x = \{x_1, x_2, \ldots, x_k\}$, while $f(z)$ represents the probability of a particular outcome, given that set of explanatory variables. The variable z is a measure of the total contribution of all the explanatory variables used in the model.

[2] With regards to age, gender, state of residence, pre-tax income and education level,

[3] Sample characteristics are comparable to U.S. Census statistics (see DeNavas-Wal, Proctor and Smith, 2012).

Table 1. Demographic variables and summary statistics (n=1004)[a]

Variable	Definition	Value
Gender	Male	48%
	Female	52%
Age	Average age in years	45 years
Annual pre-tax household income	Less than $20,000	17%
	$20,000 - $39,999	28%
	$40,000 - $59,999	19%
	$60,000 - $79,999	14%
	$80,000 - $99,999	9%
	$100,000 - $119,999	6%
	$120,000 - $139,999	3%
	$140,000 or more	4%
Educational Background	Did not graduate from high school	2%
	Graduated from high school, Did not attend college	18%
	Graduated from high school, attending college	5%
	Attended College, No Degree earned	24%
	Attended College, Associates or Trade Degree	12%
	Attended College, Bachelor's (B.S. or B.A.) Degree	25%
	Graduate or Advanced Degree (M.S., Ph.D., Law	12%
	Other	2%
Adults per household	Average number of adults per household	2
Children per household	Average number of children per household	0.6
Political Affiliation	Democratic Party	33%
	Republican Party	26%
	Independent	28%
	None of the above	13%
Division of US	New England [b]	5%
	Middle Atlantic	14%
	East North Central	17%
	West North Central	7%
	South Atlantic	19%
	East South Central	5%
	West South Central	9%
	Mountain	8%
	Pacific	16%

[a] All 1,004 respondents who completed the survey were included in these summary statistics.

[b] Divisions of the US are as defined by the US Census Bureau (http://www.census.gov/geo/www/us_regdiv.pdf).

The variable *z* is usually defined as

$$z = \beta_0 + \sum_{m=1}^{k} \beta_m x_m \quad (2)$$

where β_0 is the intercept and $\beta_1, \beta_2, \ldots, \beta_k$ are the regression coefficients of $x_1, x_2, \ldots, x_k$, respectively. Each of the regression coefficients describes the contribution of that corresponding factor. A positive regression coefficient means that the explanatory variable increases the probability of the outcome, while a negative regression coefficient means that the variable decreases the probability of that outcome; a large regression coefficient means that the factor strongly influences the probability of that outcome, while a near-zero regression coefficient means that that factor has little influence on the probability of that outcome.

Logit models were used to provide insight into self-reported changes in fish and shellfish purchasing and consumption behavior. Three questions were posed to respondents regarding the Deepwater Horizon Oil Spill and three separate questions were asked regarding the Fukushima Daiichi Nuclear Disaster. In reference to the Deepwater Horizon Oil Spill, respondents were asked specifically: 1) "Has the BP Deepwater Horizon Oil Spill of 2010 in the Gulf of Mexico impacted your general food purchasing behavior?" 2) "Has the BP Deepwater Horizon Oil Spill of 2010 in the Gulf of Mexico impacted your fish and shellfish purchasing behavior?" and 3) "Have you sought to reduce your consumption of fish and shellfish from the Gulf of Mexico due to the BP Deepwater Horizon Oil Spill?" With regard to the nuclear disaster, respondents were posed the questions: 1) "Has the recent nuclear crisis in Japan impacted your general food purchasing behavior?" 2) "Has the recent nuclear crisis in Japan impacted your fish and shellfish purchasing behavior?" and 3) "Have you sought to reduce your consumption of fish and shellfish from Asia due to the recent nuclear crisis in Japan?" Respondents were asked to select "Yes" or "No" in response to each of these six questions and no additional answers were provided or allowed to be written in.

The six questions listed above were each included in separate logit models as the dependent variable. Only consumers who reported consuming either fish or shellfish (or both) were included as part of the sample (912 out of the 1,004 individuals). Explanatory

variables investigated included standard socio-demographic characteristics such as age, gender, income, and number of adults and children (Adults/Children) in the household (Table 2). Additionally, seafood consumption and purchasing behavior variables were introduced. These include whether the respondent's household purchased more than 2.67 kg of fish/shellfish in a typical month (HighFish/HighShell); level of concern for safety of imported fish and shellfish (ImportCrn); importance of country of origin labeling in fish and shellfish purchases (COOL); the number of media reports reportedly viewed on safety of food imports from China (ChinaMed) and whether the respondent lived in a state in the Gulf/Pacific region[4,5] (Gulf/Pacific).

Table 2. Summary statistics of dependent and explanatory variables for logit models (n=912)

Variable Name	Variable Definition	Mean	Standard Deviation	Min	Max
Age	Age in years	44.87	16.54	18	87
Male	Male=1, Female=0	0.49	0.50	0	1
Income	Less than $20,000 year=1 $180,000 or more=10 (increments of $20,000)	3.28	1.97	1	10
Adults	Number of adults in household	2.10	0.96	1	11
Children	Number of children in household	0.60	1.01	0	8
HighFish	Monthly household fish purchases > 2.67 kg=1, Otherwise=0	0.21	0.41	0	1
HighShell	Monthly household shellfish purchases > 2.67 kg=1, Otherwise=0	0.10	0.30	0	1
ImportCrn	Level of concern for imported fish and shellfish Not Concerned=1, Extremely Concerned=7	5.06	1.59	1	7
COOL	Importance of COOL in imported fish and shellfish purchases Not important=1, Extremely Important=7	4.78	1.80	1	7

[4] The Gulf region of the US included the following states: Alabama, Florida, Louisiana, Mississippi and Texas.
[5] The Pacific region of the US included the following states: Alaska, California, Hawaii, Oregon and Washington.

ChinaMed	Number of media reports seen on safety of imported food products from China in past year	3.04	5.07	0	27
Gulf	Gulf state=1, Otherwise= 0	0.16	0.36	0	1
Pacific	Pacific state=1, Otherwise= 0	0.16	0.37	0	1
BPGenFood	BP Deepwater Horizon Oil Spill impacted general food purchasing behavior Yes=1, No=0	0.24	0.42	0	1
BPSeafd	BP Deepwater Horizon Oil Spill impacted seafood purchasing behavior Yes=1, No=0	0.27	0.44	0	1
BPSeafdRed	Sought to reduce seafood consumption from Gulf due to BP Deepwater Horizon Oil Spill Yes=1, No=0	0.30	0.46	0	1
FDGenFood	Fukushima Daiichi Nuclear Disaster impacted general food purchasing behavior Yes=1, No=0	0.23	0.42	0	1
FDSeafd	Fukushima Daiichi Nuclear Disaster impacted seafood purchasing behavior Yes=1, No=0	0.25	0.43	0	1
FDSeafdRed	Sought to reduce seafood consumption from Asia due to Fukushima Daiichi Nuclear Disaster Yes=1, No=0	0.35	0.48	0	1

Results and Discussion

General Fish and Shellfish Purchases

Over the past ten years, United States per capita fish consumption has followed a slight decreasing trend with 2010 per capita fish consumption being estimated at 7.17 kg. (NOAA, 2011). In this study, eighty-nine percent of respondents reported being fish consumers, while 77% of consumers indicated they consumed shellfish. Participants' quantity of monthly fish and shellfish (hereby, seafood) purchases (Table 3) were also of interest. Consistent with the aforementioned results, more fish was purchased monthly and more respondents purchased fish than shellfish in a given month; only 15% of respondents reported purchasing no fish compared to one-third of respondents indicating that they did not purchase shellfish in a typical month. Over the past year, 16% of the sample increased their seafood consumption, while only seven percent indicated decreasing their consumption. However, those participants who decreased their seafood consumption did so by an average of 48% from the previous year. The majority of

respondents, 76%, reported that their seafood consumption has remained the same over the past year. Understanding what varieties of fish and shellfish consumers purchase most frequently can provide insight into consumers' tastes and preferences and help seafood supply chain members and agribusiness make more informed product and marketing decisions. We find that canned tuna and shrimp account for nearly half of all average fish and shellfish purchases, followed by salmon and tilapia (Table 4).

Table 3. Quantity of fish and shellfish purchased in a typical month (n=1004)[a]

Quantity	Fish	Shellfish
None	15%	33%
< .45 kg	15%	19%
.45-.91 kg	16%	17%
.91-1.36 kg	14%	10%
1.36-1.81 kg	10%	6%
1.81-2.27 kg	11%	6%
>2.27 kg	19%	9%

[a] All 1,004 respondents who completed the survey were included in these summary statistics.

Table 4. Breakdown of average total seafood purchases by provided categories in percent of consumers total seafood purchased (n=1004)[a]

Seafood	Average Percentage
Canned Tuna	26%
Shrimp	23%
Salmon	15%
Tilapia	12%
Other	8%
Cod	6%
Crab	4%
Catfish	3%
Pollock	2%
Clams	1%

[a] All 1,004 respondents who completed the survey were included in these summary statistics.

We believe that carious factors could impact consumers' preference to consume seafood at home versus restaurants, including not wanting to handle raw seafood, not being familiar with cooking or preparing seafood, or not liking the smell of cooking seafood at

home. It was found that more fish than shellfish was consumed at home; 71% and 62%, respectively. The opposite is true for restaurants where more shellfish is consumed (37% versus 28% of fish). The fact that the majority of seafood was consumed at home could be related to the fact that canned tuna accounted for 26% of the seafood purchased (Table 4). To gauge preferences for seafood purchases for at home preparation, respondents were asked to indicate whether the seafood they purchased was fresh or frozen, as well as not prepared or value added. On average, 44% was fresh and 56% was frozen; 77% was not prepared (plain) and 23% was value added (e.g. marinated, breaded, stuffed).

The importance of product attributes when purchasing fish and shellfish was of particular interest in this analysis. Approximately 52% percent of the sample stated they read labeling on production practices used when making fish and shellfish purchases. Of the 517 participants that indicated reading labeling about production method used, 36% purchased farm-raised seafood and 64% selected wild-caught products. Product price, safety certification, all natural and quality certification labels were ranked, on average, as most important by participants when making seafood purchases.

Table 5. Importance of attribute when making fish and shellfish purchases (n=1004)[a]

Attribute	**Average Importance** [b]
Product Price	5.70
Safety Certification Labels	5.24
All Natural	5.13
Quality Certification Labels	5.02
Protein Content	4.65
Product Traceability	4.58
Country of Origin	4.55
Produced using environmentally sustainable practices	4.53
Other nutritional information (aside from protein, fat and cholesterol content)	4.52
Fat Content	4.37
Cholesterol Content	4.33
Packaging	4.27
Locally Produced	4.25
Organic	3.93

[a] All 1,004 respondents who completed the survey were included in these summary statistics.
[b] One indicates least important and seven most important.

Finally, the level of safety that consumers associated with seafood from various regions of the world was investigated (Table 6). It is not surprising that the "Product of China" and "Product of Thailand" labels were somewhat likely to decrease purchase, given the recent negative media attention on seafood products from these countries/regions. These results parallel those found by McKendree et al. (2012), which found that participants ranked the US highest for food safety and quality and ranked China the lowest. Beyond a base level of confidence in seafood from certain countries, geographic regions of production may play a role in the perceived impacts on seafood quality after an aquatic disaster in a given area. Because we hypothesize that consumers' perception of seafood safety and quality is shaped by media coverage of environmental disasters and these events obtained heightened news coverage of seafood safety reports from China, we control for the number of food safety news reports about China seen by respondents in our analysis.

Table 6. Level of safety associated with fish and shellfish purchases from select countries (n=1004)[a]

Country	Average Rating [b]
United States	5.55
Canada	5.19
Japan	3.91
Chile	3.81
Ecuador	3.55
Mexico	3.53
Thailand	3.5
Indonesia	3.39
India	3.39
Viet Nam	3.31
China	3.28

[a] All 1,004 respondents who completed the survey were included in these summary statistics.
[b] One indicates extremely unsafe and seven indicates extremely safe

Reaction to the BP Deepwater Horizon Oil Spill

Consumers' perceptions of fish and shellfish following the Gulf of Mexico BP Deepwater Horizon Oil Spill were of primary interest (Table 7 and Figure 1). Only 29% of participants indicated that they sought to reduce their consumption of seafood after the oil spill, while

26% reported that the oil spill impacted their seafood purchasing behavior, and 23% stated that the oil spill impacted their general food purchasing behavior. However, over half (59%) of respondents agreed that they felt seafood from the Gulf of Mexico posed a health risk to consumers (Figure 1). Additionally, over half of participants who agreed that they felt seafood from the Gulf of Mexico was of lower quality than before the oil spill. Similarly, participants were more likely to purchase farm-raised than wild-caught seafood from the Gulf region (Table 7).

Table 7. Response to BP Deepwater Horizon Oil Spill (n=1004)[a]

Have you sought to reduce your consumption of fish and shellfish from the Gulf of Mexico due to the BP Deepwater Horizon Oil Spill?	Yes	29%
	No	71%
Has the BP Deepwater Horizon Oil Spill of 2010 in the Gulf of Mexico impacted your general food purchasing behavior?	Yes	23%
	No	77%
Has the BP Deepwater Horizon Oil Spill of 2010 in the Gulf of Mexico impacted your fish and shellfish purchasing behavior?	Yes	26%
	No	74%
I feel that fish and shellfish from the Gulf of Mexico poses a health risk to consumers.	Agree	59%
	Disagree	41%
I am more likely to purchase farm-raised fish and shellfish than wild-caught fish and shellfish from the Gulf region.	Agree	58%
	Disagree	42%
I am likely to seek fish and shellfish produced within the US, but avoiding fish and shellfish from the Gulf region.	Agree	59%
	Disagree	41%

[a] All 1,004 respondents who completed the survey were included in these summary statistics.

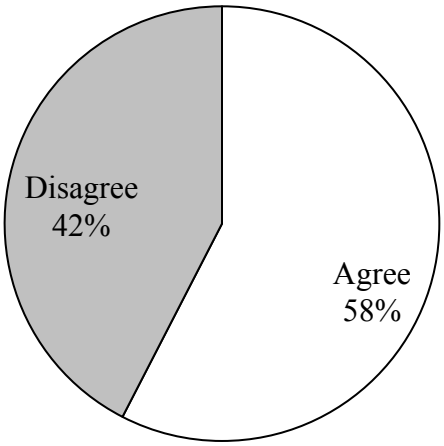

Figure 1. Respondents agreement with the statement, "I feel that fish and shellfish from the Gulf of Mexico is of lower quality than before the oil spill." (n=1004)[a]
[a] All 1,004 respondents who completed the survey were included in these summary statistics.

Logit models were used to identify factors that influenced consumers to state that the BP Deepwater Horizon Oil Spill impacted their general food or seafood purchasing behavior, and that they have sought to reduce their consumption of seafood from the Gulf of Mexico as a result (Table 8). It was found that being male was negative and significant in explaining those consumers who said their general food purchasing behavior was impacted by the BP Deepwater Horizon Oil Spill**,** but was not significant in explaining those consumers indicating their seafood purchasing behaviors were influenced or those who sought to reduce seafood consumption due to the disaster. Therefore relative to females, male consumers are less likely to change their food purchasing behavior; but the impact on seafood purchasing behaviors and seafood consumption reduction are not gender-differentiable. Age had a significant negative effect on impacting seafood purchasing behavior and seeking to reduce seafood consumption from the Gulf of Mexico, indicating that older consumers were less likely to self-report impacts on seafood purchasing or to have sought a reduction in fish and shellfish consumption from the Gulf region. Being a high shellfish consumer (defined as purchasing more than 2.67 kg for the household in a typical month) was significant and positive for impacting seafood-purchasing behavior, indicating

that those who consume more fish, on average, were more likely to have their seafood purchases affected by the oil spill.

Table 8. Regression results related to BP Deepwater Horizon Oil Spill (n=912)[a,b,c]

Variable Name	Impacted General Food Purchasing Behavior (BPGenFood)	Impacted Fish and Shellfish Purchasing Behavior (BPSeafd)	Sought to Reduce Fish and Shellfish Consumption from Gulf of Mexico (BPSeafdRed)
Male	-0.337(0.161)**	0.073(0.175)	-0.029(0.116)
Age	0.000(0.005)	-0.014(0.005)***	-0.019(0.005)***
Income	-0.009(0.044)	-0.040(0.048)	-0.014(0.044)
Adults	0.050(0.090)	0.038(0.087)	-0.058(0.081)
Children	-0.050(0.084)	-0.131(0.099)	-0.217(0.091)**
HighFish	0.054(0.233)	-0.355(0.240)	0.244(0.235)
HighShell	-0.035(0.300)	0.670(0.302)**	0.367(0.302)
ImportCrn	0.272(0.066)***	0.310(0.080)***	0.249(0.075)***
COOL	0.336(0.056)***	0.266(0.067)***	0.320(0.066)***
ChinaMed	0.069(0.017)***	0.062(0.017)***	0.075(0.017)***
Gulf	-0.016(0.219)	0.643(0.223)***	0.131(0.219)
Constant	-3.830(0.471)***	-3.632(0.472)***	-2.744(.450)***

[a] Respondents who indicated they did not purchase seafood were eliminated from the data set employed for the logit models described in this analysis.
[b] Number in parenthesis indicates robust standard error.
[c] *, **, and *** indicate corresponding variable is significant at the 10%, 5% and 1% level, correspondingly.

Concern for imported seafood was significant and positive in all three models examined, indicating that increased concern for imported seafood was associated with a higher likelihood of reporting impacts on food and seafood purchasing behavior and seeking to reduce consumption of seafood from the Gulf of Mexico. Results for the importance of the country of origin labeling were positive and significant across all models, yielding similar interpretation to those concerned about the safety of imports. Placing higher importance on country of origin labeling was associated with a higher likelihood of altered purchasing

behavior and seeking to reduce seafood consumption from the Gulf of Mexico. It is commonly acknowledged and accepted that consumers use information on country of origin labeling to evaluate products (Hong and Wyer, 1989; Maheswaran, 1994). The importance of country of origin labeling as an indication for quality has been both confirmed and rejected in the literature (Bilkey and Nes, 1982). In this case, it was the respondents view on the importance of country of origin labeling that was evaluated. It is fitting that those consumers indicating higher levels of importance for country of origin labeling were also more likely to alter behavior due to environmental disasters. Our results suggest that country of origin labeling (and traceability of production in general) plays a key role in helping a concerned consumer determine if a product was produced in a region that may have been impacted by such an event. Without this type of information, it would be very difficult to determine if seafood was produced in a potentially impacted area.

Living in a Gulf state had a positive and significant relationship on the impact of fish and shellfish purchasing behavior, but not for impacting general food purchasing behavior or for seeking to reduce seafood consumption from the Gulf of Mexico. Potentially, this can be attributed to the fact hat consumers residing in the Gulf States are concerned – but supportive of their local fisheries and livelihoods.

Reaction to the Fukushima Daiichi Nuclear Disaster

The reactions to the Fukushima Daiichi Nuclear Disaster (Table 9 and Figure 2) generated a larger response from participants than the BP Deepwater Horizon Oil Spill. One-third of respondents indicated that they have sought to reduce their consumption of seafood from Asia due to the recent nuclear crisis in Japan. Twenty-two percent of participants stated that the nuclear crisis in Japan impacted their general food purchases and 24% specified that it impacted their seafood purchasing behavior. A larger number, nearly two-thirds, of participants felt that seafood from Asia posed a health risk to consumers and also felt that seafood from Asia was of lower quality than before the nuclear crisis in Japan. A smaller percentage, but still the majority- 58%- agreed that they were more likely to purchase farm-raised seafood than wild-caught seafood from Asia.

Table 9. Response to Fukushima Daiichi Nuclear Disaster (n=1004)[a]

Have you sought to reduce your consumption of fish and shellfish from Asia due to the recent nuclear crisis in Japan?	Yes	33%
	No	67%
Has the recent nuclear crisis in Japan impacted your general food purchasing behavior?	Yes	22%
	No	78%
Has the recent nuclear crisis in Japan impacted your fish and shellfish purchasing behavior?	Yes	24%
	No	76%
I feel that fish and shellfish from Asia poses a health risk to consumers.	Agree	67%
	Disagree	33%
I am more likely to purchase farm-raised fish and shellfish than wild-caught fish and shellfish from Asia.	Agree	58%
	Disagree	42%

[a] All 1,004 respondents who completed the survey were included in these summary statistics.

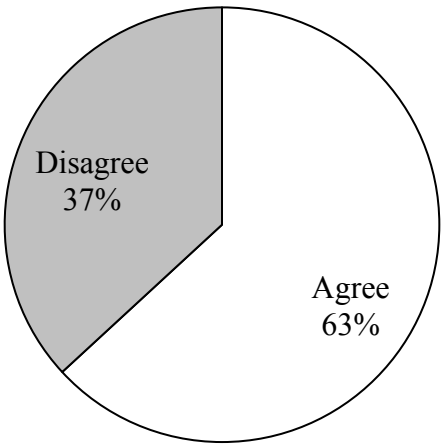

Figure 2. Respondents agreement with the statement, "I feel that fish and shellfish from Asia is of lower quality then before the nuclear crisis in Japan." (n=1004)[a]
[a] All 1,004 respondents who completed the survey were included in these summary statistics.

Logit models were used to identify factors that influenced a participant to say that the Fukushima Daiichi Nuclear Disaster impacted their general food or seafood purchasing behavior, and that they have sought to reduce their consumption of seafood from Asia due to the nuclear disaster in Japan (Table 10). Being male was found to be significant and to negatively determine whether fish and shellfish purchasing behavior was impacted and whether a consumer sought to reduce consumption of seafood from Asia (but not in impacting general food purchasing behavior). Therefore, being male made a consumer less likely to report changes in seafood purchasing behavior and less likely to report a reduction in consumption of seafood from Asia due to the nuclear disaster. Age also had a significant negative relationship, similar to the case of the Gulf oil spill, but for impacting general food and seafood purchasing behavior. Consumers who stated concern about imported seafood reported having their general food and seafood purchasing impacted by the Japan disaster and had sought to reduce consumption of seafood from Asia as a result. Similarly, respondents indicating the importance of country of origin labeling on their seafood purchases showed a significant impact on their purchasing of general food and seafood and have sought to reduce their seafood consumption from Asia, as a result of this event.

Table 10. Regression results related to Fukushima Daiichi Nuclear Disaster (n=912)[a,b,c]

Variable Name	Impacted General Food Purchasing Behavior (FDGenFood)	Impacted Fish and Shellfish Purchasing Behavior (FDSeafd)	Sought to Reduce Fish and Shellfish Consumption from Asia (FDSeafdRed)
Male	-0.249(0.183)	-0.368(0.173)**	-0.337(0.161)**
Age	-0.18(0.006)***	-0.010(0.005)*	0.000(0.005)
Income	-0.003(0.049)	0.015(0.046)	-0.009(0.044)
Adults	-0.002(0.091)	-0.067(0.097)	0.050(0.090)
Children	0.026(0.094)	-0.033(0.083)	-0.050(0.084)
HighFish	0.024(0.251)	0.024(0.243)	0.054(0.233)
HighShell	0.089(0.308)	0.138(0.306)	-0.035(0.300)
ImportCrn	0.205(0.076)***	0.205(0.076)***	0.272(0.066)***
COOL	0.297(0.068)***	0.267(0.065)***	0.336(0.056)***
ChinaMed	0.075(0.017)***	0.061(0.016)***	0.069(0.017)***
Pacific	0.0142(0.236)	-0.124(0.235)	-0.016(0.219)
Constant	-3.220(0.510)***	-3.002(0.494)***	-3.830(0.471)***

[a] Respondents who indicated they did not purchase seafood were eliminated from the data set employed for the logit models described in this analysis.
[b] Number in parenthesis indicates robust standard error.
[c] *, **, and *** indicate corresponding variable is significant at the 10%, 5% and 1% level, correspondingly.

In the regression for both events, the number of reports seen on the safety of imported food products from China in the past year had a significant and positive sign for all six models. This result hints at a degree of association between the negative consequences of environmental disasters on seafood purchases and the negative publicity that imported food products from China have received in the mainstream media. Although China is not related to these two environment disasters, the seemingly unrelated association is likely caused by the fact that consumers who pay more attention to food safety issues, such as media reports about Chinese food safety problems, are more responsive to food safety problems stemming from other sources.

Due to the timing of the survey versus the occurance of the environmental disasters investigated, the authors are cautious against directly comparing the findings of one disaster versus the other. At the time that the survey was conducted, the nuclear disaster in Japan was more recent and in the forefront of consumers' minds compared to the oil spill in the Gulf of Mexico. It is acknowleged that there are potential differences across findings in these two environmental disasters due to the timing of the data collection via the online survey.

Conclusions and Implications

An online survey was conducted to determine US consumers' seafood purchasing characteristics and preferences for seafood after two environmental disasters, the Deepwater Horizon Oil Spill and Fukushima Daiichi Nuclear Disaster. It was found that nearly 90% of survey participants are fish consumers while over 75% reported being shellfish consumers. When looking at general seafood consumption, most consumption occurred at home. Understanding at home consumption versus restaurant consumption, as well as which fish species and attributes of the product (canned, frozen, fresh, etc.) consumers prefer can help agribusiness and seafood supply members better understand how to create additional value for their customers. Our results indicate that consumers reported being concerned about seafood safety in the wake of the environmental disasters under investigation, however the majority did not report changing their consumption in the past year. A better understanding of the factors that influence consumer behavior and perceptions following environmental disasters can make seafood industries, supply chain members and agribusiness more resilient and better able to respond to their consumers' concerns. Given the importance of attributes that consumers look for and value in determining seafood product safety, such as safety and quality certification labels, seafood industry stakeholders can use these attributes to communicate effectively with their consumers and improve their reputation (maybe restore trust in their products) in the aftermath of disasters. Understanding consumer behavior under such circumstances will allow for careful and efficient response by the seafood industry and allow for optimal policy decision-making.

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