Analyzing Consumer Preferences for Credence Attributes of Fish and Fishery Products in Davao City, Philippines

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ABSTRACT

Fish remains among the essential diet components in a typical Filipino household. As fish consumption rises, the manner of how it is caught is in question as it affects the quality of the fish. This study aims to analyze the importance of the two credence attributes of environmental sustainability and food safety in fish and fishery products in Davao City, Philippines. Conjoint analysis was used to analyze consumer preference by estimating the consumer's utility function. From the preference model, the relative importance of the considered attributes in descending order are food safety certification, sustainability practice information, and extent of good animal welfare for target and non-target species. Three major segments of seafood consumers (N = 300) were clustered in terms of policy preferences. These are consumers who preferred policies on food safety certification and traceability system (77%), consumers who preferred policies regarding food safety certification and environmental sustainability certification (16%), and consumers who highly preferred only food safety certification (7%). Using multinomial logistic regression, the factors affecting preferences were found to be average price per kilogram for capture fishery products, barangay (i.e., village) classification, household size, retail outlet choice, sex, frequency of buying, beliefs and practices regarding environmental sustainability and environmental concerns, age, years of education, and frequency of buying fish. The study showed the potential of environmental sustainability and food safety attributes in influencing the purchasing decisions of the consumers.

Keywords: conjoint analysis, consumer preference, food safety, credence attributes

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INTRODUCTION

Consumers have grown conscious about the nutritional benefits, safety, and the sustainable production of the food they serve on their table. Food labels such as eco-labels, fair trade, and hazard analysis and critical control points (HACCP), among others, signal superior quality or presence of other attributes. In so doing, these create premiums for such products (Magnier, Schoormans, and Mugge 2016; Teng and Wang 2015; McCluskey and Loureiro 2003). Labels are crucial in ensuring that consumers are well-informed of the product characteristics, giving them broader options in purchasing. These labels are considered as a way to address information asymmetry (Caswell and Padberg 2013; Karstens and Belz 2006) and promote incentives to firms (Golan et al. 2001; Caswell and Mojduszka 1996). However, these labels are not incentivizing at all (Bronnmann and Asche 2016) and may not be a solution for the improvement of certain environmental or food safety problems (Yokessa and Marette 2019).

In the Philippines, while there are existing government laws and private certifying bodies, food labels are not widely known among consumers. The most common verification for freshness is the "best before" and "consume before" dates for processed foods. However, many products do not have these labels. Limited "product safety" information could be attributed to the inadequacy of safety guidelines, which is also the case in most other Asian countries (Shepherd and Tam 2008). A study conducted about consumer perception on food safety of fresh vegetables revealed that the appearance, freshness, cleanliness, and freedom from physical damage was considered the most important across all income groups. This could be so as consumers only limit their definition of "safe" as clean. However, only the high-income groups appeared to know about food safety (Aban, Concepcion, and Montiflor 2009).

On the other hand, Filipino consumers have gradually become "green consumers", having awareness of environment-friendly, eco-friendly, and sustainable characteristics. This growing interest has not only focused on durables but also on agricultural products. Apparently, while the consumer's ethics motivates him to protect or care for the environment (Verbeke et al. 2007), little research has been conducted to reveal its association with fish consumer behavior.

In light of the preference shift and growing attention to marine conservation issues, market-based incentives to promote sustainable fishing practices have emerged and are being regulated through a third-party accrediting organization. The most popular is the certification provided by the Marine Stewardship Council, which focuses on sustainable fishing in the ocean. The organization's thrust is to ensure sufficient fish stocks, minimize harmful impacts of fishing, and strictly implement fishing laws relating to sanitation and labor, among others.

In the Philippines, there are limited studies that focused on the importance of food attributes (e.g., food safety and environmental sustainability labels) to the decision-making process of purchasing fish. Lack of a proper definition of a "sustainable seafood" could lead to generic realizations if not erroneous interpretations. The Philippines currently addresses existing issues on illegal fishing (e.g., dynamite and cyanide fishing), which are not only destructive to the ocean but also expose consumers to health risks.

This paper reports the results of a study to investigate the importance of the environmental sustainability and safety features of selected fish and fishery products in the purchasing decisions of consumers. The discussion is based on the hypothesis that consumers are highly aware of environmental sustainability and food safety issues related to seafood products. A further hypothesis is that consumer preferences are influenced by awareness of environmental and food safety issues, and knowledge about sustainability, economic and socio-demographic characteristics, and purchasing patterns and price.

The findings of this study will provide information on consumer preferences relating to sustainable and safety attributes of fish and fishery products in the Philippine market. The results will provide empirical evidence to

support recommendations to the government for appropriate measures to strengthen its policies regarding sustainable fishing practices and assuring food safety to the consumers.

The attributes and attribute levels of the selected fishery products are valuable information in improving the production and marketing of such commodities. Finally, knowledge of consumer preferences for fish and fishery products will guide the market actors to adjust their operations.

REVIEW OF LITERATURE

Methods for Evaluating Consumer Preferences

Consumer preference is the overall satisfaction of an individual that results in an optimal choice. It is measured by utility of various bundles of goods, measured using stated preference and revealed preference models. Stated preference models are used in testing for new policies and other commodities and services with multiple attributes. Basically, these involve making the respondent choose which is the "alternative" among the given hypothetical scenarios. These are combinations of attributes generated by an experimental design. On the other hand, revealed preference models involve observing the choices of consumers and estimating their preference. This technique enables the researcher to avoid issues on possible biases. While this is a critical point in research, the technique has also its major weakness, which is its reliance on observable behaviors only. Hence, the revealed preference method may not be appropriate for quantifying preferences for attributes where no variation exists or for which the attribute cannot be observed (Hicks 2002).

Two methods are commonly used in stated preference analysis—the contingent valuation method (CVM) and the discrete choice method (DCM). The CVM is flexible and convenient and has gained popularity as it allows for analysis of a variety of nonmarket goods and services. Despite these advantages, the CVM is prone to biased and unreliable results due to the structure of data collection (Bateman, Willis, and Garrod 1994). Furthermore, the respondent's intentions of willingness to pay may not be fully captured by the survey. Caution should be taken on drawing conclusions as the respondents may only want to just give rather than articulate the true value of the goods under study.

On the other hand, conjoint analysis uses a DCM wherein respondents are asked to choose among alternatives. Conjoint analysis allows for a richer specification of product attributes. Conjoint analysis is more realistic in the sense that consumers may trade off attributes against each other in choosing the preferred combination of attributes (Roheim, Sudhakaran, and Durham 2012).

While the CVM measures valuation directly, the conjoint analysis measures a respondent's valuation by inferring from the preferences for the alternative products presented. In CVM, a detailed description of the good is needed while in conjoint analysis, the respondents are given various hypothetical scenarios in which they can articulate their preferences for products that are described as a bundle of various attributes. Conjoint analysis is a more realistic way of eliciting preferences as this measures how each consumer chooses products in actual marketplaces (Baker 1999).

Several studies have used conjoint analysis to measure the willingness to pay for eco-labeled seafood and aquaculture products (Johnston and Roheim 2006; Roheim, Sudhakaran, and Durham 2012) and various environmental commodities (Álvarez-Farizo and Hanley 2002). Conjoint analysis is a predictive measure to determine consumer responses toward various product attributes. It estimates the structure of the evaluation by a consumer of groups of predetermined combinations of product attributes (Green and Srinivasan 1978). Studies have emphasized the preference of consumers toward food safety attributes regardless of the type of commodity, whether for fresh fruits (Baker and Crosbie 1994) and vegetables, seafood products (Wang et al. 2013), or meat products (McCluskey et al. 2005).

Consumer Preference and Policy Link

The importance of ethical and environmental attributes of food products is recognized in terms of information signals (e.g., product descriptions and product assurances) and consumer perception. As early as the 1970s, movements related to promotion of organic and fair-trade products have emerged, but these were restricted only to niche markets. In the mid-1990s, issues regarding food safety, workers' rights, and environmental issues became important for radical actors and small niche consumers alike. The mad cow disease outbreak and oil spills have heightened the concern for incidences of food contamination. Hence, there is a growing interest in products with eco-labels (Codron, Siriex, and Reardon 2006).

Third-party certifiers play a big role in providing services to the food industry such as ensuring (1) reduced risks and liability, (2) strengthened "due diligence defense", (3) greater confidence in regulatory compliance, and (4) more effective management, among others (Tanner 2000). Third party-certifiers are independent external institutions that evaluate, assess, and certify quality claims (Deaton 2004). These certifications create market signals of superior food quality. While third-party certifiers cater to firms with higher capitalization, both local and national governments act as facilitators for the micro, small, and medium enterprises so that environmental protection and food safety assurance standards are followed.

Signals provide indirect information about a product or personal attribute that can influence probabilistic beliefs about quality. Determining consumer preference is a suitable measure to gauge public opinions regarding government policies and how these policies may be implemented. The facilitative role of the government bridges the gap between consumers, producers, as well as third party certifiers in providing policy actions that are directed toward addressing safety and environmental sustainability issues.

Use of Conjoint Analysis in Consumer and Environmental Research

Conjoint analysis is used commercially to study consumer goods, industrial goods, transportation, financial services, government, and other services (Cattin and Wittink 1982). With the academe's continuous refinements of the method, conjoint analysis has been applied to various areas (Wittink and Cattin 1989).

Conjoint analysis is used in health care studies as it can be used to quantify preferences where market choices are strictly constrained by regulatory and institutional factors (Bridges et al. 2011; Ryan and Farrar 2000). In the study of Weston and FitzGerald (2004), it was used to determine willingness to pay and preference for a certain therapy for cancer. Conjoint analysis was also used to assess women's preferences for miscarriage management (Ryan and Hughes 1997), in vitro fertilization (Ryan 1999), and growth hormone therapy (Singh et al. 1998).

The application of conjoint analysis in environmental studies include valuing recreational areas, ecosystem and land management, environment-friendly products, reduction in pollution, and conserving energy. It was also used to evaluate the importance of fisheries management, showing that among the fisheries management objectives, regional employment and sustainable yields are the key concerns of the stakeholder (Wattage, Mardle, and Pascoe 2005).

More recent applications of the model include consumer preference for biobank research and the relative importance they place on concerns for privacy and confidentiality (Johnson et al. 2013). Not only is it used in medical services, but it is also applied to specific hospital services such as improvements in its facilities (Suess and Mody 2017).

CONCEPTUAL FRAMEWORK

This study is built on integrating the concept of safety and environmental sustainability into the decision-making process of consumers when buying fresh and chilled or frozen seafood.

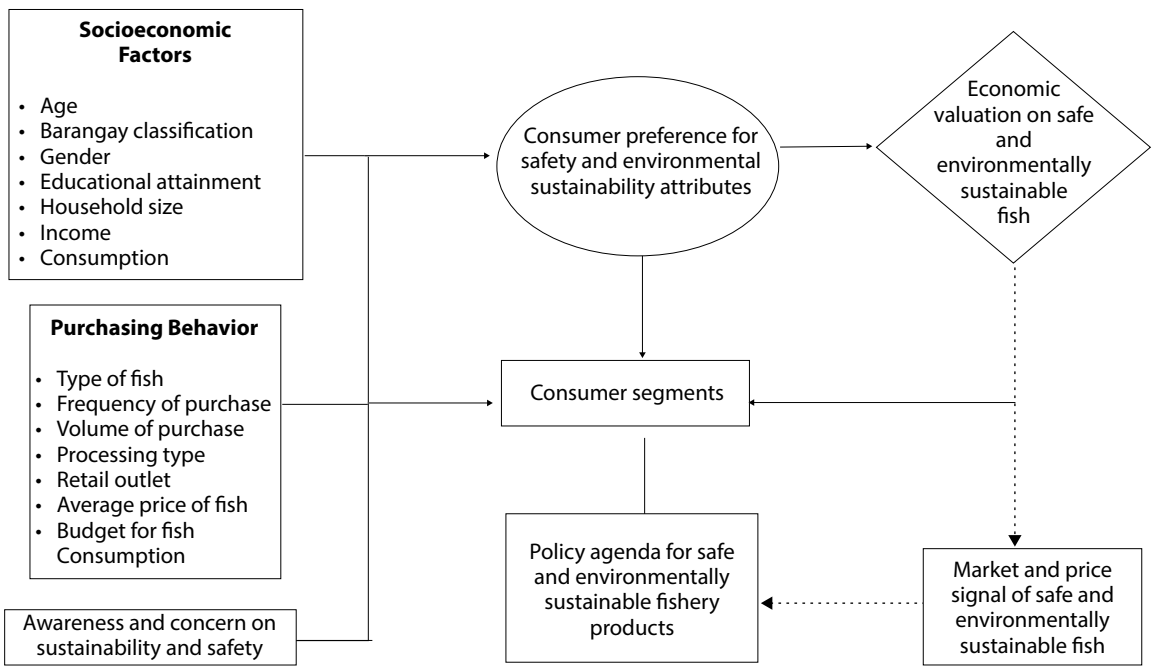
Safety and environmental sustainability, being the "credence" attributes in this study, are not readily signaled to the fish consumers especially due to lack of information (e.g., labels). It is important to look at how sustainability and food safety attributes could influence purchasing, if at all (Figure 1).

Improvement of the market and industry performance of the fisheries sector can be achieved through appropriate policy actions that promote safe and environmentally sustainable fishery products. Information on how the fish is produced and processed allows consumers to differentiate fishery products that have undergone food safety evaluations and produced through environmentally sustainable practices. These information on safety and sustainable attributes may be obtained in different forms, eco-labels, other media, and social media platforms, as well as government-initiated campaigns. These initiatives are meant to encourage consumers to patronize sustainable products. However, limited information may hinder consumers from evaluating alternatives (Chan 1996).

Understanding consumer preferences for safe and environmentally sustainable fishery products is necessary in formulating policy actions. Various factors may contribute to overall consumer preference such as a product's credence attributes (e.g., safety and environmental sustainability). For instance, awareness on safety attributes may contribute to preference toward safe seafood as this would assure consumers that what they are putting on their table are safe. Likewise, awareness on environmental sustainability may influence preference toward environmentally sustainable fishery products. An individual's level of concern for environmental issues affects consumer preferences (Chan 1996) and environmental motivation predicts actual purchase (Monier-Dilhan and Berges 2016).

Consumers who have the same preferences will make up a group or a market segment. For instance, a group of consumers may only prefer safe fishery products but not environmentally sustainable ones. On the other hand, consumer segments may be influenced by socioeconomic

F igure 1. Conceptual framework for analyzing the consumer preference for safe and environmentally sustainable fishery products in Davao City



Note: Analyses on market and price signal of safe and environmentally sustainable fish are not covered in this study.

demographics, purchase behaviors, and level of awareness regarding environmental and safety issues. Profiles such as age, gender, level of income, educational attainment, and household size are assumed to influence consumer preference toward safe and environmentally sustainable fishery products. Furthermore, the number of wet markets and supermarkets around the consumer's residence may also influence the consumer's purchasing decisions and, consequently, preferences. This may be reflected in the barangay (village) classification of the residential area. Urban barangays have better access to retail outlets; thus, consumers have options on where to buy fish. It is also important to characterize the respondents according to their buying behavior such as purchasing patterns (e.g., frequency of purchase), lifestyle, including consumer's allocation for fish consumption. The choice of retail outlet may also influence a consumer's preference toward safe and environmentally sustainable fishery products.

Determining market segments is important since policy actions may not be applicable for consumers in general. Consumer segments allow policymakers and firms to focus on specific groups and suggest appropriate management strategies (Cohen and Guajardo 2018). The existence of different market segments will allow producers of fresh seafood to target their consumers given the resulting preferences by employing specific marketing and pricing strategies.

Since safety and environmental sustainability are both credence attributes, there is no way for consumers to classify them before and after purchase. Identifying consumer preference for safe and environmentally sustainable fish is important in understanding consumer's valuation toward the said attributes. The consumer's valuations are valuable information that may reflect the consumers' interest in purchasing fish that are certified safe and environmentally sustainable. These valuations, reflected in their preferences, are expected to be relayed to the retailers. Such process creates a market signal for fish producers to employ environmentally sustainable management schemes as well as food safety procedures. To better facilitate transfer of information between consumers and producers, appropriate and targeted policy actions are necessary. The lack of information, leading to poor market signals, hinders consumers in making informed purchasing decisions.

Policymakers as well as third-party certifying bodies introduce safety and environmental sustainability information in the form of labels to reduce information asymmetry. These labels assure the consumers that the product has undergone safety protocols and applied environmentally sustainable practices. At the same time, these labels promote market incentives and emphasize desirable attributes for particular market segments (Aprile, Caputo, and Nayga 2012).

METHODS OF ANALYSIS

Data Collection

Selection of attributes and attribute levels through focus group discussion

Two sets of focused group discussions (FGDs) were conducted to determine and confirm the attributes and levels considered in the study. The FGDs were composed of 4–5 participants per group and a facilitator. Either the decision-maker in the household or who was influential when it comes to purchasing food commodities was considered.

The FGDs had three parts and lasted for at least an hour and thirty minutes. In the first part, information on the participant's demographic profiles and purchasing patterns such as frequency and retail outlet choice were generated, among others. During that portion, the participants were asked about the common seafood they buy and their considerations when buying seafood. The second part was about the participants' perceptions on food safety and environmental sustainability. They were encouraged to talk about what they understood about the concepts, for instance, if they knew any environmental and food safety issues relating to seafood products. Information about the extent of their knowledge, the source, and how the information has changed their decision-making of seafood were asked. The third part was

about their expectations toward sustainability and how these affect their present consumption. They were asked about how they would want the idea of sustainability to be conveyed to them (e.g., through eco-labels or media).

Design of hypothetical product profiles

The data from the FGDs were analyzed to come up with the attributes and attribute levels to come up with hypothetical product profiles (Table 1). Product profiles are hypothetical products with different combinations of attributes and attribute levels. The design forms different combinations of attribute levels for a particular product. The generated product profiles may either be non-existing or existing in the market. Fractional factorial design does not allow repetition of combinations of attributes and levels to ensure that there is no bias in every generated product profile (Rao 2014). These product profiles were used to elucidate preferences for the selected attributes and their corresponding levels.

The selection of attributes and levels were also based on existing and suggested policies regarding food safety and environmental sustainability issues. These policies are implemented by various government agencies in the Philippines such as the Food and Drug Administration (FDA) and the Bureau of Fisheries and Aquatic Resources. The study considered four credence attributes relating to food safety and environmental sustainability.

A total of eight hypothetical profiles were generated (Table 1). Each attribute only has two levels, i.e., presence and absence of the attribute. For instance, food safety information may be indicated or not, whether through a label in the packaging or presence of certification in the retail outlet. This is to prevent confusion among the respondents especially when explaining to them each level.

Furthermore, the study focused only on analyzing the preference for national policies that address food safety and environmental sustainability issues and not on specific third-party certifications. These attributes and levels combined created various hypothetical profiles that were rated by the respondents. A full factorial design would generate a large number of combinations with the given attributes and levels ($2 \times 2 \times 2 \times 2 = 16$). Because a respondent may not be able to evaluate the generated hypothetical profiles accurately, the fractional factorial design was deemed appropriate for this study to make sure that only the main effects of the stimulus of interest are captured.

Table 1. Hypothetical profiles rated by the respondents

Profile	Extent of Good Animal Welfare for Target and Non-Target Species During the Catch/ Production	Traceability to Specific Fish Landing/Farm	Sustainability Practice Information	Food Safety Information
1	Not Indicated	Indicated	Not Indicated	Not Indicated
2	Indicated	Not Indicated	Not Indicated	FDA/HACCP Certified
3	Not Indicated	Indicated	Not Indicated	FDA/HACCP Certified
4	Not Indicated	Not Indicated	Sustainable fishing practice certified	FDA/HACCP Certified
5	Indicated	Not Indicated	Not Indicated	Not Indicated
6	Indicated	Indicated	Sustainable fishing practice certified	FDA/HACCP Certified
7	Not Indicated	Not Indicated	Sustainable fishing practice certified	Not Indicated
8	Indicated	Indicated	Sustainable fishing practice certified	Not Indicated

The product profiles were generated using the Statistical Package for the Social Sciences (SPSS) software.

Consumer survey

A total of 300 samples were collected from nine randomly selected urban and rural barangays in Davao City, the third most populous city in the Philippines with approximately 1.63 million in population (PSA 2020). It is also one of the 33 highly urbanized cities in the country with approximately 86 percent of its population situated in urban barangays. The city has access to both public wet markets and major supermarket chains.

This study used a semi-structured survey instrument, which was composed of three sections: (1) sociodemographic profiles and purchasing behavior of respondent, (2) consumer's awareness and concern on safety and environmental sustainability of fish products, and (3) consumer's ratings of the generated product profiles. For the consumer's awareness and concern levels for safety and environmental sustainability, the respondents were rated on their attitude, behavior, awareness, and concern for the said attributes using a Likert scale. The generated hypothetical product profiles were rated by the respondents on a scale of 1−10 with 1 having the lowest possibility of purchase and 10 as the highest.

Analytical Techniques

Conjoint analysis

Conjoint analysis was used to determine consumer preferences for safe and environmentally sustainable fish products. This method involves a preference model, more commonly part-worth models comprising a generic form, which can estimate a large number or parameters (Green and Srinivasan 1990). This model was used because of its flexibility as it allows for estimation of a large number of parameters (Green and Srinivasan 1990). Part-worth is an estimate of the utility that a consumer associates with each level of each attribute considered. Furthermore, it has an advantage for categorical attributes (Green and Srinivasan 1978). The model is similar to the estimation of ordinary least squares, which, while simple, is very robust in terms of capturing the alternative forms of utilities. Since a rating scale is utilized rather than ranking the products, the part-worth model is appropriate. The idea is that the utilities are based on a dummy matrix of predictor variables that either has the presence of the attribute level or not. The evaluation of the respondent, in the form of a rating, is the dependent variable (Rao 2014). The preference model is expressed as:

$$r_j = \sum_{p=1}^{t} f_p Y_{jp} \quad (1)$$

where

r_j = is the respondent's rating of the stimulus object at level j;

fp = the function representing the part-worth of each of the different levels of the stimulus object, Yjp for the pth attribute; and

Yjp = the level of the pth attribute for the jth stimulus object.

The estimation of part-worth utilities was generated using the conjoint feature of the SPSS software.

Cluster analysis

Cluster analysis was used to find out if there are market segments of fish product consumers in Davao City. The clusters were based on the responses and results of the part-worth utility estimates. Consumer segments are classified on the basis of the consumers' demographic characteristics, desired benefits from the product/service, and past-purchase behaviors as well as preferred fish attributes. To identify the various consumer segments, Ward's agglomerative hierarchical clustering method in SPSS was utilized to determine the number of clusters, from the agglomerative schedule. An agglomerative schedule shows the summary of cluster solutions and denote the strength of the structure of clustering obtained by the group average linkage (Kaufman and Rousseeuw 2009). This method

associates cluster analysis as an analysis of variance problem where the distance between two clusters, A and B, refers to how much the sum of squares will increase as they are merged. The Ward's method finds the pair of clusters that minimizes the increase in total within-cluster variance after merging.

After the number of clusters was determined using Ward's hierarchical procedure, a non-hierarchical procedure, also known as the K-means clustering was used to determine the members of each cluster produced. Combining both hierarchical and non-hierarchical procedures complement each method's weaknesses. Conjoint analysis was employed on each of the generated clusters.

Multinomial logistic regression

From the consumer segments formed in the cluster analysis, multinomial logistic regression was performed to determine the factors affecting the preferences. Each consumer cluster has its own preference for policies that may be implemented in the fish and fisheries products. These preferences may be influenced by socioeconomic characteristics, purchasing patterns, and current practices, awareness, and concerns relating to food safety and environmental sustainability.

The resulting clusters formed were used as a dependent variable in looking at the factors that influence consumer preference. To analyze this, a multinomial logit model was used. The logit model is based on the cumulative logistic distribution (IDRE 2019; Gujarati 2004). The logit model is expressed as:

$$
\begin{aligned}
Y_i = {} & \beta_0 + \beta_1 Age + \beta_2 BrgyClass + \beta_3 Sex \\
& + \beta_4 Educ + \beta_5 HHsize + \beta_6 AveInc + \beta_7 HighInc \\
& + \beta_8 FishTypeAqua + \beta_9 FishTypeCapture \\
& + \beta_{10} FishTypeBoth + \beta_{11} FreqPurch \\
& + \beta_{12} FishVol + \beta_{13} RetOutWet + \beta_{14} RRetOutSup \\
& + \beta_{15} AvePriceCapture + \beta_{16} AvePriceAqua \\
& + \beta_{17} BudgFish + \beta_{18} SafeConcern + \beta_{19} \text{Envi}Concern \\
& + \beta_{20} \text{Safe Aware} + \beta_{21} EnviAware + \beta_{22} SafePrac \\
& + \beta_{23} EnviPrac + \varepsilon_i
\end{aligned}
\qquad (2)
$$

where:

Y_i	=	(i= 1, 2…, n) consumer cluster or segment
β_i	=	(i= 1, 2…, n) coefficients to be estimated
Age	=	number of years
Barangay Classification	=	1 if urban; 0 otherwise
Sex	=	1 if male; 0 otherwise
Educational Attainment	=	number or formal years of education
Household Size	=	number of members in the household
LowInc	=	1 if monthly income is below PHP[1] 15,000; 0 otherwise
AveInc	=	1 if monthly income is PHP 15,000 to less than 30,000; 0 otherwise
HighInc	=	1 if monthly income is above PHP 30,000; 0 otherwise
Fish Type Aquaculture	=	1 if aquaculture fish only; 0 otherwise
Fish Type Capture	=	1 if capture fisheries only; 0 otherwise
Fish Type Both	=	1 if both types; 0 otherwise
Frequency of Purchase	=	number of times the respondent buys fish in a week
Volume of Purchase	=	estimated volume of purchased fish in kilograms per week
RetOutWet	=	usual place where the respondent buys fish; 1 if wet market; 0 otherwise
RetOutSup	=	usual place where the respondent buys fish; 1 if supermarket; 0 otherwise

1 Philippine peso; USD 1.00 = PHP 47.95 (2021) (https://www.bloomberg.com/quote/USDPHP:CUR)

AvePriceCapture	=	average price fish (capture fisheries) purchased in PHP/kg
AvePriceAquaculture	=	average price fish (aquaculture) purchased in PHP/kg
Budget for Fish Consumption	=	estimated weekly budget for fish consumption (in PHP)
Food Safety Concern	=	Likert scale of 1–3, where: 1 = not important 2 = important 3 = very important
Environmental Sustainability Concern	=	Likert scale of 1–3, where: 1 = not important 2 = important 3 = very important
Food Safety Awareness	=	Likert scale of 1–3, where: 1 = not at all aware 2 = aware 3 = extremely aware
Environmental Sustainability Awareness	=	Likert scale of 1–3, where: 1 = not at all aware 2 = aware 3 = extremely aware
Food Safety Practices	=	Likert scale of 1–3, where: 1 = do not agree 2 = agree 3 = highly agree
Environmental Sustainability Practices	=	Likert scale of 1–3, where: 1 = do not agree 2 = agree 3 = highly agree
Environmental Sustainability Awareness	=	Likert scale of 1–3, where: 1 = not at all aware 2 = awaree 3 = extremely aware
Food Safety Practices	=	Likert scale of 1–3, where: 1 = do not agree 2 = agree 3 = highly agree
Environmental Sustainability Practices	=	Likert scale of 1–3, where: 1 = do not agree 2 = agree 3 = highly agree

The parameters denoted by β were estimated using maximum likelihood estimation (MLE) using Stata. The variable for "both" fish types, wet market as retail outlet, and "HighIncome" were dropped to avoid multicollinearity. The base categories were "rural" for barangay classification, "female" for sex, "high income" for level of monthly income, "fish type aquaculture" for type of frequently bought fish, and "wet market" for retail outlet.

The multinomial logistic regression relates to the log of the odds ratio, which we can define as Z. The higher the value of Z, the higher the odds for an event to happen; in this case, preference for a specific policy or combination of policies. The Z is denoted as:

$$Z_i = ln \frac{P_{(y=m)}}{P_{(y=1)}} \tag{3}$$

which can be used in predicting for the probability of an event happening. Marginal effects were evaluated at mean values of the independent variables. Computation of probabilities for multinomial logit for the reference or base category is

$$P_{(y=1)} = \frac{1}{1 + \sum e^{Z_h}} \tag{4}$$

where $\sum e^{Zh} = e^{Z2} + e^{Z3} + \cdots + e^{Zm}$. For the m or the comparison category, the computation is

$$P_{(y=m)} = \frac{e^{Z_m}}{1 + \sum e^{Z_h}} \tag{5}$$

where the base of the natural logarithm is e = 2.71828. Post-estimation tests such as test of independent variables and test of the independence of irrelevant alternatives were also performed.

In multinomial logistic regression, the generated parameters or coefficients are relative to the referent group or the base outcome. For instance, the interpretation of the multinomial

logit with clusters as the dependent variable is that for every unit change in the independent variable, the relative log-odds of cluster 1 relative to the referent group cluster 3 is expected to change by its respective coefficient, ceteris paribus.

RESULTS

Respondent Characteristics

Majority of the respondentss come from urban barangays (86%) and most of the respondents were female (75%), averaging 47 years old (58%) and married (77%). Respondents with a monthly income of below PHP 15,000 made up 10 percent of the sample, while 52 percent earn PHP 15,000 to below PHP 30,000, and 38 percent earn PHP 30,000 and more. The average household size is five. About 64 percent of the respondents indicated that they purchase both aquaculture and capture fishery products while the remaining 36 percent indicated that they buy either wild-caught fish or aquaculture products only. Based on multiple responses, the top three frequently-bought capture fishery products were tuna (89%), bigeye scad (37%), and roundscad (13%). For aquaculture products, only milkfish (54%) and tilapia (33%) were bought.

Preferences of consumer-respondents

In verifying the predictive power of the part-worth model, the correlation between the actual ranking and estimated ranking of the product profiles must be tested using Pearson's R correlation test. The Pearson's R correlation result for the estimated utility and actual utility for each attribute and attribute level were positively correlated with coefficient of 0.999 with a p-value of 0.000, which is less than 0.05 (Table 2). Therefore, there exists a strong relationship between the model and the actual utility, which implies that there is correlation between the observed and the estimated preferences.

Results from estimating the parameters of the utility function in Table 2 suggest that information about food safety plays the most important role among the four credence attributes in consumer likelihood to buy fish and fishery products. This is followed by information about the traceability to specific fish landing or farm with a relative importance, followed by sustainable practice information, and extent of good animal welfare for target and non-target species.

Table 2. Average part-worth utility, relative importance, and goodness of fit, 300 respondents, Davao City, 2019

Attributes	Levels	Utility	Relative Importance (%)
Extent of good animal welfare for target and non-target species during the catch/production	Not Indicated	–0.2993	15.73
	Indicated	0.2993	
Traceability to specific fish landing/farm	Not Indicated	–0.4273	26.13
	Indicated	0.4273	
Sustainability practice information	Not Indicated	–0.3060	17.94
	Sustainable fishing practice certified	0.3060	
Food safety information	Not Indicated	–1.0351	40.20
	FDA/HACCP Certified	1.0351	
	Constant	7.6229	
Goodness of Fit			
	Value	Significance	
Pearson's R	0.9998	0.000	

Positive utility scores indicate attractiveness compared with the negative signs. For instance, consumers preferred the presence of information on the extent of good aquatic and animal welfare for target and non-target species during catch/production. Higher utility scores suggest increasing preference for such level. In this case, among the eight attribute levels in the model, the presence of the FDA/HACCP certification had the highest contribution to the overall utility with a utility score of 1.04.

In connection with food safety information, the traceability to specific fish landing/farm has the second highest importance value at 26.13 percent. This information must however be indicated on the product.

The two attributes that were found least important to the consumers were sustainability practice information and extent of good welfare to target and non-target fish species.

Consumer segments based on preferences

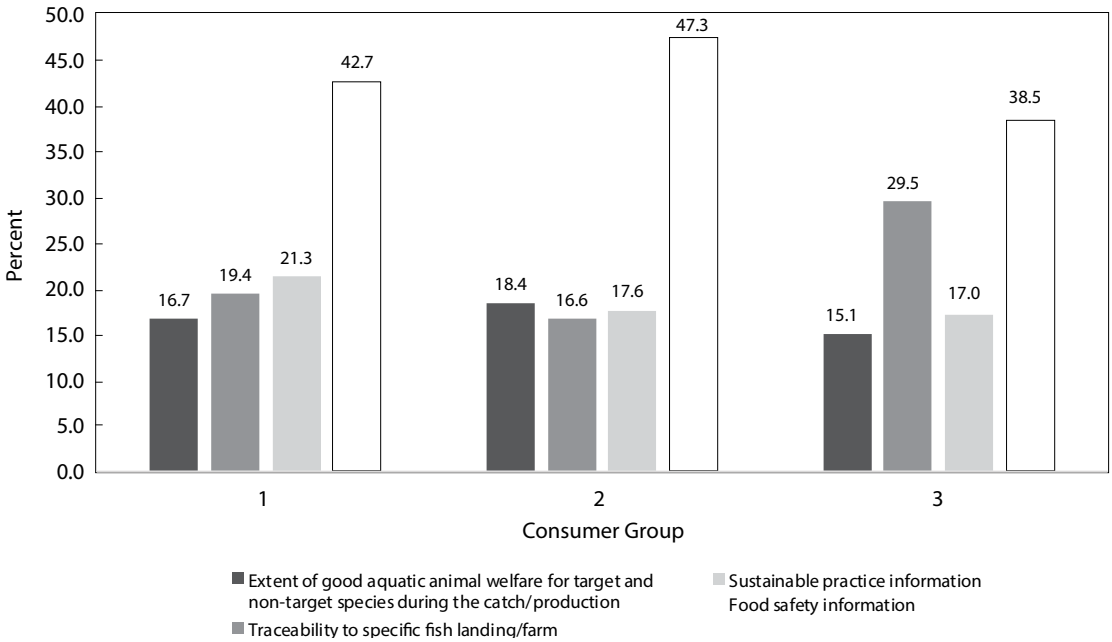
Conjoint analysis for each of the clusters was performed to analyze the segment characteristics based on the level of importance of the attributes (Table 3). The resulting preferred attribute may translate to preference for a particular policy since the credence attributes under study were based on existing and potential policies. The difference between the consumer segments is their ranking of preferred policies and the combination or mix of the information they want that would influence their decision making.

A preference model was estimated for the three consumer segments and using Pearson's R, the p-value of the preference models for the three clusters were 0.000 and less than 0.05 (Table 3). This means that there is a strong relationship between the observed and model preferences. In terms of relative importance, the information relating to food safety is the highest among the three clusters (42.7% in cluster 1; 47.3 in cluster 2; and 38.5 in cluster 3) as shown in Figure 2. Positive utility scores were given to attribute levels indicating the presence of such attributes. For instance, positive utility scores were estimated in attribute levels indicating the presence of information regarding the extent of good aquatic

Table 3. Estimated utility values for the three clusters, 300 respondents, Davao City, 2019

Attribute	Level	Cluster 1		Cluster 2		Cluster 3	
		Utility Estimate	Std. Error	Utility Estimate	Std. Error	Utility Estimate	Std. Error
Extent of good animal welfare for target and non-target species during the catch/production	Not Indicated	–.367	.042	–.388	.105	–.267	.029
	Indicated	–.367	.042	.388	.105	–.267	.029
Traceability to specific fish landing/farm	Not Indicated	–.182	.042	–.113	.105	.267	.029
	Indicated	.182	.042	.113	.105	–.544	.029
Sustainability practice information	Not Indicated	–.404	.042	–.046	.105	.544	.029
	Sustainable fishing practice certified	.404	.042	.046	.105	–.315	.029
Food safety information	Not Indicated	–1.330	.042	–1.638	.105	.315	.029
	FDA/HACCP	1.330	.042	1.638	.105	–.862	.029
	Certified Constant	7.121	.042	6.854	.105	.862	.029
		Value	**Sig**	**Value**	**Sig**	**Value**	**Sig**
				0.994		0.999	
	Pearson's R	0.9987	0.000	2	0.000	0	0.000

Figure 2. Summary of relative importance by consumer segment, 300 respondents, Davao City, 2019



animal welfare for target and non-target species during the catch/production (0.37 in cluster 1, 0.39 in cluster 2' and 0.27 in cluster 3). Another is the presence of information on traceability to specific fish landing/farm (0.18 in cluster 1, 0.11 in cluster 2, and 0.54 in cluster 3). Next is the presence of sustainability practice information (0.40 in cluster 1, 0.05 in cluster 2, and 0.32 in cluster 3). There is likewise presence of food safety information (1.33 in cluster 1, 1.64 in cluster 2, and 0.86 in cluster 3).

Comparing the utility values of attribute levels, cluster 2 has the highest utility for FDA/HACCP certified fish and fishery products with a value of 1.64, while cluster 3 has the lowest utility with only 0.86. It is also interesting to note that cluster 2 has the least utility for sustainable practice information with only 0.05 compared to cluster 1 with 0.40 and cluster 3 with 0.32. This may indicate that consumers in cluster 2 will not consider this attribute in their purchasing decision since it only contributes a very minimal amount in their total utility.

Determinants of preferences

Due to incomplete information, some respondents were automatically dropped by Stata. Hence, a total of 232 respondents were considered in the final model. Results of the multinomial logistic regression show that eight variables were significant for the cluster 1 model and 3 were significant for the cluster 2 model (Table 4). Note that the variables for practices, concern, and awareness for food safety and environmental sustainability are variables summarized from the questions relating to this category. Stata automatically set cluster 3 as the base outcome or the referent group since it has the highest number of entries.

The coefficient for barangay classification compared urban to rural barangay classifications for cluster 1 relative to cluster 3, holding other variables in the model constant. The log-odds for urban barangays is 2.24 units higher for being in cluster 1 to being in cluster 3, the base outcome (Table 4). In other words, urban barangay settlers were more likely than rural barangay settlers to prefer both environmental sustainability and food

Table 4. Multinomial logistic regression results for the determinants of consumer preferences for clusters 1 and 2 (cluster 3 is base outcome), 232, Davao City, 2019

Variable	Coefficient	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Cluster 1						
brgyclass	2.2356 *	1.1525	1.94	0.0520	−0.0233	4.4945
Age	−0.0214	0.0191	−1.12	0.2620	−0.0587	0.0160
Yrseduc	−0.0659	0.1222	−0.54	0.5900	−0.3053	0.1736
hhsize	0.3073 *	0.1633	1.88	0.0600	−0.0128	0.6273
Both	0.2206	0.5567	0.4	0.6920	−0.8705	1.3116
supermarket	2.1813**	0.8637	2.53	0.0120	0.4885	3.8740
sex	1.0664 **	0.5299	2.01	0.0440	0.0279	2.1050
Aveinc	−0.7140	0.5754	−1.24	0.2150	−1.8417	0.4138
Lowinc	−0.0274	0.9835	−0.03	0.9780	−1.9550	1.9002
weekbudget	−0.0009	0.0024	−0.39	0.6950	−0.0056	0.0037
Freqpurch	0.3108	0.3638	0.85	0.3930	−0.4023	1.0239
volume	−0.7378 *	0.4209	−1.75	0.0800	−1.5628	0.0872
avepricecap	−0.0120 **	0.0047	−2.54	0.0110	−0.0213	−0.0027
Foodprac	0.2662	0.3922	0.68	0.4970	−0.5025	1.0349
Foodconc	0.2270	0.5369	0.42	0.6720	−0.8252	1.2793
Foodaware	0.0393	0.5784	0.07	0.9460	−1.0942	1.1729
envibel	0.8162 **	0.4126	1.98	0.0480	0.0075	1.6249
enviconc	1.2650 **	0.5512	2.29	0.0220	0.1846	2.3454
Enviaware	−0.3531	0.5324	−0.66	0.5070	−1.3966	0.6903
Constant	−5.4318	3.5211	−1.54	0.1230	−12.3330	1.4695
Cluster 2						
Brgyclass	15.3073	1,226.5170	0.01	0.9900	−2,388.6210	2419.2350
age	−0.0564 **	0.0262	−2.15	0.0320	−0.1078	−0.0049
yrseduc	−0.4029 **	0.1660	−2.43	0.0150	−0.7282	−0.0776
Hhsize	−0.2242	0.2411	−0.93	0.3530	−0.6968	0.2484
Both	0.1511	0.7182	0.21	0.8330	−1.2564	1.5587
supermarket	−14.9660	1,564.3350	−0.01	0.9920	−3,081.0070	3,051.0750
Sex	−0.2608	0.8965	−0.29	0.7710	−2.0179	1.4963
Aveinc	1.3214	1.1253	1.17	0.2400	−0.8843	3.5270
Lowinc	1.0077	1.4032	0.72	0.4730	−1.7425	3.7579
weekbudget	−0.0050	0.0035	−1.42	0.1540	−0.0118	0.0019
freqpurch	1.2779 **	0.5203	2.46	0.0140	0.2580	2.2977
Volume	−0.2412	0.6532	−0.37	0.7120	−1.5215	1.0391
avepricecap	0.0065	0.0065	1	0.3190	−0.0063	0.0193
foodprac	0.4437	0.5538	0.8	0.4230	−0.6418	1.5292
foodconc	−0.2695	0.7610	−0.35	0.7230	−1.7609	1.2220
foodaware	0.1101	0.9682	0.11	0.9100	−1.7876	2.0077

Continued on next page

Table 4 continued

Variable	Coefficient	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Envibel	0.2760	0.6077	0.45	0.6500	−0.9151	1.4670
enviconc	0.2120	0.7163	0.3	0.7670	−1.1919	1.6159
enviaware	0.3873	0.8636	0.45	0.6540	−1.3053	2.0799
constant	−14.3403	1,226.5250	−0.01	0.9910	−2,418.2850	2,389.6040
Cluster 3 (Base Outcome)						
Log likelihood = −104.06349			Number of respondents = 232 LR $\chi^2(38) = 115.54$ Prob > $\chi^2 = 0$ Pseudo $R^2 = 0.357$			

Note: *significant at 10%; **significant at 5%

safety policies (cluster 1) to a combination of food safety and traceability policies (cluster 3). This is consistent with a study conducted in China wherein urban consumers showed preference for animal welfare and environmental stewardship (Lai et al. 2018)

As for the household size, an increase in the number of members increases the multinomial log-odds for being in cluster 1 to cluster 3 by 0.31, holding other variables constant. The log-odds for supermarket goers relative to non-supermarket goers is 2.18 units higher for being in cluster 1 to cluster 3. The log-odds for male relative to female is 1.07 units higher for being in cluster 1 to cluster 3, which is the base outcome. In this case, males were more likely than females to prefer both environmental sustainability and food safety policies (cluster 1) to a combination of food safety and traceability policies (cluster 3).

For the cluster 2 model, the significant variables were age, years in formal education, and frequency of purchase. A year increase in the age of the respondent decreases the multinomial log-odds of being in cluster 2 to cluster 3 by 0.06, holding other variables constant. Likewise, a one-year increase in the years in formal education decreases the log-odds ratio of being in cluster 2 to cluster 3 by 0.40. Lastly, a day increase in the frequency of purchasing fish and fishery products in a week increases the log-odds ratio for being in cluster 2 to cluster 3 by 1.28 units. This means that younger respondents and frequent buyers of fish and fishery products would more likely prefer policies related to food safety certifications only over policies related to food safety certification and traceability system. It is also interesting to note that consumers who have fewer years in formal education were more likely to prefer food safety certifications policies only over a combination with a traceability system.

Marginal effects

The interpretations of the marginal effects are the probabilities that a consumer will belong to a certain cluster with respect to a change in a certain characteristic (independent variable). For the marginal effects presented in Table 5, the variables barangay classification and supermarket as retail outlet were not significant while the others remained significant. A larger household size also increases the probability of being in cluster 1 by 3.2 percent. Being male increases the probability of being in cluster 1 by 10 percent. However, an increase in the volume of purchase and the average price for capture fishery products decreases the probability of being in cluster 1 by 6.5 percent and 0.01 percent, respectively. Consumers who already believe that current fishing practices are sustainable such as not capturing endangered species in the ocean or making sure that there is enough fish in the ocean have seven percent more chances of being in cluster 1. Lastly, increasing the level of concern toward environmental sustainability increases the probability of being in cluster 1 by 11.4 percent.

Table 5. Marginal effects of selected variables, 238 respondents, Davao City, 2019

Variable	dy/dx	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Cluster 1						
Brgyclass	–0.008	17.176	0.000	1.000	–33.672	33.657
Hhsize	0.032**	0.014	2.210	0.027	0.004	0.060
Supermarket	0.411	21.907	0.020	0.985	-42.525	43.347
Sex	0.102**	0.047	2.190	0.028	0.011	0.194
Volume	–0.065*	0.038	–1.710	0.087	–0.139	0.009
Avepricecap	–0.001***	0.000	–2.900	0.004	–0.002	0.000
Enviprac	0.072**	0.036	1.970	0.049	0.000	0.143
Enviconc	0.114**	0.048	2.380	0.017	0.020	0.208
Cluster 2						
Age	–0.002**	0.001	–2.010	0.045	–0.005	0.000
Yrseduc	–0.019**	0.008	–2.460	0.014	–0.034	–0.004
Freqpurch	0.059**	0.024	2.470	0.013	0.012	0.106
Cluster 3						
Age	0.004*	0.002	1.950	0.051	0.000	0.007
Freqpurch	–0.070*	0.037	–1.910	0.056	–0.141	0.002
Enviprac	–0.074*	0.041	–1.780	0.074	–0.155	0.007
Enviconc	–0.107**	0.053	–2.000	0.045	–0.211	–0.002

Note: *significant at 10%; **significant at 5%; ***significant at 1%

Results of the marginal effects for the outcome cluster 2 showed that a year increase in the age decreases the probability by 0.02 percent. Furthermore, a year increase in the years of formal education decreases the probability of being in cluster 2 by 1.9 percent. Lastly, a day increase in the frequency of purchase increases the probability of being in cluster 2 by 5.9 percent.

The marginal effects for the outcome or cluster 3 showed that age, frequency of purchase, environmental practices, and environmental concerns determine a consumer's probability to prefer policies related to food safety and traceability system (Table 5). Increasing the age by one year increases the probability of a consumer to belong to cluster 3 by 0.4 percent. Increasing the number of purchases per week decreases the probability of being in cluster 3 by seven percent. Consumers having better practices relating to environmental sustainability are less likely to be in cluster 3 since the probability of being in this cluster decreases by seven percent. Lastly, consumers who showed higher concerns toward environmental sustainability are less likely to be in cluster 3 as the probability decreases by 11 percent.

DISCUSSION

The results suggest that information about food safety plays the most important role among the four credence attributes. This indicates that if consumers were given the choice to pick which information they want in their products, they would choose labels on the assurance of product safety. Consumers had very limited, if not incorrect, definitions about food safety. Common definitions of food safety are about cleanliness and freshness, which may be related to but not entirely what food safety is. The respondents associate a

safe product with freshness. When the consumers were asked about how they would know about the safety of the fish they are buying, most of their answers were related to physical attributes of the fish such as the appearance, color, and smell. Currently, information regarding food safety is not explicitly provided especially for seafood products sold in wet markets. Furthermore, the traceability to specific fish landing/farm has the second highest importance value. Interestingly, this attribute may have a connection to the food safety information attribute. While the traceability system does not exclusively result in assurance of food safety, it is associated with it since it records the persons or entities to whom the products were sold and from whom they were bought. Consumers only relied on the information given by the sellers on product origin and delivery time. Consumers would normally ask for the information regarding the origin or the source of the fish. However, in this case, the origin of the fish may not say much about the environmental sustainability of the fish, as consumers would associate it with the freshness and the quality of fish. For instance, consumers would most likely ask if the tilapia and milkfish came from Alcantara and Sons Inc. The said company has one of the largest aquaculture farms in Mindanao. Furthermore, according to the respondents, the company has already established its reputation of having better taste quality. In the case of wild-caught fish, respondents would often ask the origin as they have knowledge that fish coming from a particular region have better quality. For instance, consumers perceive that tuna and blue marlin coming from General Santos City are of high quality, while reef fishes in Davao Oriental are of high quality.

Consumers, in general, seemed to pay less attention to environmental sustainability. This result is consistent among the three market segments identified in the study. However, the consumers' current knowledge on issues relating to environmental sustainability, or the lack thereof, hinder the consumers' clear definition of what they should demand for in products. Most believe that current fishing practices are environmentally sustainable. It should also be emphasized that the consumers did not have prior knowledge as to what "environmentally sustainable practices" were but only trusted the sellers. This is especially true in the case of consumers buying in wet markets. Unlike in supermarkets where consumers can read the labels from the packaging, wet markets do not offer this kind of service.

Those who had positive beliefs and practices regarding environmental sustainability generally favor lower average price per kilogram for capture fishery products, were from urban barangays, had larger households, bought from supermarkets, were male, and bought less volume of fish and fishery products per week. Those who had higher environmental concerns had higher probability to prefer both policies for food safety certifications and certified environmentally sustainable practices against food safety certification and traceability system policies. On the other hand, younger consumers, those having lower years of education and are frequent buyers of fish and fishery products have higher probabilities of preferring food safety certification policies alone against food safety certification and traceability system policies. It should be highlighted that beliefs toward a sustainable environment, such as the assurance that current fishing practices are sustainable, are contributory factors to preference for sustainable policies.

While this study shows that consumers had a fair level of awareness on both food safety and environmental sustainability issues, only a few aspects were touched in the study and not indicative of a deep appreciation on the attributes under study. With the absence of actual food labels in fish sold in fish markets, analysis of the study pertaining to preference toward specific food labels is impossible. Nonetheless, preference for information regarding safety and environmental sustainability may show a potential to formalize and implement product labels in fish and fishery products.

CONCLUSION

The result of the conjoint analysis shows the policies that seafood consumers will prefer if they were to choose between food safety and environmental sustainability to be included in their seafood products. This is not indicative of the general preference of consumers for specific policies. Consumers were more likely to prefer food safety-related policies such as the food safety certifications and traceability systems. Despite lack of knowledge about the dimensions of food safety, consumers placed higher importance on policies that would reinforce their general trust that the food sold in the market are safe for consumption. For all the consumer segments, food safety was the dominantly preferred policy, which means that it is a major policy concern for all consumers. In this case, the general preference for a food safety information is indicative of a potential to adapt food safety product labels.

The low priority for environmental sustainability-related information as exhibited in the three consumer segments may imply lack of awareness for environmental concerns. This can be addressed by focusing on increasing awareness particularly on marine conservation. While food safety labels may be seen as a direction, this may not be true in adapting eco-labels unless awareness is heightened on environmental issues.

Furthermore, supermarkets have a big role in facilitating the shift of preference toward food safety certified and environmentally sustainable seafood. This is so especially because they can demand information about these attributes from their suppliers, which is less practiced in wet markets. However, it should also be noted that with the addition of product labels, costs may be incurred by the producers and consumers alike. Hence, deciding on the strict implementation of labels must be carefully done. The results of the study showed the potential of these credence attributes to influence purchasing decisions of the consumers and therefore would be the critical areas for public policy. In conjunction to this, the determinants for preference for these policies should be carefully considered.

RECOMMENDATIONS

Food safety was found to be the most important policy concern across all consumer segments. This study found that while the consumers in general wanted safe food, they did not consciously demand for it. Thus, the implementing agencies of the Food Safety Act of 2013 need to strengthen not only on the strict enforcement of food safety compliance among sellers, but also on its consumer training and education component. Lastly, labels as indicators of compliance for food safety regulations is a possible direction shown by the preference of the consumers. Likewise, food safety of fresh products sold in wet markets should be given high priority by the local government units.

The government may take advantage of the environment-conscious attitude of urban households in major cities as they turned out to have high chances of better reception of both food safety and environmental sustainability policies, thereby strengthening the fisheries management efforts of the country.

An information campaign must be conducted to raise awareness on the current issues on food, including safety and environmental sustainability not just at the downstream nodes but to upstream nodes as well. This information campaign should especially target those consumers who are completely unaware of these issues. It is important to make the consumers better understand the significance of these attributes as these not only inform the consumers about the safety, but also make the manufacturer/producer liable for any untoward incidences arising from consumption. On the other hand, it is also important that the consumers are informed of the consequences of unsustainable practices, and how they can participate in addressing marine conservation issues. This may be done through social and behavior change communication so that the intervention may become interactive and engaging to the target participants. Lastly, the information on consumer preference may signal incentives to producers as they consider shifting their current practices that adhere to safe and environmentally sustainable practices.

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