



## Personal and socioeconomic factors affecting perceived knowledge of farmed fish

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### ABSTRACT

The global decline in wild fish has given impetus to the rapid growth of seafood produced by aquaculture, as well as of farmed fish (FF). Although product knowledge is directly linked to fish consumption, continuous asymmetric information leads to consumer ambiguity and confusion regarding their knowledge of farmed fish. However, ambiguity tolerance (AT) and confusion avoidance (CA) as personal and relevant socio-economic factors positively affect fish consumption. Despite such potential of these factors, little research has investigated if the personal and socio-economic factors are associated with consumers' value perception of FF knowledge. Therefore, this study analyses the effects of AT, CA and socio-economic factors on consumers' acquisition of knowledge of farmed fish. A total sample of 1041 households from the two major Bangladeshi urban areas of Dhaka and Chittagong were interviewed using a structured questionnaire. The data were analysed employing exploratory factor analysis and the ordered probit regression model. The findings reveal that AT affects FF knowledge positively and significantly but that CA does not. Individuals with a high level of fish consumption and who do their fish shopping personally are more likely to gather FF knowledge. However, those who buy fish from the supermarket and are members of an environmental organisation are not interested in doing so. The findings also lead to significant managerial implications for improving ways to develop substantial factors to increase FF knowledge and the consumption of such fish, which will benefit consumers and the aquaculture industry.

### 1. Introduction

As they provide essential polyunsaturated fatty acids, calcium, antioxidants, minerals, vitamins, and protein, fish and fish products are considered to be one of the key functional foods [1]. Consumers eat such food for utilitarian and nutritional value. The utilitarianist characteristics of the products encourage consumers to find out more about them [2]. Therefore, identifying consumers' knowledge and understanding their preferences for fish products are crucial for increasing fish consumption [3,4]. As the world population grows and the public health authorities recommend consuming more fish, demand and consumption frequency have increased. It is anticipated that fish consumption will continue to rise due to the ongoing growth in the population [5]. While fish consumption has increased because of its nutritional value and

dietary characteristics, population growth, pollution, overfishing, and ocean acidification have dramatically reduced wild fish stocks [6].

However, scientific progress and human interest have given birth to an alternative forms of aquaculture products (e.g., fish farming) to supplement wild-caught fish and help meet the additional demand [7]. In such farming, fish are fed marine oil to increase their polyunsaturated fatty acid and its composition, giving an extended range of functional fish [1]. Being a rich source of functional food, the aquaculture sector is growing continuously. However, despite its rapid expansion, the sector is still at a relatively early developmental stage and be steered in a favourable direction [8]. If fisheries want to accelerate overall aquaculture development and their enhancement programme, they need to obtain knowledge concerning consumer awareness, including biology, profitability, and environmental aspects [8]. Therefore, the emerging

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fisheries and aquaculture industry should provide opportunities to adapt production and product development according to consumers' wishes. On the one hand, consumers are interested to know about FF attributes in terms of their hedonic characteristics. On the other hand, fisheries need to generate knowledge of consumers' awareness of FF to develop the product and production process.

Consumers' perceived value plays a crucial role in developing FF products and the production process [9]. Such perceptions depend on consumers' attitudes and beliefs about FF and aquaculture products. However, these attitudes are dynamic and may change, depending on product information and the level of consumers' knowledge. Secondly, consumers' knowledge plays an important role in their fish decision-making process [9]. Therefore, it is vital to understand consumers' perceived value and knowledge of FF in order to be aware of their buying intentions and to develop FF and production systems. Several authors [10] have discussed the link between product attribute preferences and consumer values. The literature also demonstrates that individual factors can be useful in predicting green and healthy behaviour [11,12]. Consumers' usage and prior experience, product familiarity and eating habits can lead to their perceived value of product knowledge [13,14].

However, information uncertainty regarding aquaculture markets makes consumers confused about FF, whereas subjective knowledge strengthens their purchase intention and objective knowledge helps reduce their confusion [7]. Confusion avoidance (CA) has become more apparent as consumers face ever-growing levels of decision-relevant knowledge in their purchasing environments [15]. Verbeke et al. (2007) [16] include such confusion as one of the principal dilemmas in developing the global FF market. In fact, both consumers' AT and CA as personality factors have been associated with their behaviour during decision-making processes [17]. Such findings indicate that to create a positive attitude towards FF, consumers' personality variables such as CA and AT are crucial for perceiving relevant knowledge. Consumers with low AT require more information than those with a higher level [18]. Similarly, CA requires substantial knowledge of a particular product [19].

Though FF is the most prevalent strand in current fish food studies regarding consumers' acceptance and willingness to pay (WTP) [20,21], attitudes towards it deteriorate when environmental matters arise [22]. Unfavourable media coverage, information gaps, and ambiguous farming processes have affected consumers' perception of FF [23] and led to associated ambiguity [20]. Consumers face an ambiguous situation because of conflicting or insufficient information, which they are unable to appropriately structure or interpret [24]. In parallel with the research on ambiguity tolerance (AT) as measured by self-report, behavioural measures of AT have been using frequently in economics and decision theory [25]. In addition to ambiguity, there could be misconceptions due to intentional mis-selling by suppliers, with consequent distrust amongst consumers of the methods used in aquaculture production [26]. The Confusion over' product ingredients [27] and poor knowledge of their health consequences [28] can also lead to consumer confusion.

During the last three decades, the production, consumption, and export of fish and aquaculture in Asia have grown significantly [29]. Thailand, China, India, the Philippines, Indonesia, and Bangladesh are the main countries involved in the aquaculture industry [30]. The world's largest flooded wetland and the third largest aquatic biodiversity are located in Bangladesh, which greatly facilitate both the capture and culture of fish [29]. The country was also ranked third for inland open range fresh water capture production and fifth for global aquaculture production in 2017 [31]. Furthermore, aquaculture is expected to continue rising in the country and now provides around 50% of the total fish supply to the market for direct human consumption [32]. However, the sector in Bangladesh is still at a preliminary stage compared to the farming of poultry and other livestock [7]. The movement from extensive to intensive production methods and a rise in the

imbalance of realistic and media-based information on the intensive fish farming aquaculture process has resulted in anxiety and negatively affected consumers' fish product awareness. Therefore, an understanding of the determinants of FF knowledge is relevant in terms of both demand and supply. The outcomes of the study, which address the influence of customers' AT and their CA with regard to FF knowledge, could be crucial in increasing such knowledge; helping the aquaculture industry in their decision-making, and formulating aquaculture product development policy.

Despite evidence of the more likely significant role of consumers' AT and CA in explaining their perceptions and involvement in eating seafood, little research has been conducted which examines the effect of AT, CA, and socio-economic variables as influencing factors in framing knowledge of FF. Therefore, this study aims to fill this knowledge gap. To achieve its objective, this study examines the effects of the two relevant personal factors, namely consumers' AT and CA, on their perceived knowledge of FF and the aquaculture industry. The study also assesses the impacts of consumers' socio-economic factors on the level of their perceived knowledge of FF. To help achieve the aim of the study and the associated analysis, data were obtained from 1041 households in Dhaka, the capital city, and Chittagong, the main commercial capital city, of Bangladesh. The respondents were asked to complete a questionnaire that included statements regarding their perceived knowledge of FF, and their AT and CA personality traits. A mixed method was used to develop the variables and analyse the effect and relationships between them, involving exploratory factor analysis (EFA) and ordered probit (Oprobit) regression modelling.

The remainder of the article is structured as follows. The second section provides the theoretical framework and introduces the conceptual background, while the data and methods are defined in the third section. The fourth section analyses the findings and presents the discussion. In the final section, the conclusion includes the key findings, drawbacks of the study, and recommended lines of future inquiry.

## 2. Theoretical framework

In 2016, the world's total fish harvest was 171 million tons, of which around 88% was used for direct human consumption [31]. Global fish food consumption grew at an annual average rate of 3.1% from 1961 to 2017, almost double that of the annual world population growth rate (1.6%) over the same period [33]. Presently, in order to contribute a higher share of fish protein, the production of aquaculture has been increasing. It is currently one of the fastest-growing animal-farming sectors globally, having grown steadily since 1990 and is projected to exceed 109 million tonnes by 2030 [31]. It is also expected to supply 60% of the food needs produced by aquaculture by 2030, compared to the existing 52% [31].

Developing markets have shown steady growth in production and consumption in the global fish food economy, particularly in Asia [34]. As an emerging South Asian economy, Bangladesh has become the fourth largest fish producing economy globally [35,36] with an extensive coastline and a delta system that feeds the large volume of capture and culture fisheries. The economy enjoys rich inland waters and river systems with great potential for wild fish and aquaculture [32]. Almost 2% of the country's total export revenue comes from the inland fisheries sector [37], with more than 17 million people, including approximately 1.4 million females, relying on it for their incomes through fisheries, aquaculture, fishery management and processing [38]. Most importantly, the inland aquaculture industry contributes more than 55% of the total seafood output in the region [37]. In this way, fisheries and aquaculture play an important role in satisfying animal protein needs and improving consumers' socio-economic status.

Aquaculture is the agriculture of various aquatic creatures, including fish, under controlled conditions for all or part of their life cycle [39]. It can take place in inland freshwater, and coastal and marine areas, including tanks, ponds, lakes estuaries, rivers, bays and the open sea

[40]. As a major industry, the sector promotes global food and nutrition sustainability by helping to alleviate hunger and enhance social well-being for millions of people around the world [41]. While public concerns and awareness of production processes, food quality and protection, health effects, food security, sustainability and animal welfare have contributed considerably to the growth of the industry [42,43], there is still ambiguity and confusion among consumers regarding the taste and quality of farmed fish [44]. Excessive information or the limited number of reliable sources may cause confusion related to various factors, such as the nutritional benefits, availability, and use of antibiotics to prevent infection and breed and grow FF [16]. Such information and sources are effective for knowledge transfer regarding consumers' attitudes and fish purchase intention [7]. Those with the most effective use of all the information sources related to fish had the highest intention to consume it [3].

The literature reveals that psychological, personal and socio-economic factors affect individuals' behaviour [45]. Causal ambiguity, confusion, knowledge observability, absorptive capacity, and shared understanding are significant knowledge-related predecessor factors for substantial knowledge transfer [46], and influence consumer perceptions [47]. A diversity of terms has been used concerning psychological factor attitudes towards ambiguity, including tolerance and/or intolerance of ambiguity [24,48,49]; tolerance of ambiguity [50]; and ambiguity tolerance [49]. Studies also show that AT as an emotional and perceptual personality factor could predict individuals' behavioural features in ambiguous situations [24,51]. The concept of AT is appropriate for experimental and cognitive outcomes [52] and is treated as a property of both organisations [53] and national cultures [54], so has attracted research in various branches of psychology [51]. Because AT is associated with psychological well-being [55], it moderates the impact of marketing knowledge on consumer confusion [56].

The confusion caused can result in goal avoidance, a negative attitude and delegation of purchase responsibility [57]. The concept of 'consumer confusion' and the variables that contribute to a confusing environment lead to an avoidance approach [27,58]. For instance, consumers want to receive balanced information regarding FF (positive valence) and to avoid asymmetric information (negative valence), which constitutes an approach-avoidance conflict. Such conflict is experiential and has been described as consisting of two related parts: the unwillingness to remain in contact with knowledge, and the action taken to alter the events that elicit consumers [59]. Because of information asymmetry, many customers face confusion when buying farmed fish [60]. Although augmented information may create confusion, customers with balanced information will be in a position to avoid this [44]. To solve such approach-avoidance conflict, information confusion should be reduced [61], with personality variables such as AT and CA encouraging consumers to perceive balanced information or knowledge [46].

Several avenues are open for the investigation of the association between AT and other traits and personalities [62]. As the confusion caused can result in goal avoidance [58], and customers' risk evasion develops brand trust and reliability [63], we believe that CA may be caused by a generally positive attitude towards product learning. Therefore, prior product knowledge can affect consumers' perceived capability to search for the perceived value of further knowledge [64]. Nevertheless, they vary in their connection with information and perceived knowledge of fish safety and quality [65], meaning that their perceived value of AT and CA affects their perceived knowledge as the explanatory factors. Despite these effects of increased AT and CA, relatively few studies exist on the ambiguity and confusion concept; in particular, the sources of ambiguity and confusion and the ideas of AT and CA to which the aquaculture sector should pay attention are understudied. Although the level of consumers' perceived knowledge regarding fish depends on antecedent personality factors and socio-economic variables, there is a wide gap between what occurs with regard to FF knowledge antecedents and consumers' perceived

knowledge. Therefore, this study examines the effects of AT and CA, including socio-demographics, on consumers' FF knowledge.

Socio-economic factors such as economic variation, educational attainment and farming experience significantly affect farmers' knowledge regarding the hiring of labour for their farms [66]. In addition, socio-economic variables, namely involvement in federal programs to transfer income, total water zones, and production in tanks and ponds, are significant factors contributing to producers' likelihood of selling fish [67]. The literature also shows that age, education level, gender, income, place of residence, taste, health, nutrition, and convenience are key determinants of fish-eating behaviour [68–70]. Several studies have shown that gender and income [71,72] and product-related variables, including the frequency level of consumption [73], also play crucial roles in such behaviour [74,75]. Furthermore, fish-eating is also influenced by diverse variables such as the socio-economic context, the personal health status of consumers, overall food consumption patterns, and various attitudinal dimensions [76].

### 3. Materials and methods

#### 3.1. Sample and data collection

The survey covered household respondents in Dhaka, the main capital, and Chittagong, the commercial capital, in Bangladesh (see Fig. 1). The per capita consumption of fish in both cities is the highest in the economy [77]. In addition, people living there are better educated and richer than the rest of the nation [78], so they were appropriate subjects for our exploration of the FF knowledge status of an emerging market. Consequently, we expected that the consumers' AT and CA values in the two cities would be significant for Bangladeshi fish market segmentation in order to establish whether AT and CA as possible personality traits affect consumers' perceived FF knowledge.

Employing a structured and formal questionnaire (see Appendix A),

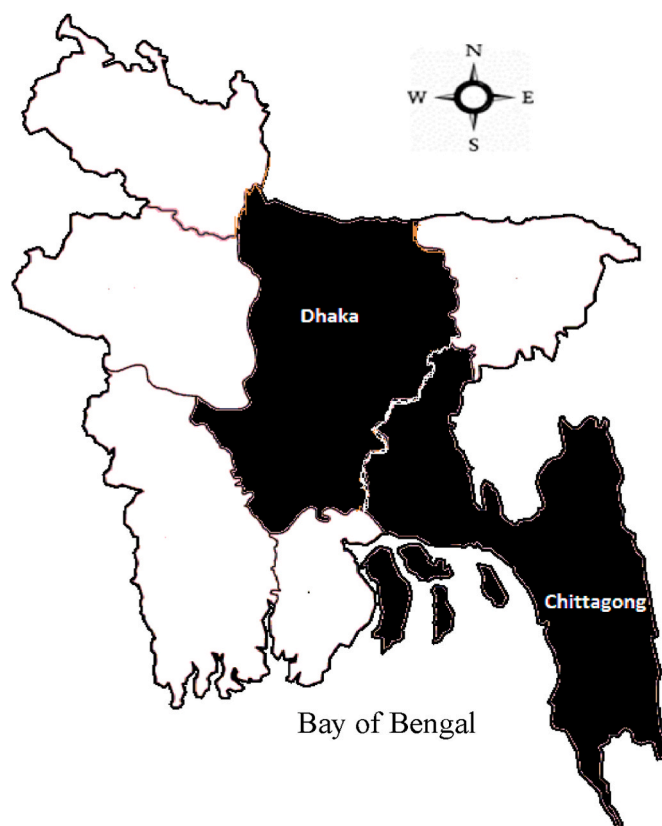


Fig. 1. Black shading indicates the study area (Source: Hoque & Myrland [79]).

we interviewed the participants in Bengali, the local language. Random sampling techniques were used to identify the sample, with the fieldwork conducted from November 2, 2019 to February 21, 2020. Before collecting the data, a pre-test survey was performed on 28 subjects from Dhaka and 23 from Chittagong to ensure that they understood the questions and that there were no issues with semantics or calculation [80]. As no major obstacles were found, it was agreed to keep the same language and procedures for the final version. The primary respondents were aged over 21, and responsible for buying fish and taking care of what the other household members ate. Each interview took on average 15 min. The objective of the study and the concepts of ‘consumer confusion’ and ‘consumer ambiguity’ were detailed in a motivational letter and Cheap talk. Among the total of 1048 respondents, seven were omitted because of insufficient social and demographic data, meaning the final number of active respondents was 1041 (Dhaka 551 and Chittagong 490). The main statistical methods used in the research were descriptive analysis, EFA, and the Oprobit model. SPSS version 26.00 was used for the factor analysis, and STATA version 17.00 was used for the Oprobit analysis.

### 3.2. Questionnaire and measures

The statements in the questionnaire were tailored according to the perspectives of the fresh form of farmed fish, i.e. fresh farmed fish (FFF), AT, CA, and the socio-demographic variables. The opening section explained the concepts of ‘ambiguity and ‘confusion’. The respondents were first asked to read about the two concepts, and were then requested to rate the statements relating to AT, CA, and FFF knowledge. The second section recorded the socio-demographic information of the respondents. The statements and items were based on the literature review and measured the variables of consumers’ perceived FFF knowledge, AT and CA. A seven-point Likert rating scale was used to assess the degree of agreement with the statements, ranging from ‘Strongly Disagree’ (1) to ‘Strongly Agree’ (7). Low scores, therefore, indicated a low level of agreement, and high ones a high level.

First, the study adapted the AT scale developed by Budner [24], with participants asked to rate five statements assessing their individual AT perceptions. They were asked to indicate their feelings based on a series of items/statements such as “It is more fun to tackle a complicated problem than to solve a simple one.” The framework covered consumers’ perception of the joy of living; tackling personal issues; agreeing not to mind being different and original; the inability to know how complicated things really are, and being comfortable with a lack of information. Second, the CA scale was adapted from the study of Schweizer et al. (2006) [81]. To develop the construct, six statements were presented, through which CA was measured based on norms such as novelty, variety, complexity, conflict, comfort, and reliability. For example, the respondents were asked to rate items such as “I prefer food with a label to food without a label”. Third, the respondents’ demographics and product-related data and information were collected to measure their socio-demographics.

Fourth, the study adopted the perceived knowledge scale of Hoque et al. [60]. To develop the product knowledge scale, FFF were divided into two classes: whole (FFF in general) and single (a specific FFF species). These groups were then sub-classified into three levels: assessment, rating and comparison (see Table 1). Finally, participants were asked to rate six (two × three) statements to create the FF knowledge scale.

As recommended by Pallant [82], the study followed a two-step process, as has been operationalised in recent studies [7]. Therefore, multiple measures needed to be used to establish the suitability of respondents’ data for analysis before the factors were extracted. Kaiser-Meyer-Olkin (KMO) and Bartlett’s Sphericity Test [83] are the most accepted measures in this regard. The overall KMO index varies between 0 and 1; for factor analysis, 0.50 is considered to be adequate [84]. Bartlett’s Test of Sphericity should be significant for factor analysis

**Table 1**  
Taxonomy-based farmed fish knowledge scale.

Type	Particulars	Statement
Whole	Assessment	To fulfil dietary requirements, obtaining vitamins by eating fresh farmed fish is more important to me than searching for fresh wild fish.
	Comparison	Genetically-engineered fresh farmed fish is not as nutritious as fresh wild fish.
Single	Ranking	The best thing about fresh farmed fish is its availability.
	Assessment	Pangas ( <i>Pangasius</i> ) is the most economical of all fresh farmed fish.
	Comparison	The next cheapest fresh farmed fish, I think, would be tilapia ( <i>Oreochromis niloticus</i> ).
	Ranking	The fat content of fresh farmed ‘rui’ ( <i>Labeo rohita</i> ) is not harmful in terms of calories.

to be appropriate ( $p < 0.05$ ) [84]. Table 2 reports the results. The KMO test reached 0.764, thus ensuring adequate sampling. A significant value  $p < 0.01$  was also obtained in the Bartlett Sphericity Test, which confirms a high probability of the data factorability being accurate, consistent with other studies [82].

EFA was run after obtaining a satisfactory result to assess the convergent validity of the proposed constructs and to confirm the factor loadings based on the previous literature [85]. The EFA considered three items related to AT, four to CA and three to FFF knowledge. Each of the constructs had eigenvalues greater than one (Table 3), explaining 62.50% of the total variance. The mean values of the three factors for AT and the four for CA were then calculated for use as explanatory variables. Of all the ten items, the standardised regression weights ( $\lambda$ ) were well above the suggested threshold level of 0.50 [85], indicating that they were significant for the corresponding latent constructs. Cronbach’s alpha ( $\alpha$ ) [86] was used to evaluate the internal consistency. Table 3 also shows that in line with Hair et al. (2009) [87], each of these three item and construct components fulfilled the minimum cut-off value of Cronbach’s alpha, with more than 0.60 being achieved. It is recommended that Cronbach’s alpha is greater than 0.70. In addition, we also checked for composite reliability [88] to observe if there were values considerably above the 0.70 level [89]. The values of composite reliability ( $\rho$ ) were also in line with the recommended standard. Furthermore, for each construct the average variance extracted (AVE) [88] value was well above 0.50, thus demonstrating the convergent validity of each construct [89].

As Fornell and Larcker [88] suggest, the AVE of each factor is contrasted with the corresponding correlations between the respective constructs to assess the discriminant validity. Table 4 shows that all the extracted variances were more higher than their corresponding square correlation ( $r^2$ ), which means that each construct was exclusive and that there was no issue of multicollinearity in the dataset. Therefore, discriminant validity is also verified.

Convergent validity, discriminant validity, and face validity were performed to check the construct validity. Convergent and discriminant validity were verified when individual perception approves the face validity of whether a specific construct assesses the intended measure, while face validity was verified by the theoretical analysis discussed in this section and the details provided in Tables 3 and 4. Therefore, it can be concluded that there was a reasonably good match between the observed data and the model.

Finally, as consumers’ perceived knowledge is central to the study,

**Table 2**  
Kaiser–Meyer–Olkin (KMO) and Bartlett’s test of sphericity.

KMO and Bartlett’s Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.764
Bartlett’s Test of Sphericity	Approx. Chi-Square	2719.958
	Degree of Freedom (df)	45
	Significance Level (sig)	0.000

**Table 3**

Measurement model.

Constructs and Items	$\lambda$	$\alpha$	$\rho$	Eigenvalue	AVE
Ambiguity Tolerance (AT)		0.618	0.795	2.932	0.563
Often the most stimulating people are those who do not mind being dissimilar and original.	0.772				
People who demand a 'yes' or 'no' answer do not know how complex things really are.	0.752				
Many of our most significant decisions are based upon inadequate information.	0.727				
Confusion Avoidance (CA)		0.843	0.834	1.996	0.681
I enjoy troubleshooting, which can create confusion.	0.854				
I think the violation of products' trademarks is the origin of the probability of confusion.	0.842				
I expect to see farmed fish species with common names in all markets.	0.838				
I prefer food with a label to that without one.	0.764				
Farmed Fish Knowledge (FFK)		0.665	0.811	1.322	0.592
The good thing about fresh farmed fish is its availability.	0.835				
Pangas is the cheapest fresh farmed fish.	0.806				
The next cheapest fresh farmed fish, I think, would be tilapia.	0.654				

Note(s):  $\lambda$  – standardised regression weights;  $\alpha$  – Cronbach's alpha;  $\rho$  – composite reliability; AVE – average variance extracted.

**Table 4**

Descriptive statistics and correlations among the latent constructs.

Statement/Item	Mean	SD	AT	FFK	CA
Ambiguity Tolerance (AT)*	4.69	1.51	<b>0.563</b>	0.051	0.014161
Farmed Fish Knowledge (FFK)*	5.71	1.09	0.225	<b>0.681</b>	0.026896
Confusion Avoidance (CA)*	3.87	1.44	0.119	0.164	<b>0.592</b>

**Note:** As measured on a seven-point Likert scale. The diagonal values signify AVE. The lower diagonal value denotes the correlation between the constructs, whereas the upper diagonal values signify the squared correlation between the constructs.

their knowledge of farmed fish was classified into various levels to gain in-depth insights. The seven-point Likert scale ranged from 7, strongly agree, to 1, strongly disagree. The mean and standard deviations of reliable and valid measurements were used to categorise the respondents' perceived knowledge of farmed fish into three groups: low, medium, and high. The overall form to classify this knowledge was as follows:

$$Y^*(Knowledge) \begin{cases} Y = 1 \text{ if mean scale scores} < (\bar{x} - SD) \\ Y = 2 \text{ if } (\bar{x} - SD) < \text{mean scale scores} < (\bar{x} + SD) \\ Y = 3 \text{ if mean scale scores} > (\bar{x} + SD) \end{cases}$$

where  $\bar{X}$  is the mean of farmed fish knowledge, and SD is the standard deviation. To determine the factors that influence perceived knowledge, the response variable calculated above was then regressed on the AT, CA, and a set of socio-economic variables, using the Oprobit model described below.

### 3.3. Econometric model

Since the response variables of main interest, the factors that determine consumers' perceived knowledge (at three levels), had an ordinal categorical nature, to analyse such polychotomous response data, the Oprobit model was employed. For the model, let:

$$y^* = x_i'\beta + \varepsilon_i \dots (1)$$

When an intercept coefficient is considered in the model,  $\varepsilon_i$  is normalised to a zero value [89], meaning that  $\varepsilon_i$  is normally distributed with zero mean and unit variance. When  $y^*$  is the dependent variable that indexes the level of households' perceived knowledge,  $X$  is a vector of parameters to be estimated  $I$  and  $\varepsilon$  is the error term. The responses of these categories are thus observed when the underlying continuous response falls in these three intervals as:

$$\begin{aligned} y &= 1 \text{ if } y^* < \mu_1 \\ &= 2 \text{ if } \mu_1 < y^* < \mu_2 \\ &= 3 \text{ if } y^* > \mu_2 \dots (2) \end{aligned}$$

The  $\mu$ 's are unknown threshold parameters to be estimated with  $\beta$ . These determine the estimations for the different observed values of  $y^*$  and can be interpreted as intercepts in equation (1). Therefore, the probabilities for each of the observed ordinal responses (1, 2, 3) will be given as:

$$prob(Y = 1) = P(Y^* < \mu_1) = P(x_i'\beta + \varepsilon < \mu_1) = \Phi(-x_i'\beta) \dots (3)$$

$$prob(Y = 2) = \Phi(\mu_1 - x_i'\beta) - \Phi(-x_i'\beta) \dots (4)$$

$$prob(Y = 3) = 1 - \Phi(\mu_1 - x_i'\beta) \dots (5)$$

For the above probabilities, the corresponding marginal effects of the changes in the explanatory variables are:

$$\frac{\partial prob(Y = 1)}{\partial x} = \Phi(-x_i'\beta)\beta \dots (6)$$

$$\frac{\partial prob(Y = 2)}{\partial x} = [\Phi(\mu_1 - x_i'\beta) - \Phi(-x_i'\beta)]\beta \dots (7)$$

$$\frac{\partial prob(Y = 3)}{\partial x} = [\Phi(\mu_1 - x_i'\beta)]\beta \dots (8)$$

The Oprobit analysis then tests the model fit by examining the fit indexes and criteria. The model's log-likelihood = -788.1282, and the pseudo  $R^2 = 0.0631$ . In addition, the probability of the model likelihood ratio  $\chi^2(16) = 106.16$  was 0.000, which is lower than the recommended

**Table 5**  
Demographic profile of the sampled households.

Sample size (households)	1041
<b>Age (mean ± SD)</b>	40.92 ± 13.39
<b>Gender (%)</b>	
Male	69.30
Female	29.10
Did not want to specify	01.60
<b>Income in BDT ('000s) (mean ± SD)</b>	47.63 ± 30.29
<b>Children (aged 1–16) in household (%)</b>	
Yes	53.20
No	46.80
<b>Number of family members (mean ± SD)</b>	4.68 ± 2.35
<b>Education in years (mean ± SD)</b>	13.88 ± 3.85
<b>Profession (%)</b>	
Job holder	41.60
Self-employed or other	58.40
<b>Do food shopping personally for the family (%)</b>	
Yes	60.80
No	39.20
<b>Overall fish eating (%)</b>	
Less than once/month	3.20
Once/month	2.20
Several times/month	17.80
Once/week	9.30
Several times/week	54.10
Daily	13.40
<b>I buy fish from (%)</b>	
Wet market	60.20
Supermarket	07.40
Both markets	32.40
<b>Registered membership of an environmental organisation (%)</b>	
Yes	14.20
No	85.80

Note: BDT 85 = 1 USD; SD = Standard Deviation.

level of significance of 0.010 (the  $p < 0.01$ ). Consequently, it is established that the model fits the data.

#### 4. Results and discussion

Table 5 shows the sample demographics and socio-economic variables. Most of the participants (69.30%) were male and 53.20% had children aged between 1 and 16. The respondents' average monthly income was BDT 47,630 (USD 1 = BDT 85), reflecting Bangladesh's middle-class income category, ranging between \$2 and \$20 per day [82]. The mean number of each respondent's family members was almost five. The respondents had an average of almost 14 years' education. The descriptive figures indicate that 60.80% personally shopped for their family members; 58.40% were self-employed; 54.10% consumed fish several times a week; and 60.20% bought fish from the wet markets (see Table 5). The figures summarising these demographic and socio-economic factors are consistent with recent studies in Bangladesh [7,30].

The study predicted the impact of AT, CA, and socio-demographics on consumers' perceived FF knowledge by employing the Oprobit model, which is frequently used in economics and marketing research [90]. We interpreted the estimated Oprobit parameters shown in Table 6. The outcomes show the effects of the consumers' personal and socio-demographic variables on their farmed fish knowledge.

Ambiguity tolerance significantly impacted consumers' perceived FF knowledge. This outcome is consistent with previous studies [17,91], which report that AT positively and significantly affects FF knowledge. Hence, up to a certain level, consumers are comfortable with the conflicting direction of the production process and multiple demands for the product. The role of AT as an antecedent of FF knowledge is established by the hypothesis, demonstrating that consumers prefer ambiguous prospects when making decisions [92,93]. Second, although a positive link between CA and FF knowledge is shown, confused consumers choose to acquire the appropriate FF knowledge insignificantly, as the

**Table 6**  
Effect of ambiguity tolerance, confusion avoidance and socio-economic factors on perceived FF knowledge in the ordered probit model.

Variable	Coefficient	S.E.	z-ratio	95% Conf. Interval
Ambiguity tolerance	0.261***	0.044	5.87	[0.174, 0.348]
Confusion avoidance	0.034	0.037	0.91	[-0.039, 0.107]
Age	0.003	0.003	0.98	[-0.003, 0.009]
Male	0.254	0.299	0.85	[-0.333, 0.842]
Female	0.221	0.305	0.72	[-0.377, 0.819]
Income	-0.250	0.213	-1.17	[-0.669, 0.168]
Years of education	-0.010	0.010	-1.01	[-0.030, 0.009]
Children in family	0.008	0.077	-0.12	[-0.160, 0.142]
Number of family members	0.002	0.016	0.13	[-0.029, 0.034]
Personally does fish shopping	0.189**	0.082	2.30	[0.028, 0.350]
Low fish consumption	-0.092	0.181	-0.51	[-0.447, 0.262]
High fish consumption	0.216***	0.086	2.51	[0.047, 0.385]
Job as profession	-0.018	0.077	-0.24	[-0.171, 0.133]
Shops at wet market	0.110	0.085	1.94	[-0.056, 0.277]
Shops at supermarket	-0.437***	0.158	-2.76	[-0.749, -0.126]
Membership of environmental organisation	-0.270***	0.109	-2.49	[-0.488, -0.058]
N = 1041	Pseudo-R <sup>2</sup> = 0.0631, LR $\chi^2$ (16) = 106.16, Prob. ( $\chi^2$ ) = 0.0000; Log likelihood = -788.12825			

S.E. = Standard errors; \*\*\* $p < 0.01$ . \*\* $p < 0.05$ . \* $p < 0.1$ . Parameter estimates from ordered probit regression model.

average level of confusion faced by them in their purchase intention is not the same as that they experienced during the response time [94]. The study by Hoque et al. (2021) [60] found that a high level of perceived CA does not affect the intention to purchase farmed fish. As AT influences CA positively, this study supports the hypothesis that firms' strategy of increasing the level of AT could help improve CA. Alternatively, consumers may follow strategies to reduce their confusion in order to increase their perceived product awareness [95] and they tend to increase product familiarity to reduce product-related uncertainty [96]. Furthermore, fisheries can take initiatives to encourage confused consumers to follow salespeople's recommendations and clarify fish buying goals.

Amongst the various socio-economic variables, doing fish shopping personally significantly and positively affected knowledge of the product. Individuals with higher fish consumption and who do their fish shopping personally are more likely to gather FF knowledge. This finding implies that consumers have a physical interaction with the FF product. As product knowledge is positively associated with shoppers' search effort [97] and ongoing searches appear to be vital elements in the marketplace [98], shoppers wish to experience products physically before making a purchase [99]. Secondly, those who eat a large quantity of fish are more likely to prefer to perceive have knowledge of farmed fish. Generally, frequent fish consumption makes consumers aware of food security. As this cannot be achieved without food safety, in order to know about fish safety, consumers need to have a keen interest in receiving and learning more about food safety-related information about FF. In addition, the wet markets are less supervised; over 60% of the sampled consumers buy fish from these, which provide less information to buyers than supermarkets. To find the required fish traceability information, customers who buy fish from wet markets consider FF knowledge to be important.

Alternatively, shopping at supermarkets significantly negatively impacts consumers with higher FF knowledge. Customers are more exposed to supermarket-specific information than in wet markets. Supermarkets display information regarding vitamin, mineral and sugar levels to encourage consumers to use such nutritional information [100]. Environmental organisation membership negatively affects consumers with lower-level FF knowledge. This indicates that individuals who are members of environmental organisations are confident that they already have the required knowledge regarding FF, which may help them make appropriate decisions about aquaculture products and the environment. Therefore, they are more likely to reject a high level of information about FF. Such a conclusion is consistent with the study by Smythe & Brook (1980) [101]. Finally, consumers' age, gender, income, education, profession, number of family members, low frequency of fish consumption and presence of children in the family do not significantly influence perceived FF knowledge.

The classifications of knowledge into low, medium and high levels effectively reflect the concept of prior product knowledge [102]. Accordingly, we categorised the dependent variable, FF knowledge, into high, medium and low groups; Oprobit can be an accurate prediction technique in such a categorical situation [103]. As the response variables which determine consumers' perceived FF knowledge (low, medium or high) are of an ordinal categorical nature, the AT and CA personality trait and socio-demographics impacts on perceived knowledge (low, medium or high) were assessed with the marginal effects in the ordered probit analysis (see Table 7). The outcomes revealed that

**Table 7**  
Marginal effects of Socio-economic Factors on Level-wise Perceived FF Knowledge in the Ordered Probit Model.

Variable	Low knowledge (Level 1)	Medium knowledge (Level 2)	High knowledge (Level 3)
	Marginal coefficient (S.E.)	Marginal coefficient (S.E.)	Marginal coefficient (S.E.)
Ambiguity tolerance	-0.0466 (0.0082) ***	-0.0170 (0.0054) ***	0.0636 (0.0109) ***
Confusion avoidance	-0.0061 (0.0066)	-0.0022 (0.0025)	0.0083 (0.0091)
Age	-0.0005 (0.0005)	-0.0001 (0.0002)	0.0007 (0.0007)
Male	-0.0483 (0.0605)	-0.0106 (0.0070)	0.0590 (0.0660)
Female	-0.0372 (0.0485)	-0.0190 (0.0328)	0.0563 (0.0810)
Income	0.0044 (0.0382)	0.0162 (0.0146)	-0.0610 (0.0521)
Years of education	0.0018 (0.0018)	0.0006 (0.0006)	-0.0024 (0.00247)
Children in family	0.0015 (0.0137)	0.0005 (0.0050)	-0.0021 (0.0188)
Number of family members	-0.0003 (0.0029)	-0.0001 (0.0010)	0.0005 (0.0039)
Does fish shopping personally	-0.0346 (0.0155) **	-0.0104 (0.0050) **	0.0451 (0.0191) ***
Low fish consumption	0.0173 (0.0358)	0.00421 (0.005)	-0.0215 (0.0405)
High fish consumption	-0.0405 (0.0170) ***	-0.0101 (0.0045) **	0.0507 (0.0194) ***
Job as profession	0.0033 (0.0139)	0.0012 (0.0049)	-0.0046 (0.0189)
Shops at wet market	-0.0200 (0.0156)	-0.0065 (0.0050)	0.0266 (0.0202)
Shops at supermarket	0.0974 (0.0424) **	-0.0101 (0.0190)	-0.0873 (0.0251) ***
Member of environmental organisation	0.0549 (0.0246) **	0.0051 (0.0056)	-0.0600 (0.0216) ***
N = 1041	y = Prob. (Low level knowledge) (predict, outcome (1)) = 0.1023	y = Prob. (Medium level knowledge) (predict, outcome (2)) = 0.7374	y = Prob. (High level knowledge) (predict, outcome (3)) = 0.1602

S.E. = Standard errors in parentheses; \*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1; parameter estimates from the ordered probit regression model.

ambiguity tolerant consumers were less likely to gain a low or medium level of knowledge. Such behavioural outcomes support the robustness of the findings of the regular Oprobit model provided in Table 6 and indicate that such consumers are highly interested in having a high level of FF knowledge. In addition, consumers who eat fish very frequently and shop for it themselves are less likely to display a low or medium level of knowledge, meaning they are only interested in having a high level of such knowledge. On the contrary, the environmental organisation member and those who shop for fish at supermarkets are confident enough to understand and interpret FF attributes. Therefore, they are more likely to have a low level of FF knowledge.

### 5. Conclusion, implications and future research directions

While the literature widely supports the role of product knowledge in strengthening consumers' buying decisions, few studies have been conducted to explain the effect of such knowledge. Following this line of thought, this study has examined the impact of two farmed fish food knowledge antecedents, ambiguity tolerance and confusion avoidance, together with relevant socio-economic factors. The scope of the research was the growing aquaculture industry in the emerging market of Bangladesh. The research questions were posited based on existing theories and the outcomes of previous studies and answered accordingly, with analysis of the survey data. The survey was conducted using a direct interview approach with a standardised questionnaire. We explored different items suggested by the literature to assess ambiguity tolerance, confusion avoidance, and farmed fish knowledge. We then utilised exploratory factor analysis to discover the factor structure and subsequently form the latent variables with reliable and valid statements. These statements were only employed in calculating the independent and dependent variables. The ordered probit regression assessed the impact of ambiguity tolerance, confusion avoidance, and socio-economic factors on the three categories (low, medium and high) of farmed fish knowledge.

It is concluded that a higher level of ambiguity tolerance amongst consumers can positively influence their perceived knowledge of farmed fish. However, their preference for avoiding confusion does not significantly or positively impact on gaining FF knowledge. In relation to socio-economic factors, we found that a high level of fish consumption and personal fish shopping positively influenced the level of knowledge acquisition about farmed fish and that shopping in the supermarket and environmental organisation membership negatively and significantly influenced it. Such findings indicate that behavioural market segmentation significantly affects perceived knowledge of farmed fish, whereas the influence of demographics is insignificant. If demographic market segmentation is inadequate to analyse such knowledge, marketers should focus more on geographic (country, city, urban, climate) and psychographic market segmentation (personality traits, attitudes, lifestyles, beliefs, motivation, values etc.) in order to enhance consumers' perceived knowledge of farmed fish. The findings contribute to the literature by establishing the influence of two personality traits, namely ambiguity tolerance and confusion avoidance, in enhancing the seafood product knowledge that promotes the success of the farmed fish market in Bangladesh and other emerging economies.

From the managerial perspective, the paper demonstrates that consumers with a higher ambiguity tolerance level are more knowledgeable about farmed fish. The evidence reveals that adaptation to change, risk information, and alternatives developed to solve aquaculture problems could help increase consumers' ambiguity tolerance. Such an increase would encourage them to be willing to innovate, engage in creativity, and develop their esthetic preferences. Such creativity could help them be more conscious about fish production methods, safety issues related to fish preservation, and the use of ethical and sustainability labels for fish and fish products. To meet these creative goals, aquaculture innovators should implement a high level of aquatic technology to prevent diseases; introduce biologically-reliable feed conversion ratios to

replace fishmeal and ensure ethical, safe and sustainable aquaculture; establish blockchains, and avoid the mislabelling of seafood. Such creative initiatives would motivate consumers to find out and learn more about aquaculture, thus increasing their level of ambiguity tolerance to farmed fish.

Second, since consumers' ambiguity tolerance affects confusion avoidance positively, and as confusion avoidance has no significant effects on the gaining of knowledge, marketers should focus on initiatives to enhance AT. Strategies to reduce consumers' confusion about farmed fish could also help increase knowledge. Information about farmed fish which states particular fish attributes, their comparative advantages, and the benefits of consuming fish food, together with provision of post-sale services to consumers, may help reduce confusion. In turn, this could motivate consumers to gain knowledge about farmed fish, making them enthusiastic about processing and gaining more related information. Therefore, suppliers could adopt an information-based approach to help consumers acquire such knowledge. Such an approach could provide the most desired information (e.g., nutrition, food safety, and sustainability) to improve farmed fish knowledge and add value to the community. Because of their tradition and culture, Bangladeshi consumers eat a large amount of fish, which they are most likely to buy personally from the market. These fish consumption tendencies and responsible buying behaviour may also motivate them to find out the relevant and necessary information about farmed fish.

Additionally, fish farmers and aquaculture innovators could campaign to persuade people to buy fish personally from the wet market and encourage involvement in volunteer environmental organisations. Such activities could help increase consumers' involvement in aquaculture products and allow them to know more about farmed fish and their effects on the environment. High frequency of fish consumption could also make consumers curious and subsequently learn about farmed fish. Current literature lacking the requisite help to provide the antecedents of seafood knowledge, which in turn affects consumers' perceived knowledge. Therefore, this paper encourages marketers and other stakeholders to obtain a competitive edge in farming commercially by resolving the factors affecting perceived aquaculture product knowledge.

Finally, the influence of psychology and socio-economic factors on understanding the level of farmed fish knowledge would be an essential addition to applied agriculture and food research, allowing farmed fish

stakeholders to consider customer behaviour in a new dimension. However, this study does suffer from some limitations. Other large cities in Bangladesh such as Khulna, Barisal, Sylhet and Rangpur could be included in the sample. While more efficient methods (e.g., Logit regression) are recommended, the model fitness and statistical indicators demonstrate good credentials for the baseline analysis. Further research is encouraged to consider the sensory/organoleptic properties of fish to help increase farmed fish knowledge and its consumption, benefitting both consumers and the aquaculture industry. Future studies could also cover a greater range of antecedent contexts of farmed fish knowledge, such as consumers' specific beliefs, perceived threats, lifestyles, and motivations.

#### Author contributions

Conceptualization, M.Z.H.; Methodology, M.Z.H.; Software, M.Z.H., A.H.; Validation, A.H., M.T.M.F, N.S.; Formal Analysis, M.Z.H. A.H.; Investigation, M.T.M.F, N.S. A.H.; Resources, M.Z.H., N.S. M.T.M.F; Data Curation, M.Z.H. N.S.; Writing-Original Draft Preparation, M.Z.H., N.S., A.H.; Writing-Review & Editing, M.Z.H., N.S., M.T.M.F; Visualization, M.Z.H., A.H., M.T.M.F, N.S.; Supervision, M.Z.H., A.H., M.T.M.F; Project Administration, M.T.M.F., A.H.; Funding Acquisition, M.Z.H.

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## Appendix A

Exploring Antecedents of Product Knowledge of Farmed Fish (an Aquaculture Product): Survey Questionnaire, November 2019.

This questionnaire survey is the part of our academic study about the knowledge of farmed fish. The aim is to measure the effects of ambiguity tolerance and confusion avoidance on consumers' knowledge. Please fill in the first choice that comes to your mind, as this is probably closest to your real perception, choice or payment behaviour in markets. There are no risks or benefits related to filling in the survey and all the information you provide will remain completely confidential. Note that all data will be used anonymously for academic purposes as suggestions to estimate the impact of consumer personality traits and socio-economic variables on their perceived value of knowledge concerning farmed fish.

The survey comprises a direct interview method and mostly involves self-report rating statements. It is divided into two parts. First, we will ask you to choose one level out of seven related to various statements. In the second phase, we will ask you to answer some socio-demographic questions. It will take around 15 min to fill in the questionnaire.

### Section 1

#### Cheap talk

Please read the texts below carefully, and then go to section 2.

**Consumer ambiguity** is the absence of the information required for consumers to understand a situation or identify a given future state. For consumers, the remanufacturing process may be a source of ambiguity.

**Consumer confusion** indicates a state of mind that makes them make imperfect buying decisions or means they lack confidence in the accuracy of such decisions. In the eyes of consumers, an overwhelmingly large set of purchasing options can be a source of confusion.



**Section 2**

*Product Knowledge*

PK1: To fulfil dietary requirements, obtaining vitamins by eating fresh farmed fish is more important for me than searching for fresh wild fish.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

PK2: Genetically-engineered fresh farmed fish are not as nutritious as fresh wild fish.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

PK3: The good thing about fresh farmed fish is its availability.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

PK4: Pangas is the cheapest fresh farmed fish.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

PK5: The next cheapest fresh farmed fish, I think, would be tilapia.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

PK6: The fat content of fresh farmed rui (Labeo rohita) is not harmful in terms of calories.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

*Ambiguity Tolerance*

AT1: People who fit their lives to a schedule probably miss most of the joy of living.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

AT2: It is more fun to tackle a complicated problem than to solve a simple one.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

AT3: Often the most interesting and stimulating people are those who don't mind being different and original.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

AT4: People who insist upon a ‘yes’ or ‘no’ answer do not know how complex things really are.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

AT5: Many of our most important decisions are based upon insufficient information.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

*Confusion Avoidance*

CA1: I am capable of thinking with clarity or quickness.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

CA2: I enjoy troubleshooting, which can create confusion.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

CA3: I think the violation of product trademarks is the origin of confusion.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

CA4: I expect to see farmed fish species with a common name in all markets.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

CA5: I prefer food with a label to that without one.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

CA6: I do not consider the externalities while I buy farmed fish.

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

## Section 3: Sociodemographic Data

- a) Age: .....
- b) Gender:  Male  Female
- c) Income/month (Taka) : .....
- d) Children (age 1-16) in household:  Yes  No
- e) Number of family members: .....
- f) Years of education: .....
- g) Profession:  Self-employed  Job holder
- h) Do you do most of the food shopping for your family?  Yes  No
- i) Overall fish consumption:  Less than once/month  Once/month  Several times  
/month  Once/week  Several times/week  Daily
- j) I buy fish from:  Wet markets  Supermarkets  Both
- k) Are you a registered member of any environmental (volunteer) organisation?  
 Yes  No

Thank you in advance for your cooperation!

## References

- [1] T.R. Gormley, Fish as a functional food, *Food Sci. Technol.* 20 (3) (2006) 25–28.
- [2] N.V. Raman, J.D. Leckenby, Factors affecting consumers' "Webad" visits, *Eur. J. Market.* 32 (7/8) (1998) 737–748, <https://doi.org/10.1108/03090569810224128>.
- [3] Z. Pieniak, W. Verbeke, J. Scholderer, Health-related beliefs and consumer knowledge as determinants of fish consumption, *J. Hum. Nutr. Diet.* 23 (5) (2010) 480–488.
- [4] D. Menozzi, T.T. Nguyen, G. Sogari, D. Taskov, S. Lucas, J.L.S. Castro-Rial, C. Mora, Consumers' preferences and willingness to pay for fish products with health and environmental labels: evidence from five European countries, *Nutrients* 12 (9) (2020) 2650, <https://doi.org/10.3390/nu12092650>.
- [5] D. Pulcini, S. Franceschini, L. Buttazzoni, C. Giannetti, F. Capoccioni, Consumer preferences for farmed seafood: an Italian case study, *J. Aquat. Food Prod. Technol.* 29 (5) (2020) 445–460.
- [6] T.A.C. Gordon, H.R. Harding, F.K. Cleve, I.K. Davidson, W. Davison, D. W. Montgomery, E.M. Santos, Fishes in a changing world: learning from the past to promote sustainability of fish populations, *J. Fish. Biol.* 92 (3) (2018) 804–827.
- [7] M.Z. Hoque, M.N. Alam, Consumers' knowledge discrepancy and confusion in intent to purchase farmed fish, *Br. Food J.* (2020).
- [8] B. Bovenkerk, F.L. B. Meijboom, The moral status of fish. The importance and limitations of a fundamental discussion for practical ethical questions in fish farming, *J. Agric. Environ. Ethics* 25 (2012) 843–860.
- [9] A. Kole, A.A.M. Schelvis-Smit, M. Veldman, J.B. Luten, Consumer perception of wild and farmed cod and the effect of different information conditions, *Netherlands Institute for Fisheries Research*, 2003. No. C047/03.
- [10] J.C. Torelli, K.A. Monga, Doing poorly by doing good: corporate social responsibility and brand concepts, *J. Consum. Res.* 38 (5) (2012), <https://doi.org/10.1086/660851>.
- [11] Y. Kim, M.S. Choi, Antecedents of green purchase behavior: an examination of collectivism, environmental concern, and PCE, in: *Advances in Consumer Research*, 32, Association for Consumer Research, (U.S.), 2005, pp. 592–599, 1.
- [12] M.M. Mostafa, Shades of green: a psychographic segmentation of the green consumer in Kuwait using self-organizing maps, *Expert Syst. Appl.* 36 (2009) 11030–11038, <https://doi.org/10.1016/j.eswa.2009.02.088>.
- [13] C.W. Park, L.D. Mothersbaugh, F. Lawrence, Consumer knowledge assessment, *J. Consum. Res.* 21 (1) (1994) 71–82, <https://doi.org/10.1086/209383>.
- [14] J. J. Mkunda, B. Chachage, L. Kusiluka, L. Paspape, Consumers' Product Knowledge and Attitudes as Determinants of Buying Intention of Processed Sardine Product: Case of Lake Victoria, *Innovation and Markets for Lake Victoria Fisheries, IMLAF* Project, 2019.
- [15] I. Phau, V. Suntornnond, Dimensions of consumer knowledge and its impacts on country of origin effects among Australian consumers: a case of fast-consuming product, *J. Consum. Market.* 23 (1) (2006) 34–42.
- [16] W. Verbeke, I. Sioen, K. Brunso, S. De Henauw, J. Van Camp, Consumer perception versus scientific evidence of farmed and wild fish: exploratory insights from Belgium, *Aquacult. Int.* 15 (2) (2007) 121–136, 2007.
- [17] B.T. Hazen, R.E. Overstreet, L.A. Jones-Farme, H.S. Field, The role of ambiguity tolerance in consumer perception of remanufactured products, *Int. J. Prod. Econ.* 135 (2) (2012) 781–790.
- [18] D. Ghosh, M.R. Ray, Risk, ambiguity, and decision choice: some additional evidence, *Decis. Sci. J.* 28 (1) (1997) 81–104.
- [19] K. Matzler, D. Stieger, J. Fuller, Consumer confusion in internet-based mass customization: testing a network of antecedents and consequences, *J. Consum. Pol.* 34 (2) (2011) 231–247.
- [20] C. Cardoso, H. Lourenço, S. Costa, S. Gonçalves, M.L. Nunes, Survey into the seafood consumption preferences and patterns in the Portuguese population, *Gender and regional variability, Appetite* 64 (2013) 20–31.
- [21] A. Claret, L. Guerrero, I. Gartzia, M. Garcia-Quiroga, R. Ginés, Does information affect consumer liking of farmed and wild fish? *Aquaculture* 454 (2016) 157–162.
- [22] H.E. Froehlich, R.R. Gentry, M.B. Rus, D. Grimm, B.S. Halpern, Public perceptions of aquaculture: evaluating spatiotemporal patterns of sentiment around the world, *PLoS One* 12 (1) (2017), e0169281.
- [23] T. Altintzoglou, W. Verbeke, F. Vanhonacker, J. Luten, The image of fish from aquaculture among Europeans: impact of exposure to balanced information, *J. Aquat. Food Prod. Technol.* 19 (2) (2010) 103–119.
- [24] S. Budner, Tolerance for ambiguity scale, *J. Pers.* 30 (1) (1962) 29–50.
- [25] D. Ellsberg, Risk, ambiguity, and the Savage axioms, *Q. J. Econ.* (1961) 643–669.
- [26] G. Sogari, C. Corbo, M. Macconi, D. Menozzi, C. Mora, Consumer attitude towards sustainable-labelled wine: an exploratory approach, *Int. J. Wine Bus. Res.* (2015).
- [27] G. Walsh, T. Hennig-Thurau, V.W. Mitchell, Consumer confusion proneness: scale development, validation, and application, *J. Market. Manag.* 23 (7-8) (2007) 697–721.
- [28] J. Wiseman, Beliefs about food components, foods, fat and heart disease in New Zealand, *Br. Food J.* (1994).

- [29] M.M. Dey, Analysis of demand for fish in Bangladesh, *Aquacult. Econ. Manag.* 4 (1-2) (2000) 63–81.
- [30] M.Z. Hoque, Sustainability indicators for sustainably-farmed fish in Bangladesh, *J. Sustain. Prod. Consum.* 27 (2020) 115–127, <https://doi.org/10.1016/j.spc.2020.10.020>.
- [31] Food and Agriculture Organization, The State of World Fisheries and Aquaculture—Meeting the Sustainable Development Goals, Rome, 2018.
- [32] M.M. Shamsuzzaman, M.M. Islam, J.N. Tania, A.A.M. Mamun, P.P. Barman, X. Xu, Fisheries resources of Bangladesh: present status and future direction, *Aquacult. Fish.* 4 (2017).
- [33] Food and Agriculture Organization, Sustainability in Action, State of World Fisheries and Aquaculture, Rome, 2020.
- [34] A. Claret, L. Guerrero, R. Ginés, A. Grau, M.D. Hernández, E. Aguirre, C. Rodríguez-Rodríguez, Consumer beliefs regarding farmed versus wild fish, *Appetite* 79 (2014) 25–31.
- [35] Food and Agriculture Organization, The State of World Fisheries and Aquaculture, Contributing to Food Security and Nutrition for All, 2016.
- [36] OECD, “Business, Insights on Emerging Markets 2020, OECD Emerging Markets, 2020.
- [37] DoF, Yearbook of fisheries statistics of Bangladesh 2016-17, Dhaka, Bangladesh, in: Yearbook of Fisheries Statistics of Bangladesh 2017-18, DoF, Dhaka, Bangladesh, 2018.
- [38] BFRI, BFRI Annual Progress Report 2015-16, Mymensing, Bangladesh.
- [39] R.S.V. Pullin, in: R.S.V. Pullin, H. Rosenthal, J.L. Maclean (Eds.), An Overview of Environmental Issues in Developing Country Aquaculture, ICLARM, 1993.
- [40] T.V.R. Pillay, Aquaculture and the Environment, John Wiley & Sons, 2008.
- [41] J.A. Gephart, C.D. Golden, F. Asche, B. Belton, C. Brugere, H.E. Froehlich, E. H. Allison, Scenarios for global aquaculture and its role in human nutrition, in: *Reviews in Fisheries Science & Aquaculture*, 2020, pp. 1–17.
- [42] B. Aarset, S. Beckmann, E. Bigne, M. Beveridge, T. Bjørndal, J. Bunting, J. Young, The European consumers’ understanding and perceptions of the “organic” food regime, *Br. Food J.* (2004).
- [43] W.C. Valenti, J.M. Kimpara, B.D.L. Preto, P. Moraes-Valenti, Indicators of sustainability to assess aquaculture systems, *Ecol. Indic.* 88 (2018) 402–413.
- [44] M. Hoque, N. Akhter, Z. Mawa, Consumers’ willingness to pay (WTP) for organically farmed fish in Bangladesh, *J. Agric. Appl. Econ.* (2021) 1–28. <https://doi.org/10.1017/aae.2021.12>.
- [45] R.S. Bhandari, A. Bansal, A comparison of psychological and socio-economic factors affecting individual user’s social media behaviour, *FIIB Business Rev.* 7 (2) (2018) 126–134, <https://doi.org/10.1177/2319714518789759>.
- [46] W.R. King, Knowledge transfer, in: *Encyclopedia of Knowledge Management*, second ed., 2011, pp. 967–976. IGI Global.
- [47] K. Walley, L. Cheng, T. Liu, Antecedent factors impacting country of origin (COO): an investigation into food provenance in China, *Transnatl. Market. J.* 7 (1) (2019).
- [48] C.M. Ely, Tolerance of ambiguity and use of second language strategies, *Foreign Lang. Ann.* 22 (5) (1989) 437–445.
- [49] S.K. Kamran, Effect of gender on ambiguity tolerance of Iranian English language learners, *J. Educ. Pract.* 2 (11) (2011) 25–32.
- [50] S. Dubikovsky, Does experience with collaborative problem-based projects alter student’s tolerance for ambiguity, in: *Proceedings of Joint International Conference on Engineering Education and International Conference on Information Technology*, 2014, pp. 2–6.
- [51] E. Frenkel-Brunswick, Intolerance of ambiguity as an emotional and perceptual personality variable, *J. Pers.* (1949).
- [52] A. Furnham, J. Marks, Tolerance of ambiguity: a review of the recent literature, *Psychology* 4 (9) (2013) 717–728.
- [53] A. Furnham, B. Gunter, Corporate culture: definition, diagnosis and change, *Int. Rev. Organiz. Psychol.* 8 (1993) 233–261.
- [54] G. Hofstede, Culture’s Consequences: International Differences in Work Related Values, SAGE, Beverly Hills, CA, 1980.
- [55] J. Hancock, K. Mattick, Tolerance of ambiguity and psychological well-being in medical training: a systematic review, *Medical education* 54 (2) (2020) 125–137.
- [56] V.W. Mitchell, G. Walsh, M. Yamin, Towards a conceptual model of consumer confusion, in: *NA - Advances in Consumer Research*, Association for Consumer Research, 32, 2005, pp. 143–150.
- [57] B. Mitchell, Depression Decade: from New Era through New Deal, 2019, pp. 1929–1941.
- [58] V.W. Mitchell, V. Papavassiliou, Marketing causes and implications of consumer confusion, *J. Prod. Brand Manag.* (1999).
- [59] C.S. Hayes, G.K. Wilson, V.E. Gifford, Experiential avoidance and behavioral disorders: a functional dimensional approach to diagnosis and treatment, *J. Consult. Clin. Psychol.* 64 (6) (1996) 1152–1168.
- [60] M.Z. Hoque, M.A. Bashar, F. Akhter, Ambiguity tolerance and confusion avoidance in the intent to purchase farmed fish, *J. Appl. Aquacult.* (2021). <https://doi.org/10.1080/10454438.2021.1872462>.
- [61] V.T. Dang, Information Confusion and Intention to Stop Using Social Networking Site: a Moderated Mediation Study of Psychological Distress and Perceived Novelty, *Information Technology & People*, 2020.
- [62] D.L. McLain, E. Kefallonitis, K. Armani, Ambiguity tolerance in organizations: definitional clarification and perspectives on future research, *Front. Psychol.* 6 (2015) 344.
- [63] S.H. Lee, J.E. Workman, K. Jung, Brand relationships and risk: influence of risk avoidance and gender on brand consumption, *J. Open Innov. Technol. Mark. Complex* 2 (2016) 14–15.
- [64] D. Awasthy, A. Banerjee, B. Banerjee, Understanding the Role of Prior Product, 2012.
- [65] T. Altintzoglou, M. Heide, Fish quality and consumers: how do consumers’ knowledge about and involvement in fish quality define factors that influence fish buying behavior? *J. Aquat. Food Prod. Technol.* 25 (6) (2016) 885–894.
- [66] K. N’Souvi, C. Sun, A. Egbendewe-Mondzozo, K.K. Tchakah, B.N. Alabi-Doku, Analysis of the impacts of socioeconomic factors on hiring an external labor force in tilapia farming in Southern Togo, *Aquacult. Fish.* 6 (2) (2021) 216–222.
- [67] R.M.V. Flores, M.X.P. Filho, Effect of socio-economic variables on fish production of small farmers in Tocantins State, Brazil, *J. Agric. Sci. Technol. B* 4 (2014) 331–339.
- [68] Ø. Myrland, T. Trondsen, R.S. Johnstone, E. Lund, Determinants of seafood consumption in Norway: lifestyle, revealed preferences, and barriers to consumption, *Food Qual. Prefer.* 11 (3) (2000) 169–188.
- [69] S.O. Olsen, Understanding the relationship between age and seafood consumption: the mediating role of attitude, health involvement and convenience, *Food Qual. Prefer.* 14 (3) (2003) 199–209.
- [70] M. Tomić, Z. Lucevic, T. Tomljanović, D. Matulić, Wild-caught versus farmed fish – consumer perception, *Croat. J. Fish.* 75 (2017) 41–50.
- [71] R. Sellers-Rubio, J.L. Nicolau-Gonzalez, Estimating the willingness to pay for a sustainable wine using a Heckit model, *Wine Econ. Pol.* 5 (2) (2016) 96–104.
- [72] G. Szolnoki, D. Hoffmann, Online, face-to-face and telephone surveys—comparing different sampling methods in wine consumer research, *Wine Econ. Pol.* 2 (2) (2013) 57–66.
- [73] T. Garcia, R. Barrena, I. Grande, The wine consumption preferences of young people: a Spanish case study, *Int. J. Wine Bus. Res.* (2013).
- [74] D. Pearson, J. Henryks, P. Sultan, T. Anisimova, Organic food: exploring purchase frequency to explain consumer behaviour, *J. Organ. Syst.* 8 (2) (2013) 50–63.
- [75] Y. Wang, B.T. Hazen, Consumer product knowledge and intention to purchase remanufactured products, *Int. J. Prod. Econ.* 181 (2016) 460–469.
- [76] T. Trondsen, B. Braaten, E. Lund, A.E. Eggen, Health and seafood consumption patterns among women aged 45–69 years: a Norwegian seafood consumption study, *Food Qual. Prefer.* 15 (2) (2004) 117–128.
- [77] S. Needham, S.J. Funge-Smith, The consumption of fish and fish products in the Asia-Pacific region based on household surveys (Food and Agriculture Organization of the United Nations, in: Regional Office for Asia and the Pacific, 12, RAP Publication, Bangkok, Thailand, 2015.
- [78] Bangladesh Bureau of Statistics (BBS), Statistics and Informatics Division, Ministry of Planning, Bangladesh, 2019.
- [79] M.Z. Hoque, Ø. Myrland, Consumer preference for fish safety inspection in Bangladesh, *Aquaculture* 551 (2022), 737911. <https://doi.org/10.1016/j.aqua.2022.737911>.
- [80] P.M. Podsakoff, S.B. MacKenzie, J.Y. Lee, N.P. Podsakoff, Common method biases in behavioral research: a critical review of the literature and recommended remedies, *J. Appl. Psychol.* 88 (5) (2003) 879.
- [81] M. Schweizer, A.J. Kotout, T. Wagner, Scale development for consumer confusion, *Adv. Consum. Res.* 33 (1) (2006) 184–190.
- [82] J. Pallant, SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS for Windows Version 15, 2007.
- [83] M.S. Bartlett, Tests of significance in factor analysis, *Br. J. Stat. Psychol.* (1950).
- [84] D.E. Tabachnick, Heidegger’s essentialist responses to the challenge of technology, *Can. J. Pol. Sci./Revue canadienne de science politique* (2006) 487–505.
- [85] J.F. Hair, W.C. Black, B.J. Babin, R.E. Anderson, R.L. Tatham, *Multivariate Data Analysis*, New Jersey, 1998.
- [86] L.J. Cronbach, Coefficient alpha and the internal structure of tests, *Psychometrika* 16 (3) (1951) 297–334.
- [87] J.F. Hair, *Multivariate Data Analysis*, 2009.
- [88] C. Fornell, D.F. Larcker, Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics, 1981.
- [89] J.F. Hair, Successful strategies for teaching multivariate statistics, in: *Proceedings of the 7th International Conference on Teaching Statistics*, 2006.
- [90] P. Doyle, The application of probit, logit, and tobit in marketing: a review, *J. Bus. Res.* 5 (3) (1977) 235–248.
- [91] S. Wang, J. Wang, F. Yang, Y. Wang, J. Li, Consumer familiarity, ambiguity tolerance, and purchase behavior toward remanufactured products: the implications for remanufacturers, *Bus. Strat. Environ.* 27 (8) (2018) 1741–1750.
- [92] C. Camerer, M. Weber, Recent developments in modeling preferences: uncertainty and ambiguity, *J. Risk Uncertain.* 5 (4) (1992) 325–370.
- [93] G. Keren, L.E. Gerritsen, On the robustness and possible accounts of ambiguity aversion, *Acta Psychol.* 103 (1-2) (1999) 149–172.
- [94] I. Gunne, J. Matto, J. The Influence of Subjective and Objective Knowledge of Ecolabels on Consumers’ Green Purchasing Practices, 2017.
- [95] R. Lee, L. Lockshin, L. Greenacre, A memory-theory perspective of country-image formation, *J. Int. Market.* 24 (2) (2016) 62–79.
- [96] P.A. Dacin, D.C. Smith, The effect of brand portfolio characteristics on consumer evaluations of brand extensions, *J. Market. Res.* 31 (2) (1994) 229–242.
- [97] Sundaram, Ronald D. Taylor, An investigation of external information search effort: replication in in-home shopping situations, in: *NA - Advances in Consumer Research*, Association for Consumer Research, 25, 1998, pp. 440–445.
- [98] H. Peter, Bloch, L. Daniel, M. Nancy Sherrill, Ridgway, consumer search: an extended framework, *J. Consum. Res.* 13 (1) (1986) 119–126.
- [99] L. Dailey, Understanding consumers: need to personally inspect products prior to purchase, in: *NA - Advances in Consumer Research*, Association for Consumer Research, 30, 2003, pp. 146–147.

- [100] J.E. Russo, R. Staelin, C.A. Nolan, G.J. Russell, B.L. Metcalf, Nutrition information in the supermarket, *J. Consum. Res.* 13 (1986) 48–70.
- [101] P.C. Smythe, R.C. Brook, Environmental concerns and actions: a social-psychological investigation, *Can. J. Behav. Sci/Revue canadienne des sciences du comportement* 12 (2) (1980) 175.
- [102] D. Gursoy, Prior product knowledge and its influence on the traveler's information search behavior, *J. Hospit. Leisure Market.* 10 (3-4) (2003) 113–131, [https://doi.org/10.1300/J150v10n03\\_07](https://doi.org/10.1300/J150v10n03_07).
- [103] Garrido Rui, Ana Bastos, Ana de Almeida, José Paulo Elvas, Prediction of Road Accident Severity Using the Ordered Probit Model, *Transportation Research*, 2014.