AACL BIOFLUX
Aquaculture, Aquarium, Conservation & Legislation
International Journal of the Bioflux Society

Consumers' behavior towards cultured oyster and mussel in Western Visayas, Philippines

[1]Merlina N. Andalecio, [2]Peter F. Duncan, [3]Ernestina M. Peralta, [1]Ruby P. Napata, [4]Liberato V. Laureta

[1] Institute of Fisheries Policy and Development Studies, College of Fisheries and Ocean Sciences, University of the Philippines Visayas, Miagao, Iloilo, Philippines; [2] School of Ocean Sciences, Bangor University, Askew Street, Menai Bridge, LL59 5AB, United Kingdom; [3] Institute of Fish Processing Technology, College of Fisheries and Ocean Sciences, University of the Philippines Visayas, Miagao, Iloilo, Philippines; [4] Institute of Aquaculture, College of Fisheries and Ocean Sciences, University of the Philippines Visayas, Miagao, Iloilo, Philippines. Corresponding author: M. N. Andalecio, merlina_andalecio@yahoo.com

Abstract. This study examined consumers' attitude and knowledge related to consumption of cultured oysters and mussels in Western Visayas, Philippines. Survey interviews were conducted using a validated questionnaire consisting of consumption pattern, purchasing behavior, product information and environmental concerns. We hypothesized that the level of consumption is influenced by demographic and socio-economic factors. Only 32% were frequent (daily to more than once a week) consumers of oysters and mussels during peak season. The main factors that dictate frequency of purchase and consumption are gender, household size and those who indicated to have been to the culture sites. Males and those who have been to the culture sites were more likely to be frequent buyers and consumers. The likelihood of oyster purchases was 1.23 times more with increasing household size and females were most likely to try new oyster products. More educated consumers would refrain from eating large quantities of oyster and mussel which may be related to health concerns. Consumption decisions tended to concentrate more on product freshness and size rather than price. Product origin is less important for consumers in Western Visayas, although there are indications that awareness and concern about seafood safety is becoming an issue especially for the more educated consumers. The issues of production site environment, product quality and food safety have to be addressed to strengthen consumer confidence.
Key Words: molluscs, seafood consumption, aquaculture, preference.

Introduction. The increasing demand for seafood has opened opportunities for the aquaculture sector to expand both globally and in the Philippines. In 2010, aquaculture accounted for 41.3% of global fish food supply, and in terms of quantity, eight of the top ten producing countries were in Asia, with China leading at 36.7 million tons (FAO 2012). Recent years have shown an increased demand for seafood at the consumer level, resulting in higher seafood prices (Trondsen et al 2004a), increased choice and development of new product types (Myrland et al 2000; Arvanitoyannis et al 2004) as well as improved product-quality assurance. In 2010, per capita fish consumption in the world reached an all-time high of 17 kg, an increase of almost 14% from 1990s (FAO 2010).

In the Philippines, the aquaculture industry has also grown steadily, reaching over 744,695 metric tons in 2010 (excluding aquatic plants) (BAS 2011); the country ranked tenth among global aquaculture producers (FAO 2012). The Philippine waters offer a favorable environment for aquaculture, and estimates indicate that this industry is likely to continue its growth to compensate for declining capture fisheries. For an archipelagic country, fish is a staple food and thus per capita consumption is expected to be high. While the mean per capita consumption of fish and fishery products decreased from an average of 40.5 kg in 1987 to a low of 36 kg in 1993, it has increased to 38 kg in 2003 or 11.8% of the total food intake (BFAR 2008). This was considerably higher than the world

average of 16.3 kg, indicating that the Philippines is a seafood-eating country. The majority of fish and fishery products consumed are fresh fish (66% of total consumption) (BFAR 2008). Consumption of crustaceans and molluscs accounted for 11% of total intake, with mussel (and perhaps oyster also) contributing only about 1 kg, or 2.6% (BFAR 2008). Perhaps, such low consumption of shellfish may be attributed to more finfish choices or its low availability in the market.

Bivalve mollusc production from mariculture has stagnated while production and gross revenue of major Philippine aquaculture products like prawn and milkfish have generally increased. Currently, oyster and mussel are the only bivalve molluscs cultured in commercial quantity. The majority of production is derived from the extensive culture of slipper-shaped oyster, *Crassostrea iredalei* and the Asian green mussel, *Perna viridis.* Combined oyster and mussel production in 2010 was 43,402 metric tons, or 1.8% of total aquaculture production (BAS 2011). Compared to other aquaculture activities, oyster and mussel farming has not undergone much improvement, remaining small-scale, family-based and with minimal farming system inputs. The market is mainly domestic and the potential for international growth is yet to be realized since the state of the environment is critical in the trade of fishery products. Production has been constrained by environmental problems, stagnant demand and a comparatively longer growing period relative to the product price. Over two decades ago, Delmendo (1989) reported that local consumption of oysters was constrained by poor water quality because farms were usually located in shallow coastal areas contaminated with industrial and domestic pollutants. These environmental conditions have not changed based on the works of Vicente-Beckett (1992), Prudente et al (1997), Monirith et al (2003) and Duncan et al (2009).

The state of bivalve mollusc aquaculture in the country has received very little attention. There is insufficient or even an absence of institutional support to improve the technology and optimum marketing strategies for these products to become competitive. Also, farmers could have been unaware of marketing strategies that will ensure price stability when there is an oversupply. Thus, to increase marketing opportunities and improve the value of cultured bivalve molluscs, it is essential to understand consumers' attitudes, perception and preferences. Knowledge of consumer behavior could potentially improve production, ensure marketing efficiency and reduce uncertainty in the decision-making process (Batzios et al 2004; Al-Mazrooei et al 2001; Bose & Brown 2000).

Literature (Cardoso et al 2013; Sveinsdóttir et al 2009; Trondsen et al 2004a; Olsen 2003; Lin & Milon 1993) has consistently cited factors that influence the purchase and consumption of seafood in general, and oysters and mussels in particular. These include socio-economic factors (e.g., age, gender, education, income level, geographical location) and product attributes (e.g., taste, nutritional value, quality and freshness, convenience). Also, extrinsic factors are price, product source, perceived health risks and benefits, exposure to information. Redkar & Bose (2004) found that religion, household size and ages of the household members significantly influenced Mumbai households' seafood-purchasing decisions. The health benefits of seafood have been well documented (McManus et al 2011; Lund 2013) making it a good substitute for meat products. Oyster and mussel contain antiviral properties and bioactive components (e.g., proteins, lipids, carbohydrates) beneficial for the development of functional foods (Grienke et al 2014; Kim & Pallela 2012).

Olsen (2003) and Verbeke & Vackier (2005) found that seafood consumption is higher for more educated and older individuals. Older consumers have more health concerns, whereas, more educated consumers are exposed to information on the health benefits of seafood (Myrland et al 2000). This is in agreement with the results of Gempesaw et al (1995) and Batzios et al (2004) who have found that older (>40 years old) and more educated individuals are more likely to buy and consume oysters and mussels more often. Younger consumers (40 years or younger) in Trinidad and Tobago eat oyster raw (Laloo et al 2000) while young French consumers developed a certain aversion towards eating oyster because it is expensive, difficult to open and its unappealing characteristics (Debucquet et al 2012). Price may be expected as a potential barrier to consumption because of the increasing demand and consequent increases in

seafood prices. However, several studies have shown that price is less important than inspection attribute (Wessells & Holand 1998), physical appearance (Myers et al 2010), taste, religion, household size and age of family members (Redkar & Bose 2004) which may suggest the relatively inelastic demand for fish (Myrland et al 2000; Al-Mazrooei et al 2003). The perception that seafood prices are high is negatively related to income and education which means that higher income and more educated groups are less sensitive to seafood price changes (Myrland et al 2000; Trondsen et al 2003; Loose et al 2013; Batzios et al 2004).

There have been few, if any, researches on consumer choice of cultured Philippine oysters and mussels. Therefore, this study, which is exploratory in nature examined consumers' attitude and knowledge related to consumption of cultured oysters and mussels. The Western Visayas region presents a useful case study since it has the highest production of oysters and mussels in the country. The region contributed about 17,444 metric tons or 40% of the total oyster and mussel production in 2010 (BAS 2011). We hypothesized that the level of consumption is influenced by age, gender, marital status, education, income, household size, and perceptions about product attributes. These hypotheses follow from the findings of others. We hope that the findings will provide insights into the current consumption of oysters and mussels and contribute to the adoption of appropriate technology and marketing strategies to improve the industry.

Material and Method

Data collection. Domestic consumer requirements and expectations from Philippine-produced molluscs were determined via a validated survey instrument and personal interviews (Annex 1). The information was collected from 163 respondents, randomly selected from rural areas, city centers, universities, restaurants and markets in Western Visayas using convenience sampling. The interviewers were trained in conducting the survey to solicit honest opinions through an orientation workshop. During the workshop, the information required from the interviews was explained. The survey instrument consisted of questions organized into four sections including: demographics and socio-economics (age, gender, marital status, level of education, ethnicity, religious affiliation, monthly-household income and household size, membership in social or environmental organizations), consumption pattern (frequency and place of consumption, method of preparation, consumption of other processed products and problems encountered), purchasing behavior (frequency of purchase, quality attribute, place of purchase and price perception) and product information (knowledge and preference for product origin, knowledge of production method and environment, quality and safety concerns, availability of information, government support, and knowledge of eco-labelled products). The consumers were also asked to respond to six statements relating to product source, safety, and environmental concerns, indicating their level of agreement or disagreement. For non-consumers, questions only covered demographic information, socio-economics, organizational affiliations, knowledge of eco-labelled products and reasons for non-consumption.

Statistical analysis and models. Descriptive statistics were used to summarize the data. The data for the independent variables, age and household monthly income were split into $\leq$34 and >34 years old, and $\leq$PhP15,000 and >PhP15,000, respectively. The educational level was categorized into elementary, high school/technical and college/postgraduate levels. The non-parametric tests such as Chi square, Mann-Whitney test and Kruskal Wallis were utilized to test for significant differences between groups since the assumption of normality and homogeneity of variance does not hold for most variables.

This study adopted the logistic regression analysis to examine which factors affect consumption pattern, purchasing behavior and product information. Logistic regression has been extensively used in researches (Adeogun et al 2008; Harris et al 2009; Gempesaw et al 1995; Trondsen et al 2004b; Ahmed et al 2011; Al-Mazrooei et al 2001;

Whitmarsh & Palmieri 2011) related to consumers' behavior and attitude towards seafood products. The technique is useful in estimating the parameters of a multivariate explanatory model where the dependent variable is dichotomous and the independent variables are continuous or categorical (Peng et al 2002). In all models, the demographic and socio-economic factors were considered as well as the predictor variable, "have been to the culture sites" (1 = yes, 0 = no) (Table 1).

Table 1

Explanatory variables used in constructing the logistic regression models

Variable	*Measure*	*Definition and coding values*
Age	Continuous	Measured by the number of years
Sex	Dichotomous	Female = 1; Male = 2
Civil Status	Dichotomous	Married = 1; Single = 2; Widow/widower = 3
Education	Categorical	Elementary = 1; High school/Technical = 2; College/Postgraduate = 3
Monthly household income	Dichotomous	≤PhP15,000 = 0; >PhP15,000 = 1
Household members		Total number
Have been to the culture sites	Dichotomous	1 = yes; 0 = no

The data collected in this study were categorical and since the response variables are designed into dichotomy as shown in Table 2, binary logistic regression was applied.

Table 2

Response variables used in the logistic regression models

Response variables	*Definition and coding values*
A. Consumption pattern	
1. How often, on average, do you eat during peak season?	1 = Daily to more than once a week 0 = otherwise
2. What is your most preferred method of preparation?	Oyster: 1 = steamed; 0 = otherwise Mussel: 1 = stew; 0 = otherwise
3. Have you tried other processed products?	1 = yes; 0 = no
B. Purchasing behavior	
4. How often do you purchase during peak season?	1 = Daily to more than once a week 0 = otherwise
5. The most important attribute in buying	Oyster: 1 = freshness; 0 = otherwise Mussel: 1 = size; 0 = otherwise
6. Place where you are most likely to purchase	Oyster: 1 = restaurants; 0 = otherwise Mussel: 1 = wet market/supermarket; 0 = otherwise
7. Are oysters and mussels reasonably priced?	1 = yes; 0 =no
C. Product details	
8. Is source an important consideration for consumption?	1 = yes; 0 = no
9. Do you know of any health benefits of eating oysters and mussels?	1 = yes; 0 =no
10. Do you know of health problems associated with eating mussels and oysters?	1 = yes; 0 =no

A typical logistic regression model used in this study is of the form:

$$\text{Logit}\,(P_i) = \ln\,(P_i\,/1-P_i) = \dot{a} + \beta_1 X_1 + \ldots + \beta_n X_n$$

where:

$\ln\,(P_i\,/1-P_i)$ = logit or natural logarithm of an odds ratio for response variables;

P_i = predicted probability of a particular outcome of interest (e.g., more frequent consumption; tried processed products);

$1–P_i$ = otherwise (e.g., less frequent consumption; never tried processed products);

ɑ = constant or y-intercept;

β = logistic coefficients or estimates for the parameters $X_{1...}$ X_n;

X = represents covariates or explanatory variables.

Adjusted odds ratio (OR) was calculated and related with each analysis, a Hosmer and Lemeshow goodness-of-fit test was performed to assess whether the model's estimates predicted the outcome variable, where higher *P*-value (greater than 0.05) indicates better fit. To estimate the relationship between the predictors and outcome, the Nagelkerke R^2 which ranges from 0 to 1 has been chosen. All statistical analyses were performed in SPSS version 11. Statistical significance was accepted at $p \leq 0.05$.

Results

Profile of respondents. The survey included both oyster and mussel consumers and non-consumers, and 163 individuals were interviewed. Table 3 shows the demographic and socioeconomic profile of respondents. Over half of the respondents were females, and with educational level up to college (72%). The average age was 34 years old and most (69%) reported to have household monthly income of ≤PhP15,000. The respondents belonged to households with an average size of 6 (±2), and whose religious affiliation is catholic (90%) and ethnic group Ilonggo (64%). Similarly, all respondents were frequent buyers and consumers of seafood, eating fish either daily (66%) or weekly (29%). In this survey, only 27% of respondents belonged to any social association or environmental organization, and only 23% were familiar with ecolabelled products. Ecolabelled products were described as environmentally-friendly products that were certified with respect to quality, type of packaging made from recycled or organic materials, and indication of product origin.

Table 3

Demographic and socio-economic characteristics of the respondents

Characteristics	*Category*	*All samples (N = 163)*
Gender (% respondents)	Male	47
	Female	53
Age (years)	Mean	34
	Maximum	86
	Minimum	13
	SD*	14.8
Marital status (% respondents)	Married	47
	Single	51
	Widow/widower	2
Household size (total number)	Mean	6
	Maximum	13
	Minimum	1
	SD*	2
Level of education (% respondents)	College/Postgraduate	72
	High School/Technical	23
	Elementary	5
Monthly household income (% respondents)	≤PhP15,000	69
	> PhP15,000	31

*SD = standard deviation.

A total of 131 (80%) respondents were oyster and mussel consumers (89% both oyster and mussel consumers, 4% oyster consumers only, and 7% mussel consumers only) which included 48% males and 52% females. About 48% and 31% preferred oyster and mussel, respectively (n = 116). Half of the consumers were ≤34 years old and have been to the culture sites (52%). More consumers indicated knowledge on how oysters (68%)

and mussels (60%) were grown. Non-consumers reported various reasons for not eating oysters and mussels, but the most common were health-related (e.g., allergies, indigestion, diarrhea) and flavor dislike.

Consumption pattern. For consumers, no significant difference was found between gender ($\chi^2(131) = 1.26$, $p > 0.53$) and civil status ($\chi^2(129) = 2.28$, $p > 0.32$) with respect to preference for oyster or mussel. Respondents observed that oysters and mussels were available all year round but no specific time as to when these are best consumed was indicated. These were mostly eaten at home as part of a meal (Figure 1) and consumed in different forms, but preferences for steamed oyster and mussel stew were highest (Figure 2). Very few indicated that they have eaten oyster or mussel raw.

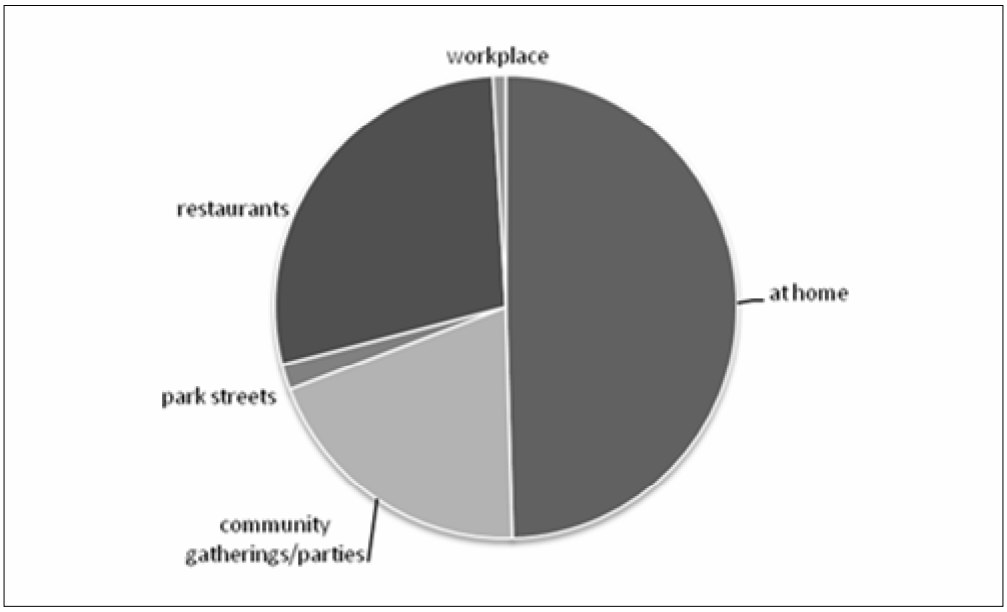

Figure 1. Places where oysters and mussels are usually consumed (multiple responses, total = 224; N = 125).

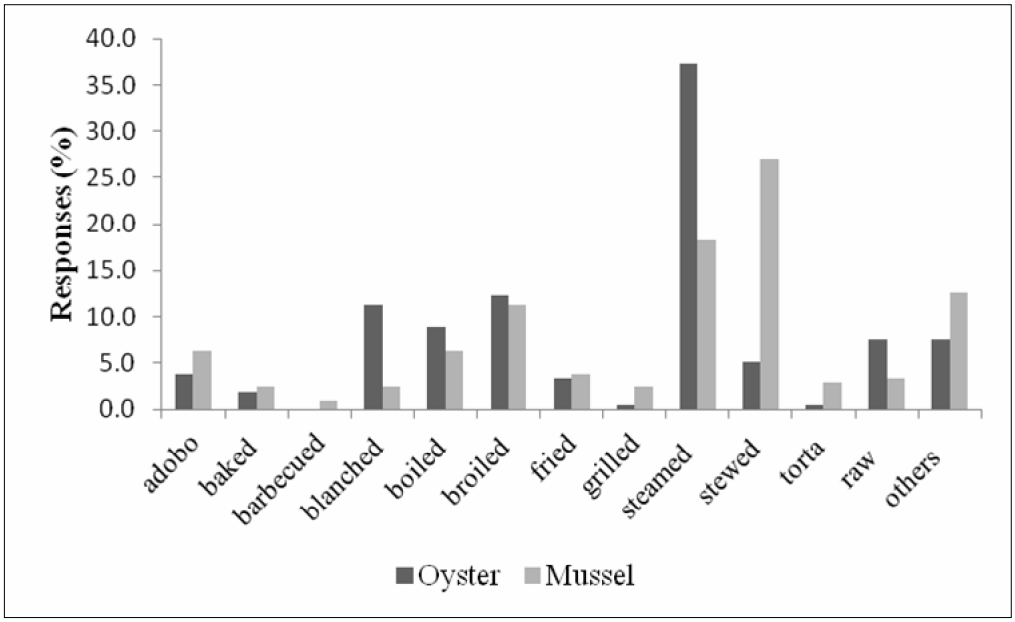

Figure 2. Preferred preparation for oysters and mussels.

Based on interviews, an individual can consume an average of 23 (±21) and 26 (±24) pieces of oyster and mussel per meal, respectively. Mann Witney and Kruskal-Wallis H

tests were performed to determine if quantity of consumption differs between age, gender, income and education. Results did not reveal significant differences in age (oyster Z = -0.387, p = 0.699: mussel Z = -1.813, p = 0.07) and income (oyster Z= -1.357, p = 0.175; mussel Z = -0.580, p = 0.562) with respect to the quantities consumed. No significant difference was also found between gender based on the quantity of oysters eaten but males consumed more mussels than females (Z = -2.063, p = 0.039). Conversely, consumers who were less educated (high school/technical) consumed more than those who were more educated (college/postgraduate) (oyster Z = -3.198, p = 0.001; mussel Z = -3.329, p = 0.001).

Three indicators represent consumption pattern namely, frequency of consumption during peak season, preferred preparation method and consumption of other processed products. The logistic models constructed to determine which factors influenced consumption and the estimated results are shown in Table 4. Only 32% of the respondents were frequent (daily to more than once a week) consumers during peak season. Logistic results revealed that household size and having been to the culture sites were important factors affecting frequency of consumption. The odds ratios suggest that if household size increases, the likelihood of eating oyster or mussel more frequently were 1.4 and 1.25 times, respectively. Males were 3.5 times more likely to often eat mussels. Similarly, those who have been to the culture sites would be frequent consumers.

Table 4

Results of the logistic regression models relating to consumption pattern

Independent variables	*Logistic coefficient*	*Standard error*	*p value*	*Odds ratio*
'daily to more than once a week consumption of oysters during peak season'				
Constant/intercept	-4.771	1.016	0.000	0.008
Age (less than equal to 34 years old)	0.891	0.714	0.212	2.438
Gender (Male)	0.611	0.481	0.205	1.841
Marital (Single)	-0.965	0.716	0.178	0.381
College			0.604	
High School	-0.940	1.043	0.368	0.391
Elementary	0.105	0.598	0.860	1.111
Income (P15,000 or less)	1.119	0.613	0.068	3.060
Size of household	0.336	0.116	0.004**	1.400
Have been to the culture sites (Yes)	1.544	0.520	0.003**	4.684
Log likelihood = 114.75	*Nagelkerke pseudo R^2= 0.33*			*N = 118*
*χ^2(8 df):32.02****	*H-L goodness of fit:p=0.55*			
'daily to more than once a week consumption of mussels during peak season'				
Constant/intercept	-3.472	0.894	0.000	0.031
Age (less than equal to 34 years old)	0.449	0.720	0.533	1.567
Gender (Male)	1.249	0.517	0.016**	3.485
Marital (Single)	-0.248	0.710	0.727	0.781
College			0.289	
High School	1.068	1.051	0.310	2.908
Elementary	0.869	0.600	0.148	2.385
Income (P15,000 or less)	-0.754	0.594	0.204	0.470
Size of household	0.220	0.111	0.047**	1.247
Have been to the culture sites (Yes)	1.284	0.528	0.015**	3.611
Log likelihood = 111.077	*Nagelkerke pseudo R^2= 0.308*			*N = 114*
*χ^2(8 df):27.86****	*H-L goodness of fit:p=0.953*			
'steamed as the most preferred method of preparation for oysters'				
Constant/intercept	1.233	0.722	0.088	3.431
Age (less than equal to 34 years old)	0.922	0.619	0.136	2.514
Gender (Male)	-0.475	0.459	0.301	0.622
Marital (Single)	-0.083	0.607	0.892	0.921

Independent variables	*Logistic coefficient*	*Standard error*	*p value*	*Odds ratio*
College			0.006***	
High School	-1.567	0.987	0.112	0.209
Elementary	-1.678	0.547	0.002***	0.187
Income (P15,000 or less)	-0.179	0.508	0.725	0.836
Size of household	-0.069	0.101	0.491	0.933
Have been to the culture sites (Yes)	0.427	0.474	0.368	1.532
Log likelihood = 130.55	*Nagelkerke pseudo R^2 = 0.257*			*N = 120*
*χ^2(8 df):24.83****	*H-L goodness of fit:p=0.372*			
'have tried other oyster products'				
Constant/intercept	0.145	0.678	0.831	1.156
Age (less than equal to 34 years old)	0.356	0.590	0.546	1.428
Gender (Female)	0.948	0.444	0.033**	2.581
Marital (Single)	0.387	0.577	0.502	1.473
College			0.049**	
High School	-2.246	1.264	0.076	0.106
Elementary	-1.108	0.555	0.046**	0.330
Income (P15,000 or less)	-0.371	0.487	0.446	0.690
Size of household	0.031	0.097	0.749	1.031
Have been to the culture sites (Yes)	1.139	0.467	0.015**	3.123
Log likelihood = 139.388	*Nagelkerke pseudo R^2 = 0.246*			*N = 119*
*χ^2(8 df):24.16****	*H-L goodness of fit:p= 0.646*			

***p≤.01; **p≤.05.

More consumers preferred steamed oysters over other methods of preparation, and preference increases with higher education. No variable was found to influence the choice for mussel stew. Those who have tried other processed products favored oyster sauce and fermented mussels (Figure 3). Females were 2.58 times more likely to try new oyster products than males (Table 4) but no significant model was estimated to 'have tried other mussel products'. Overall, consumers were willing to try new products of oysters and mussels regardless of age, gender, income and education (p > 0.05). Majority found no problem related to consumption of oyster (63%) or mussels (76%), however, because of health and safety issues, respondents indicated that they have been cognizant of where the organisms were harvested.

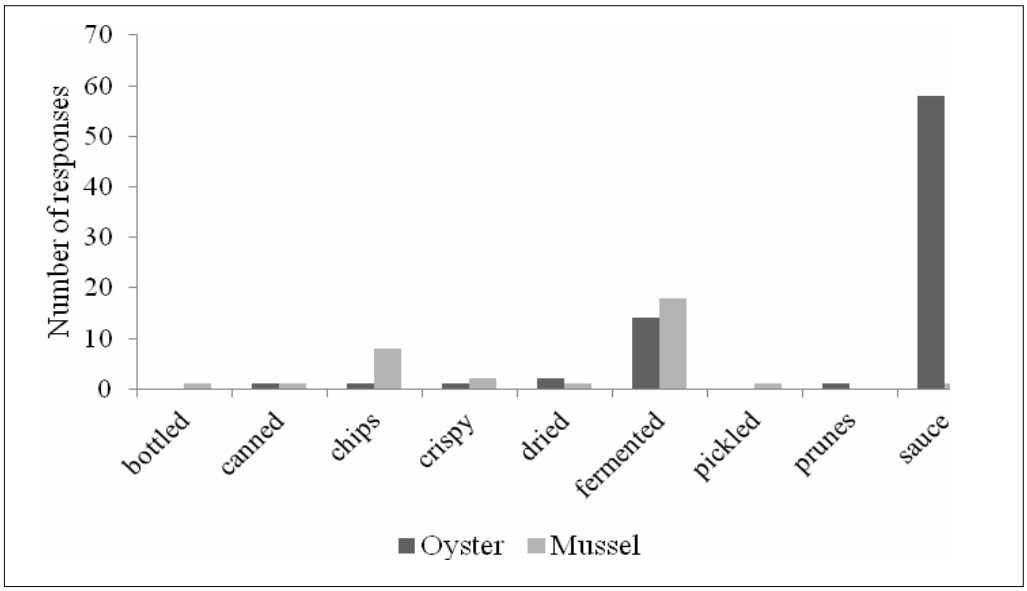

Figure 3. Other oyster and mussel products tried (multiple responses, oyster = 78; mussel = 33).

Purchasing behavior. Four indicators represent purchasing behavior, including frequency of purchase, quality attributes, place of purchase and price perception. Six logistic models were constructed as shown in Table 5. Males were 3.6 and 3.5 times more likely to be frequent buyers of oyster and mussel, respectively. Also, the likelihood of oyster purchases was 1.23 times more with increasing household size. Respondents who have been to the culture sites were more likely to be frequent buyers of oysters and mussels. A number of quality attributes were considered important in purchasing (Figure 4) but more consumers preferred freshness and size. Males and more educated respondents were more sensitive to oyster freshness (Table 5). No variable was found to explain size as an important quality attribute for mussel.

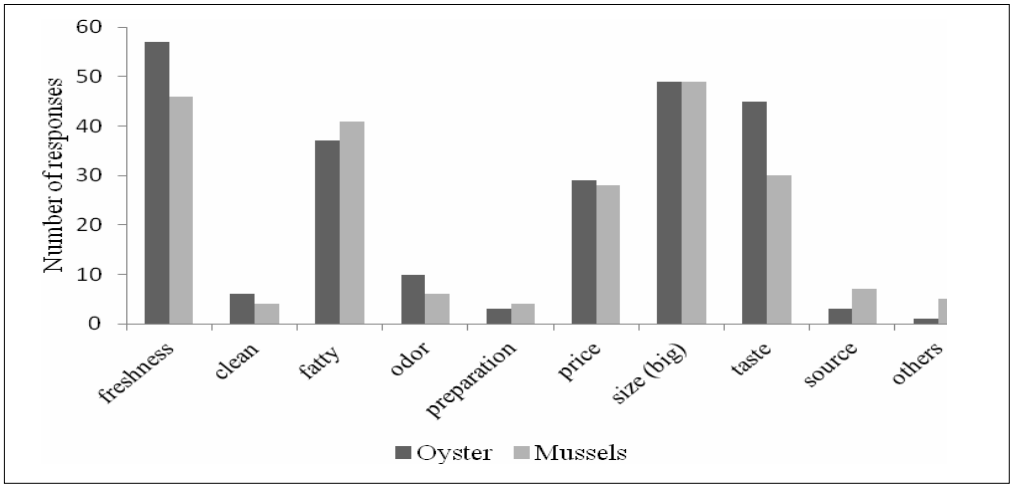

Figure 4. Quality attributes considered when purchasing oysters and mussels (multiple responses, oyster = 193; mussel = 186).

Table 5

Results of the logistic regression models predicting purchasing behavior of oyster and mussel consumers

Independent variables	*Logistic coefficient*	*Standard error*	*p value*	*Odds ratio*
'purchase oysters daily to more than once a week during season'				
Constant/intercept	-2.740	0.817	0.001	0.065
Age (less than equal to 34 years old)	0.764	0.643	0.235	2.146
Gender (Male)	1.273	0.478	0.008***	3.573
Marital (Single)	-0.661	0.636	0.298	0.516
College			0.162	
High School	-2.027	1.221	0.097	0.132
Elementary	-0.767	0.590	0.194	0.465
Income (P15,000 or less)	0.069	0.516	0.894	1.071
Size of household	0.211	0.108	0.050**	1.235
Have been to the culture sites (Yes)	1.128	0.481	0.019**	3.089
Log likelihood = 126.738	*Nagelkerke pseudo R^2=0.239*			*N = 111*
χ^2(8 df):21.461	*H-L goodness of fit:p= 0.437*			
'purchase mussels daily to more than once a week during season'				
Constant/intercept	-3.403	0.895	0.000	0.033
Age (less than equal to 34 years old)	0.837	0.663	0.207	2.310
Gender (Male)	1.264	0.510	0.013**	3.539
Marital (Single)	0.175	0.637	0.783	1.191
College			0.953	
High School	0.025	1.038	0.981	1.026
Elementary	-0.170	0.587	0.771	0.843
Income (P15,000 or less)	0.791	0.540	0.143	2.206

Size of household	0.146	0.104	0.159	1.157
Have been to the culture sites (Yes)	0.997	0.510	0.050**	2.711
Log likelihood = 120.506	*Nagelkerke pseudo R^2= 0.200*			*N = 106*
*χ^2(8 df): 16.63***	*H-L goodness of fit:p=0.233*			
freshness is the most important attribute in buying oyster'				
Constant/intercept	-0.317	1.020	0.756	0.729
Age (less than equal to 34 years old)	0.407	0.645	0.528	1.502
Gender (Male)	0.976	0.457	0.033**	2.655
Marital (Single)	-0.035	0.625	0.956	0.966
College			0.004***	
High School	-8.470	26.265	0.747	0.000
Elementary	-2.650	0.797	0.001***	0.071
Income (P15,000 or less)	0.094	0.465	0.840	1.098
Size of household	-0.013	0.101	0.896	0.987
Have been to the culture sites (Yes)	0.014	0.454	0.975	1.014
Log likelihood = 126.990	*Nagelkerke pseudo R^2= 0.369*			*N = 120*
*χ2(8 df): 38.83****	*H-L goodness of fit:p= 0.025*			
'restaurant is where oysters are purchased'				
Constant/intercept	0.977	0.747	0.191	2.657
Age (less than equal to 34 years old)	0.132	0.610	0.829	1.141
Gender (Male)	-0.158	0.479	0.742	0.854
Marital (Single)	0.755	0.597	0.206	2.128
College			0.094	
High School	-8.487	26.393	0.748	0.000
Elementary	-1.191	0.554	0.031**	0.304
Income (P15,000 or less)	-0.574	0.520	0.270	0.563
Size of household	0.090	0.105	0.392	1.094
Have been to the culture sites (Yes)	-0.930	0.462	0.044**	0.395
Log likelihood = 121.686	*Nagelkerke pseudo R^2= 0.362*			*N = 120*
*χ^2(8 df): 37.09****	*H-L goodness of fit:p= 0.795*			
'oysters are reasonably priced'				
Constant/intercept	2.117	0.995	0.033	8.303
Age (less than equal to 34 years old)	-1.198	0.864	0.165	0.302
Gender (Male)	-0.430	0.693	0.535	0.651
Marital (Single)	0.793	0.851	0.351	2.211
College			0.923	
High School	5.679	34.833	0.870	292.690
Elementary	-0.319	0.875	0.716	0.727
Income (P15,000 or less)	1.409	0.680	0.038**	4.094
Size of household	-0.033	0.142	0.816	0.967
Have been to the culture sites (Yes)	-0.498	0.666	0.455	0.608
Log likelihood = 74.919	*Nagelkerke pseudo R^2= 0.362*			*N = 107*
χ^2(8 df): 8.108 ns	*H-L goodness of fit:p= 0.814*			
'mussels are reasonably priced'				
Constant/intercept	2.893	1.200	0.016	18.042
Age (less than equal to 34 years old)	-1.920	1.172	0.101	0.147
Gender (Male)	-1.355	0.963	0.160	0.258
Marital (Single)	2.552	1.194	0.033**	12.830
College			0.451	
High School	6.249	34.390	0.856	517.518
Elementary	1.781	1.424	0.211	5.935
Income (P15,000 or less)	0.978	0.808	0.226	2.658
Size of household	-0.079	0.157	0.616	0.924
Have been to the culture sites (Yes)	-0.416	0.853	0.626	0.660
Log likelihood= 50.304	*Nagelkerke pseudo R^2= 0.213*			*N= 100*
χ^2(8 df): 10.203 ns	*H-L goodness of fit:p=0.712*			

***p≤.01; **p≤.05.

Oyster and mussel were bought from several places, but responses were highest for restaurants (42%) and wet markets or supermarkets (49.7%) (Figure 5). Logistic regression results in Table 5 shows that those who were less educated and have been to the culture sites were more likely not to buy oysters in restaurants. No variable was found to explain consumers' preference for mussels bought from wet markets or supermarkets. The average price of oyster (shell-on) per plate was PhP31.85±11.52 (N = 70) and respondents belonging to lower income group found this reasonable. Mussels which cost PhP25.9±16.99 were found reasonably priced for consumers who were single. Although there was no significant difference between prices (Z = -1.802, p = 0.072), oysters were found to be more expensive than mussels based on the quantity per serving. Oysters were relatively fewer by weight because of their larger and heavier shell. For example, of the oyster samples collected from one production site (i.e., Roxas) with an average weight of 84.6 ± 45.6 g (n = 241), 88% of the weight was hard shell which means that the average meat weight was only 10.15 ± 5.47g. In comparison, mussel samples in the same site have an average weight of 13.3 ± 5.3 g (n = 220), 77% of the weight was shell and thus, the mean meat weight was only 3.06 ± 1.22 g. More than 50% of the consumers were willing to pay more than they would normally do. The response indicated that additional PhP17±14.80 per plate for oyster (N = 43) and PhP15.20±12.70 per plate for mussel (N = 23) would be acceptable. This indicates that on the average, consumers were prepared to pay more than 50% of the current price.

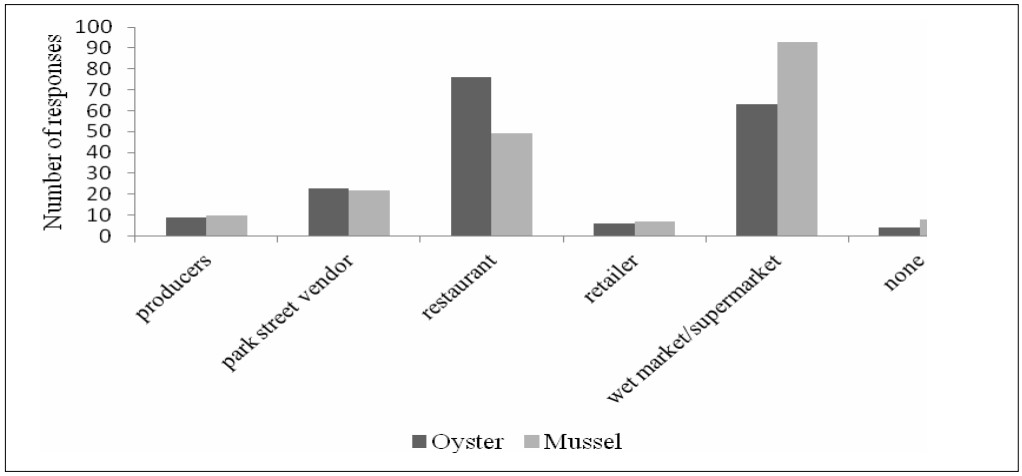

Figure 5. Places of purchase (multiple responses, oyster = 181; mussel = 181).

Product quality, safety and environmental concerns. Because all consumers were familiar with seafood products they were assumed to be confident in assessing product quality and safety. Four logistic regression models were constructed to determine which factors affect product information (Table 6). Whereas, the majority (92%) of the respondents were knowledgeable of the product origin or source and believed it is not important, especially for those who have been to the culture sites, more than half would still ask the sellers where the oysters or mussels were obtained. They preferred products coming from within Western Visayas, mainly Roxas and Capiz, over other places like Manila and Cavite. There were also those who indicated no knowledge of a particular place where they would not likely to purchase oyster or mussel.

Respondents believed that these products have health benefits, indicating that oyster (47.1%, N = 87) and mussel (45.5%, N = 88) are sources of iodine. Consumers who were less educated were not aware of the health benefits associated with eating oyster or mussel (Table 6). Males rather than females were less likely to indicate health related problems. Problems related to consumption were mostly health-related ones such as indigestion, stomach aches and diarrhea. More than half (65%) of consumers have read materials and heard information on the quality and safety of these products, mostly coming from the Bureau of Fisheries and Aquatic Resources (BFAR) and the Department of Health (DOH).

Table 6

Results of the logistic regression models relating to product details

Independent variables	*Logistic coefficient*	*Standard error*	*p value*	*Odds ratio*
Is source important?				
Constant/intercept	-0.719	0.950	0.449	0.487
Age (less than equal to 34 years old)	-0.279	0.590	0.636	0.756
Gender (Male)	-0.083	0.431	0.848	0.921
Marital (Single)	0.472	0.576	0.412	1.604
College			0.528	
High School	1.101	1.010	0.276	3.008
Elementary	-0.020	0.538	0.970	0.980
Income (P15,000 or less)	-0.213	0.463	0.645	0.808
Size of household	0.121	0.095	0.203	1.129
Have been to the culture sites (Yes)	-0.874	0.436	0.045**	0.417
Log likelihood = 149.659	*Nagelkerke pseudo R^2= 0.090*			*N = 119*
χ^2(8 df):8.171 ns	*H-L goodness of fit:p=0.311*			
'know health benefits of oysters'				
Constant/intercept	1.907	0.888	0.032	6.732
Age (less than equal to 34 years old)	-0.419	0.693	0.545	0.657
Gender (Male)	-0.042	0.541	0.938	0.959
Marital (Single)	-0.613	0.664	0.356	0.542
College			0.0164**	
High School	-10.803	26.861	0.688	0.000
Elementary	-1.763	0.619	0.004***	0.172
Income (P15,000 or less)	-0.686	0.651	0.292	0.503
Size of household	0.095	0.122	0.436	1.100
Have been to the culture sites (Yes)	0.934	0.552	0.090	2.546
Log likelihood = 104.466	*Nagelkerke pseudo R^2= 0.324*			*N = 118*
*χ^2(8 df):29.33****	*H-L goodness of fit:p= 0.345*			
'know health benefits of mussels'				
Constant/intercept	2.173	0.889	0.015	8.780
Age (less than equal to 34 years old)	-0.480	0.705	0.496	0.619
Gender (Male)	-0.015	0.553	0.978	0.985
Marital (Single)	-0.680	0.672	0.312	0.507
College			0.007***	
High School	-10.882	26.740	0.684	0.000
Elementary	-2.022	0.650	0.002***	0.132
Income (P15,000 or less)	-0.536	0.636	0.399	0.585
Size of household	0.028	0.119	0.813	1.029
Have been to the culture sites (Yes)	1.040	0.566	0.066	2.829
Log likelihood = 102.417	*Nagelkerke pseudo R^2= 0.345*			*N = 114*
*χ^2(8 df): 31.00****	*H-L goodness of fit:p=0.204*			
'know health related problems'				
Constant/intercept	1.636	1.192	0.170	5.136
Age (less than equal to 34 years old)	1.733	1.097	0.114	5.656
Gender (Male)	-2.201	0.900	0.014**	0.111
Marital (Single)	-0.847	1.039	0.415	0.429
College			0.855	
High School	6.983	25.899	0.787	1078.129
Elementary	0.461	0.932	0.621	1.586
Income (P15,000 or less)	0.561	0.819	0.493	1.753
Size of household	0.286	0.179	0.110	1.331
Have been to the culture sites (Yes)	-1.342	0.841	0.110	0.261
Log likelihood = 60.326	*Nagelkerke pseudo R^2= 0.301*			*N = 89*
*χ^2(8 df): 17.135****	*H-L goodness of fit:p=0.961*			

***p≤.01; **p≤.05.

Table 7 presents the responses to the statements relating to product source, safety and environmental concerns. Most consumers (74%, N = 131) were reluctant to eat raw oysters and mussels because of associated health risks. Nearly 45% of the consumers

were not convinced that oysters and mussels did not come from polluted waters, this response being a little higher with increasing education ($\chi^2(131) = 13.87$, $p = 0.001$). About 48% agreed that adequate information was available on the safety of eating oysters and mussels, a little higher than those who disagreed. Although 43% (N = 129) believed that public agencies have not exaggerated their reports on the risk of eating oysters and mussels, more respondents were still unaware.

Table 7
Consumers' response to statements relating to product source, safety and environmental concerns

Statements	*Agree*	*Disagree*	*Don't know*
I am concerned with eating raw oysters and mussels	74.0	20.6	5.3
Waters where the oysters and mussels are collected are free from pollution	34.6	45.4	20.0
Adequate information is available about the safety of eating oysters and mussels	48.1	37.2	14.7
Public agencies have exaggerated the risk of eating oysters and mussels	26.4	43.4	30.2
I am willing to try new product of oysters and mussels	89.3	6.1	4.6

Discussion

Consumption pattern and purchasing behavior. In this study there was no clear distinction in reported attitudes between consumption of oyster vis à vis mussel. We reported that preference for oyster over mussel and vice versa does not differ between male or female consumers. Less frequent consumption even during peak season may be attributed to a large variety of seafood (e.g., finfish and crustaceans) available in Western Visayas. Unlike in other parts of the world such as Europe and North America where oyster and mussel may be considered rare and luxury food items, they are not popular seafood choices in the Philippines. Our findings that males rather than females were more likely to be frequent buyers and consumers of oysters are comparable to the result of Laloo et al (2000). Males were believed to have a liking for oyster as a sexual stimulant (Laloo et al 2000; Kotta et al 2013) because oyster contains elevated zinc, which increases testosterone level in males. Education is not a factor affecting frequency of consumption, which is different from the findings of Batzios et al (2004) that consumers who have higher education ate Greek mussels more often than those of lower education. However, more educated consumers would refrain from eating large quantities of oyster and mussel which may be related to health concerns. As filter feeders, oyster and mussel can accumulate elevated levels of contaminants (e.g., metals, persistent organic pollutants) and concentrate microorganisms, including pathogenic bacteria and viruses causing human illnesses if cultured in polluted waters (Correa et al 2007; Cruz-Romero et al 2008; Han et al 2000; Bayen et al 2007). Eating raw oyster or mussel has also been avoided because this has been strongly tied to several illnesses such as gastroenteritis, septicemia and food poisoning (Wang et al 2010; La Valley et al 2008; Altekruse et al 1999). Culture sites will most likely influence frequency of consumption, thus this calls for improved production techniques and better culture environment.

Product attributes are vital in consumer decision-making and have received much attention in the food-marketing literature (Jang et al 2009). In our study, aside from the factors, gender, education, household size, and having been to the culture sites, the attributes freshness, size, appearance (fatty), taste, price also dictate purchase and consumption. Likewise, while consumers considered these attributes, consumption decisions tended to concentrate more on product freshness and size rather than cost. Price was not a major factor which indicates that the demand for oysters and mussels is relatively price inelastic. Oysters and mussels are relatively inexpensive, affordable and readily available in the region. This outcome is coherent with the findings of Manalo & Gempesaw (1997), Myrland et al (2000) and Batzios et al (2004). Our survey also indicated that consumers would be willing to absorb even relatively large price increases

without negatively affecting purchasing decisions. Conversely, freshness is a significant factor because the Western Visayas region is a key market for fresh finfish and shellfish. This would suggest that proximity of production sites to market and access to consumers are important considerations. Also, freshness is closely linked to food safety (Loose et al 2013). Fresh oysters have a short shelf-life, causing practical problems related to distribution (Cao et al 2009). So, since freshness is more influential than price, increased consumption can in all likelihood be better achieved through improved product quality. Postharvest facilities should also be built in coastal areas to improve and prolong product shelf-life.

Steamed oyster is the most widely preferred preparation method. Steaming is a form of heat treatment believed to be easy, less time consuming and can reduce bacterial pathogens while retaining the flavor and texture of oysters. It relaxes the adductor muscles of the organisms, thus, facilitate the shucking process. Cruz-Romero et al (2007) cautioned the use of heat as it can negatively affect the sensory, nutritional and functional properties of food. As an alternative, Azanza et al (2005) found that hot water baths gave quicker shell opening, increased meat yields and improved sensory characteristic of mussel meats without significantly changing their physico-chemical characteristics.

Increased demand for seafood may be due to increases in choice for new product forms, availability of seafood and the expanded role of supermarkets as seafood suppliers (Myrland et al 2000). Low valued species when utilized as raw materials for the development of new processed products would lead to highly valuable marketable products (Boughanmi et al 2007). Among the processed products, oyster sauce is the most well-tried products because it is regularly available in the market. Fermented mussels in bottles were commonly sold in wet markets or vended along roadsides close to the culture sites. Other processed and snack products including mussel chips and crackers and salted oyster paste, were also identified, but since they are less available in the market, this may have affected consumers' choice. Interestingly, females responded most positively to the prospect of new products from oyster and mussel. In the Philippines, food purchasing decisions are usually a female role, thus any marketing strategy for new products may usefully focus on female consumers. This is similar to the findings of Myrland et al (2000) that adult Norwegian females make food purchase decision for the family.

Product quality, safety and environmental concerns. Consumers more interested with product quality have high utility or valuation for quality products (Verbeke et al 2007), therefore, we expect that frequent buyers and consumers (eating fish weekly or daily) are better evaluators of seafood quality. It is relevant to examine other considerations such as health and nutrition, safety and environmental concerns as indicated in Hicks et al (2008). Concerns over safety encouraged consumers to pay a premium that ensures quality and origin (Trondsen et al 2004b; Birch & Lawley 2012).

Product origin or source is less important for consumers in Western Visayas, although there are indications that awareness and concern about seafood safety is becoming an issue especially for the more educated consumers. The reasons why consumers in Western Visayas were quite confident of the source may be attributed to the information that no red tides or human deaths due to paralytic shellfish poisoning (PSP) were reported in the region compared to other places in the country. In the Philippines, information related to the consumption of seafood only becomes a public concern when it poses potential health hazards to the consumers (e.g., red tide, mass fish kill). Red tides have been documented in Chang et al (2009), Furuya et al (2006), Azanza (1997) and Gacutan et al (1985) and the risks were generally publicized in the Philippines. The government has been closely monitoring red tides in the country and regular advisory has been issued prohibiting shellfish consumption from contaminated sites. It is also an opportunity to take advantage of consumers' bias toward products from their own region since consumers are more likely to patronize products coming from their place.

In addition to vendor unsanitary practices and temperature fluctuations during sale, which contribute to increased bacterial load in shellfish (Laloo et al 2000), the quality of the environment is also important in assuring product quality and safety. The relationships between environmental quality and quality of shellfish are documented in Cardellicchio et al (2008), Bayen et al (2007) and Beiras et al (2003). In our study, many educated consumers were not convinced that the waters where oysters and mussels were harvested are free from pollution. These consumers were more exposed to information about contaminated aquatic habitats and the importance of safety with new health risk information. With this information, and concurrent Philippine water quality data published elsewhere (Duncan et al 2009) there is clearly a need to improve the microbiological quality of production sites and postharvest handling methods. Relaying, depuration and post-harvest processing techniques including heat processing or fermentation and high pressure treatment can substantially reduce bacterial loads (Jackson & Ogburn 1999; Laloo et al (2000). According to Wilcock et al (2004), the low number of studies on consumer attitudes towards food safety in developing countries may be due to lack of consumer education and training and a low consumer influence on food safety. In Malaysia, consumer awareness has been enhanced through public education demonstrations or 'promotions' at fairs and in collaboration with hotels and restaurants (Nair et al 1993).

Conclusions. In the Philippines, among aquaculture species, oysters and mussels receive very little attention with respect to improving production practices and marketing. Despite better nutritional profiles (high nutritional value), i.e. omega-3 fatty acids, proteins, vitamins and minerals and accepted traditional food status, consumption is limited even within the local market. However, as traditional seafood, it may not be so difficult to further develop the domestic market for oysters and mussels provided that product quality is improved. The results of this study are broadly or even closely in agreement with other studies so there are no major 'demographic' reasons why consumption should not increase. The issues of production site environment, product quality and food safety have to be addressed. The presence of some or all of these factors may result in weakened consumer confidence. In general, increasing consumer demand will require improved production and postharvest practices and better processing facilities to extend useable shelf-life. Nevertheless, most coastal countries in the country lack the infrastructure, preparation and processing installations.

The results of this study are somewhat limited due to the survey taking place in a single region, albeit an important one for bivalve aquaculture production and consumption, i.e. Western Visayas. But these initial findings may be generally reflective of attitudes throughout the Philippine archipelago and therefore may prove useful and instructive. Further research could usefully include other areas of the country to better understand the overall domestic consumption of oyster and mussel.

Acknowledgements. The authors would like to acknowledge the financial support from the Australian Centre for International Agricultural Research (ACIAR) and UP Visayas In-House Grant. The authors are also grateful to the UPV Foundation, Inc. and its staff for project fund management and Project Assistants Erish Estante, Marnelie Gadong and Kristal Kae Ombrog. Special thanks to Dr. Barney Smith and Dr. John Skerritt of ACIAR.

References

Adeogun O. A., Ajana A. M., Ayinla O. A., Yarhere M. T., Adeogun M. O., 2008 Application of Logit model in adoption decision: a study of hybrid *Clarias* in Lagos State, Nigeria. American-Eurasian J Agric & Environ Sci 4(4):468-472.

Ahmed A. F., Mohamed Z., Ismail M. M., 2011 Determinants of fresh fish purchasing behavior among Malaysian consumers. Current Research Journal of Social Sciences 3(2):126-131.

Al-Mazrooei N., Chomo G. V., Omezzine A., 2001 Consumer purchase behavior of seafood products in Oman. Journal of International Food & Agribusiness Marketing 13(4):5-22.
Al-Mazrooei N., Chomo G. V., Omezzine A., 2003 Purchase behavior of consumers for seafood products. Journal of Agricultural and Marine Sciences 8(1):1-10.
Altekruse S. F., Yang S., Timbo B. B., Angulo F. J., 1999 A multi-state survey of consumer food-handling and food-consumption practices. Am J Prev Med 16(3):216-221.
Arvanitoyannis I. S., Krystallis A., Panagiotaki P., Theodorou A. J., 2004 A marketing survey on Greek consumers' attitudes towards fish. Aquaculture International 12:259–279.
Azanza M. P. V., Azanza R. V., Ventura S. R., 2005 Heat shocking of Philippine green mussels, *Perna viridis*. International Journal of Food Science and Technology 40:689–694.
Azanza R. V., 1997 Contributions to the understanding of the bloom dynamics of *Pyrodinium bahamense* var. *compressum*: a toxic red tide causative organism. Science Diliman 9 (1-2):1-6.
BAS, 2011 Fisheries Statistics of the Philippines 2008-2010. Department of Agriculture, Bureau of Agricultural Statistics (BAS), Department of Agriculture. Quezon City, Philippines. ISSN-2012-039719, 404 pp.
Batzios C. H., Angelidis P., Papapanagiotou E. P., Moutopoulos D. K., Anastasiadou C. H., Chrisopolitou V., 2004 Greek consumer's image of the cultured mussel market. Aquaculture International 12:239–257.
Bayen S., Lee H. K., Obbard J. P., 2007 Exposure and response of aquacultured oysters, *Crassostrea gigas*, to marine contaminants. Environmental Research 103:375–382.
Beiras R., Bellas J., Fernandez N., Lorenzo J. I., Cobelo-Garcia A., 2003 Assessment of coastal marine pollution in Galicia (NW Iberian Peninsula); metal concentrations in seawater, sediments and mussels (*Mytilus galloprovincialis*) versus embryo–larval bioassays using *Paracentrotus lividus* and *Ciona intestinalis*. Marine Environmental Research 56:531–553.
BFAR, 2008 Philippine Fisheries Profile 2007, Department of Agriculture, Bureau of Fisheries and Aquatic Resources, Fisheries Division, Quezon City, Philippines, 39 pp.
Birch D., Lawley M., 2012 Buying seafood: understanding barriers to purchase across consumption segments. Food Quality and Preference 26:12–21.
Bose S., Brown N., 2000 A preliminary investigation of factors affecting seafood consumption behaviour in the inland and coastal regions of Victoria. Journal of Consumer Studies & Home Economics 24(4):257–262.
Boughanmi H., Al-Musalami J., Al-Oufi H., Zaibet L., 2007 Estimating consumer preferences for value-added fish products in Oman: a conjoint analysis. Journal of Food Products Marketing 13(2):47-68.
Cao R., Xue C. H., Liu Q., 2009 Changes in microbial flora of Pacific oysters (*Crassostrea gigas*) during refrigerated storage and its shelf-life extension by chitosan. International Journal of Food Microbiology 131:272–276.
Cardellicchio N., Buccolieri A., Di Leo A., Giandomenico S., Spada L., 2008 Levels of metals in reared mussels from Taranto Gulf (Ionian Sea, Southern Italy). Food Chemistry 107:890–896.
Cardoso C., Lourenço H., Costa S., Gonçalves S., Nunes M. L., 2013 Survey into the seafood consumption preferences and pattern in the portuguese population. Gender and regional variability. Appetite 64:20–31.
Chang K. H., Amano A., Miller T. W., Isobe T., Maneja R., Siringan F. P., Imai H., Nakano S., 2009 Pollution study in Manila Bay: eutrophication and its impact on plankton community. In: Interdisciplinary Studies on Environmental Chemistry — Environmental Research in Asia. Obayashi Y., Isobe T., Subramanian A., Suzuki S., Tanabe S. (eds), TERRAPUB, pp. 261–267.

Corrêa A. A., Albarnaz J. D., Moresco V., Poli C. R., Teixeira A. L., Simões C. M. O., Barardi C. R. M., 2007 Depuration dynamics of oysters (*Crassostrea gigas*) artificially contaminated by *Salmonella enterica* serovar Typhimurium. Marine Environmental Research 63:479–489.

Cruz-Romero M., Kelly A. L., Kerry J. P., 2007 Effects of high-pressure and heat treatments on physical and biochemical characteristics of oysters (*Crassostrea gigas*). Innovative Food Science and Emerging Technologies 8:30–38.

Cruz-Romero M., Kerry P., Kelly A. L., 2008 Changes in the microbiological and physicochemical quality of high-pressure-treated oysters (*Crassostrea gigas*) during chilled storage. Food Control 19:1139–1147.

Debucquet G., Cornet J., Adam I., Cardinal M., 2012 Perception of oyster-based products by French consumers: the effect of processing and role of social representations. Appetite 59:844–852.

Delmendo M. N., 1989 Bivalve farming: an alternative economic activity for small-scale fishermen in the ASEAN region. ASEAN/SF/89/Tech. 11. ASEAN/UNDP/FAO Regional Small-Scale Coastal Fisheries Development Project Manila, Philippines, 45 pp.

Duncan P. F., Andalecio M. N., Peralta E. M., Laureta L., Hidalgo A. D., Napata R., 2009 Evaluation of production technology, product quality and market potential for the development of bivalve mollusc aquaculture in the Philippines. Final Report FR2009-41. Australian Center for International Agricultural Research (ACIAR), Canberra, Australia. ISBN 978 1 921615412, 193 pp.

FAO, 2010 The state of world fisheries and aquaculture. Fisheries and Agriculture of the United Nations. Rome, Italy, 197 pp.

FAO, 2012 The state of world fisheries and aquaculture 2012. Rome, Italy, 209 pp.

Furuya K., Saito H., Sriwoon R., Vijayan A. K., Omura T., Furio E. E., Borja V. M., Boonyapiwat S., Lirdwitayaprasit T., 2006 Persistent whole-bay red tide of *Noctiluca scintillans* in Manila Bay, Philippines. Coastal Marine Science 30(1):74-79.

Gacutan R. Q., Tabbu M. Y., Aujero E. J., Icatlo F. Jr., 1985 Paralytic shellfish poisoning due to *Pyrodinium bahamense* var. *compressa* in Mati, Davao Oriental, Philippines. Marine Biology 87:223-227.

Gempesaw C. M., Bacon J. R., Wessells C. R., Manalo A., 1995 Consumer perceptions of aquaculture products. Am J Agric Econ 77:1306-1312.

Grienke U., Silke J., Tasdemir D. 2014 Bioactive compounds from marine mussels and their effects on human health. Food Chemistry 142:48–60.

Han B. C., Jeng W. L., Hung T. C., Ling Y. C., Shieh M. J., Chien L. C., 2000 Estimation of metal and organochlorine pesticide exposures and potential health threat by consumption of oysters in Taiwan. Environmental Pollution 109:147-156.

Harris S. A., Urton A., Turf E., Monti M. M., 2009 Fish and shellfish consumption estimates and perceptions of risk in a cohort of occupational and recreational fishers of the Chesapeake Bay. Environmental Research 109:108–115.

Hicks D., Pivarnik L., McDermott R., 2008 Consumer perceptions about seafood – an Internet survey. Journal of Foodservice 19:213–226.

Jackson K. L., Ogburn D. M., 1999 Review of depuration and its role in shellfish quality assurance. New South Wales Shellfish Quality Assurance Programme FRDC Project No. 96/355. NSW Fisheries Final Report Series 13, 95 pp.

Jang S., Ha A., Silkes C. A., 2009 Perceived attributes of Asian foods: from the perspective of the American customers. International Journal of Hospitality Management 28:63–70.

Kim S. K., Pallela R., 2012 Medicinal foods from marine animals: current status and prospects. Advances in Food and Nutrition Research 65:1-9.

Kotta S., Ansari S. H., Ali J., 2013 Exploring scientifically proven herbal aphrodisiacs. Pharmacogn Rev 7(13):1–10.

La Valley K. J., DeAlteris J., Rice M., Gomez-Chiarri M., 2008 North Atlantic *Vibrio vulnificus* surveillance from postharvest oysters at a US shellfish processing facility. Journal of Foodservice 19:234–237.

Laloo S., Rampersad F. S., La Borde A., Maharaj K., Sookhai L., Teelucksingh J. D., Reid S., McDougall L., Adesiyun A. A., 2000 Bacteriological quality of raw oysters in Trinidad and the attitudes, knowledge and perceptions of the public about its consumption. International Journal of Food Microbiology 54:99–107.
Lin C. T. J., Milon J. W., 1993 Attribute and safety perceptions in a double-hurdle model of shellfish consumption. Am J Agric Econ 75:724-729.
Loose S. M., Peschel A., Grebitus C., 2013 Quantifying effects of convenience and product packaging on consumer preferences and market share of seafood products: the case of oysters. Food Quality and Preference 28:492–504.
Lund E. K., 2013 Health benefits of seafood; is it just the fatty acids? Food Chemistry 140:413–420.
Manalo A. B., Gempesaw C. M., 1997 Preferences for oyster attributes by consumers in the U.S. Northeast. Journal of Food Distribution Research 7:55-63.
McManus A., Fielder L., Newton W., White J., 2011 Health benefits of seafood for men. Journal of Men's Health 8(4):252-257.
Monirith I., Ueno D., Takahashi S., Nakata H., Sudaryanto A., Subramanian A., Karuppiah S., Ismail A., Muchtar M., Zheng J., Richardson B. J., Prudente M., Hue N. D., Tana T. S., Tkalin A. V., Tanabe S., 2003 Asia-Pacific mussel watch: monitoring contamination of persistent organochlorine compounds in coastal waters of Asian countries. Marine Pollution Bulletin 46:281–300.
Myers J. J., Govindasamy R., Ewart J. W., Liu B., You Y., Purduri V. S., O'Dierno L. J., 2010 Consumer analysis in ethnic live seafood markets in the Northeast Region of the United States. Journal of Food Products Marketing 16(2):147-165.
Myrland Ø., Trondsen T., Johnston R. S., Lund E., 2000 Determinants of seafood consumption in Norway: lifestyle, revealed preferences, and barriers to consumption. Food Quality and Preference 11:169-188.
Nair D., Hall R., Angel C. L., 1999 Small-scale oyster culture on the west coast of peninsular Malaysia. Bay of Bengal Programme, BOBP/REP/63, 32 pp.
Olsen S. O., 2003 Understanding the relationship between age and seafood consumption: the mediating role of attitude, health involvement and convenience. Food Quality and Preference 14:199–209.
Peng C. Y. J., Lee K. L., Ingersoll G. M., 2002 An introduction to logistic regression analysis and reporting. The Journal of Educational Research 96(1):3-14.
Prudente M., Kim E. Y., Tanabe S., Tatsukawa R., 1997 Metal levels in some commercial fish species from Manila Bay, Philippines. Marine Pollution Bulletin 34(8):671-674.
Redkar S. B., Bose S., 2004 Modelling purchasing decisions of seafood products: a case study of Mumbai, India. International Journal of Consumer Studies 28:75–82.
Sveinsdóttir K., Martinsdóttir E., Green-Petersen D., Hyldig G., Schelvis R., Delahunty C., 2009 Sensory characteristics of different cod products related to consumer preferences and attitudes. Food Quality and Preference 20:120–132.
Trondsen T., Scholderer J., Lund E., Eggen A. E., 2003 Perceived barriers to consumption of fish among Norwegian women. Appetite 41:301-314.
Trondsen T., Braaten T., Lund E., Eggen A. E., 2004a Consumption of seafood - the influence of overweight and health beliefs. Food Quality and Preference 15:361–374.
Trondsen T., Braaten T., Lund E., Eggen A. E., 2004b Health and seafood consumption patterns among women aged 45–69 years: a Norwegian seafood consumption study. Food Quality and Preference 15:117–128.
Verbeke W., Vackier I., 2005 Individual determinants of fish consumption: application of the theory of planned behavior. Appetite 44:67–82.
Verbeke W., Vermeir I., Brunsø K., 2007 Consumer evaluation of fish quality as basis for fish market segmentation. Food Quality and Preference 18:651–661.
Vicente-Beckett V. A., 1992 Trace metal levels and speciation in sediments of some Philippine natural waters. The Science of the Total Environment 125:345-357.
Wang D., Zhang D., Chen W., Yu S., Shi X., 2010 Retention of *Vibrio parahaemolyticus* in oyster tissues after chlorine dioxide treatment. International Journal of Food Microbiology 137:76–80.

Wessells C. R., Holland D. S., 1998 Predicting consumer choices for farmed and wild salmon. Aquaculture Economics & Management 2(2):49-59.
Whitmarsh D., Palmieri M. G., 2011 Consumer behaviour and environmental preferences: a case study of Scottish salmon aquaculture. Aquaculture Research 42:142-147.
Wilcock A., Pun M., Khanonax J., Aung M., 2004 Consumer attitudes, knowledge and behaviour: a review of food safety issues. Trends in Food Science & Technology 15:56–66.

Received: 01 April 2014. Accepted: 13 April 2014. Published online: 15 April 2014.
Authors:
Merlina Nabuya Andalecio, University of the Philippines College of Fisheries and Ocean Sciences, Institute of Fisheries Policy and Development Studies, Philippines Miagao 5023 Iloilo, e-mail: merlina_andalecio@yahoo.com
Peter Fergus Duncan, School of Ocean Sciences, Bangor University, Askew Street, Menai Bridge, LL59 5AB, United Kingdom, e-mail: oss011@bangor.ac.uk
Ernestina Mateo Peralta, University of the Philippines Visayas, College of Fisheries and Ocean Sciences, Institute of Fish Processing Technology, Philippines Miagao 5023 Iloilo, e-mail: le_peralta03@yahoo.com
Ruby Presas Napata, University of the Philippines Visayas, College of Fisheries and Ocean Sciences, Institute of Fisheries Policy and Development Studies, Philippines Miagao 5023 Iloilo, e-mail:rubynapata@yahoo.com
Liberator Vallejos Laureta, University of the Philippines Visayas, College of Fisheries and Ocean Sciences, Institute of Aquaculture, Philippines Miagao 5023 Iloilo, e-mail: jhunlaureta@yahoo.com

How to cite this article:
Andalecio M. N., Duncan P. F., Peralta E. M., Napata R. P., Laureta L. V., 2014 Consumer behavior towards cultured oyster and mussel in Western Visayas, Philippines. AACL Bioflux 7(2):116-136.

Annex 1

Consumer Preference Survey

Code: _____

Date: _____
Enumerator: _____
Name: _____
Address: _____
Age: _____
Sex: ☐ Male ☐ Female
Civil status: ☐ Single ☐ Married ☐ Widow ☐ Separated
Highest educational attainment:
☐ Elementary ☐ High School ☐ College ☐ Graduate
☐ Post Graduate ☐ Vocational ☐ Others, pls. specify _____
Occupation: _____
Employer: _____
Monthly household income:
☐≤₱6,000 ☐₱6,000-10,000 ☐₱10,000-15,000 ☐₱15,000-20,000
☐₱20,000-25,000 ☐₱25,000-30,000 ☐₱≥30,000
Religious affiliation: ( ) Catholic ( ) Protestant ( ) Aglipay ( ) Islam
( ) Others _____
Ethnic origin: ( ) Tagalog ( ) Cebuano ( ) Boholano ( ) Ilonggo
( ) Waray ( ) Others _____
Size of household: _____
Status of respondent in the household ☐ Father ☐ Mother ☐ Daughter
☐ Son ☐ Others _____
Are you a member of any environmental group or social association? Which group?
_____
Have you heard about eco-labelled products? What is it about?
_____
How often does your family eat fish and seafoods?
☐ Daily ☐ Weekly ☐ Every two weeks ☐ Monthly ☐ Never
Do you eat the following?
Oyster ☐ Yes ☐ No
Mussel ☐ Yes ☐ No
If no, why not? _____
If yes, proceed to the following sections:

A. <u>Consumption pattern</u>

1. Which would you prefer? Oyster or mussel? Why?
2. Which months do you usually eat oyster or mussel?
3. Have you observed if they are available whole year round?
4. Are there best times to eat them? When?
5. How often, on the average, do you consume during season (please check)
   ☐ daily ☐ weekly ☐ every two weeks ☐ monthly ☐ never
6. Where do you eat them (check as many as they apply)?
   ☐ home ☐ community gatherings/party ☐ restaurant ☐ park street
   ☐ others (pls specify)
7. How do you consume them (check as many as they apply)?
   ☐ raw ☐ steamed ☐ fried ☐ broiled ☐ stewed
   ☐ others (pls specify)
8. What other oyster and mussel products have you tried? (e.g., oyster sauce, mussel chips, etc.)
9. With whom do you eat oyster or mussel?
   ☐ father/mother ☐ husband/wife ☐ children ☐ brother/sister
   ☐ colleagues ☐ friends ☐ Others, specify

10. When you eat either at home or in a restaurant, what quality attributes are most important to you?
11. Is oyster/mussel part of your meal?
12. How would you like your oyster/mussel served?
13. How would you usually prepare or cook oyster/mussel?
14. Can you estimate how many pieces you are able to consume per sitting?
15. What other food do you eat with oyster/mussel?
16. Have you encountered any problem related to eating oyster or mussel?
17. Can you eat anywhere? Is the source important to you?
18. When was the last time you had eaten oyster/mussel?

B. Purchasing and Pricing

1. Place where you are most likely to buy oyster or mussel (specify location)
   ☐ convenience store ☐ retailer ☐ wet market/ supermarket
   ☐ restaurant ☐ park street vendor ☐ others, specify
2. How often do you buy during peak season
   ☐ daily ☐ weekly ☐ every two weeks ☐ monthly ☐ never
3. Which is more expensive, oyster or mussel?
4. Are they reasonably priced? Yes or No? Why do you think?
5. How much do you pay? per plate ____ per kg ____
6. Would you be prepared to pay more than you would usually pay? By how much? Why? In what particular instance?
7. When buying oyster or mussel which quality attributes do you consider? (e.g., price, taste, appearance, size, etc.)
8. How does a fatty oyster/mussel look like? What color or texture?

C. Product Source

1. When do you think are the months oyster or mussel very abundant?
2. Where do you think they came from? (source)
3. Which place in the Philippines is famous for its oyster and mussel? Why?
4. Which place in the Philippines where you are not likely to buy or eat oyster and mussel? Why?
5. Do you usually ask the vendor/seller the sourcce before buying?
6. Which place would you prefer the product to have come from? Why?
7. Which areas in the Philippines do you think are the oyster and mussel productions highest?
8. Are oyster and mussel caught from the wild or grown?
9. Are you particular about where the oyster or mussel you eat are harvested?
10. Have you been to a growing area? Where?
11. Do you know how oysters are grown? If yes, how?
12. Do you know of any health benefits from eating oyster and mussel? What?
13. Do you know of problems associated with eating mussel and oyster?
14. What do you think is the primary cause of unsafe oyster and mussel?
15. Have you read or heard information on oyster and mussel? Which materials and from where?
16. Which government agency is responsible in giving information on the quality and safety of oyster and mussel?

D. Postharvest, Processing and Quality

Please rate the following statements using this scale: (1) strongly disagree (2) Disagree (3) undecided (4) agree (5) strongly agree

1. I have already tried oyster and mussel products before
2. I am willing to try new product of oyster and mussel
3. Public agencies have exaggerated the risk of eating oyster and mussel
4. Adequate information is available about the safety of eating oyster and mussel
5. The waters where the oyster and mussel are collected are free of pollution
6. I am concerned with eating raw oyster and/or mussel