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RESEARCH ARTICLE

Consumers' Willingness to Pay (WTP) for Organically Farmed Fish in Bangladesh

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Abstract
This study aims to assess the market potential for organically farmed shrimp. The rank-ordered logit model was employed to investigate consumer perceptions; the findings reveal that consumers prefer organic shrimp from mariculture, and inland-farmed shrimp to the coastal version. The willingness to pay (WTP) for conventional shrimp amongst consumers with low knowledge is less than that for organic shrimp amongst highly knowledgeable ones. In addition, the lower WTP for organic shrimp compared with safe shrimp amongst those with a medium knowledge level shows that the organically farmed shrimp market is lagging behind due to limited knowledge and confusion.

Keywords: Bangladesh; Consumer knowledge; Consumer preferences; Emerging economy; Organic shrimp; Willingness to pay
JEL Classifications: Q22

1. Introduction

Modern organic food production is attracting attention around the world because of the sustainability issues influencing individual and public health, natural and social resources, and the economy (Thøgersen, 2017). Organic food products are crucial from both the production and consumption perspective (Willer and Kilcher, 2009), with consumers considering organic food to be eco-friendly because of the natural growing methods employed (McEachern and McClean, 2002) and the use of fewer pesticides and artificial fertilizers which are harmful to the environment (Cornessen et al., 2008). A positive attitude toward food safety, environment, and healthier options over conventionally grown foods plays a vital role in positively changing attitudes toward organic foods (Azzurra et al., 2019; Hsu and Chen, 2014). Therefore, the link between food safety, health benefits, and environmental development should be strengthened to develop organic food (Shafie and Rennie, 2012).

However, the actual contribution of organic food in the competitive market is relatively low (Verhoef, 2005), with its price premium a clear obstacle to its purchase, which creates a crucial distinction between the willingness to pay (WTP) and the range of factors affecting organic food (Krystallis and Chryssohoidis, 2005). In addition, consumers cannot check the characteristics of organic food (e.g., taste, freshness, benefits to animal welfare, health, and environmental issues) when deciding to buy it. In many markets, the information on such product attributes is either unavailable or unreliable. Therefore, consumers' buying intentions and demand varies according

The data that support the findings of this study are available on request from the corresponding author, [Mohammed Ziaul Hoque]

to their gender (Winterich et al., 2009); age (Scott and Willits, 1994); family income (Stiebeling et al., 1941); household size (Richardson et al., 1996); product availability (Radam et al., 2010); and product quality (Handford et al., 2016). At present, consumers are concerned about food contamination; more specifically, they perceive that seafood contains certain chemical contaminants, so organic labeling could be considered as a positive marketing technique (O'Dierno et al., 2006). Organic food processing increases food quality, sustainability, and consumers' confidence in and acceptance of the product (European Commission, 2020). Consequently, it is imperative to understand the extent of consumers' preference for organic food (Sriwaranun et al., 2015).

Concerns about health and the environment lead to increased consumer desire to purchase "natural," "hormone-free," and "antibiotic-free" fish and shellfish (Boehmer et al., 2005), qualities which indicate sustainable and organic fish. The demand for organic fish has been rising globally due to increased population, increased consumption, rising health awareness, and increases in the price of fish abroad. Therefore, consumers have come to recognize organic farming as a production method, which can satisfy their expectations. To support organic fish farming, ecological succession has been employed in the aquaculture sector (Gandini et al., 2009). In the dominance of freshwater-dependent aquaculture, fish from organic aquaculture can be produced both in marine and brackish water (Datta, 2012). These farming opportunities resulted in an increase in organic aquaculture food production worldwide of more than 415 thousand metric tonnes in 2016 (Lernoud and Willer, 2018). However, the market share of organic aquaculture products remains small (Risius et al., 2019). There is a lack of detailed empirical research on consumer differentiation between organic and conventionally farmed aquaculture products from different sources.

The increasing demand for aquaculture products and technical and commercial opportunities have made the development of fish farming an essential topic globally. Asia leads the world in aquaculture production, with China, India, Vietnam, and Bangladesh the top producers. As Bangladesh is an emerging economy (OECD, 2020) and a riverine country, fisheries and aquaculture businesses have excellent potential (Hoque, 2020). In addition, its geographic position and cultural connotations[1] also favor Bangladesh's support of fisheries and aquaculture. To obtain the required nutrition and protein, Bangladeshis depend on aquaculture products. Currently, they are becoming wealthier and more educated, with urbanization and safety issues becoming major concerns for them (Hoque, 2020). Accordingly, as it is seen as safe and healthy food, the demand for organic products in urban areas has increased despite their high price and absence of reliable information (Iqbal, 2015). Although the trend is growing in both consumption and production sectors, the number of organic food producers, including those of farmed fish, is not keeping pace (Iqbal, 2015). This issue is more critical in Bangladesh due to its large population, the popularity of fish consumption, and the lack of reliable safety information. Despite the fact that the government and NGOs have been attempting to promote the cultivation of organic fish products, to develop consumers' preferences, and to improve the market structure, buyers' lack of knowledge is a recurrent concern for marketers and policymakers, with consumers demanding balanced information and a continuous communication flow.

The literature emphasizes that attitudes to organic food significantly influence consumers' buying intentions and behaviors. In addition, several researchers report that consumers' level of purchase of organic food is very low relative to their positive attitudes (Pearson et al., 2011). Therefore, to obtain consumers' real insights, organic food marketers need to improve and implement effective green marketing practices to support consumers' decision-making process (Suki, 2018). Green marketing practice could involve a supply chain strategy of safe, sustainable, and organic food; marketing communications for eco-friendly products; eco-labeling; and branding (Hughner et al., 2007). Accordingly, the acceptability of fish and fish farming depends on the socially responsible (e.g., organic) development of the aquaculture industry (Schlag, 2010).

[1]The historical and traditional Bangali culture of "fish and rice make a Bangali (Machh-e-bhat-e-Bangali)" also motivates them to eat more fish.

Nevertheless, unlike personal factors, situational and environmental ones have been mostly unexplored in the context of farmed fish, and more specifically, in that of organic farmed fish in emerging markets. While some attention has been focused on the problems affecting the growth and supply of farmed fish, little research has been dedicated to analyzing consumers' concerns about organically farmed fish in particular, and their preferences regarding fish farming processes and their system of origin (e.g., inland aquaculture, coastal aquaculture, or marine aquaculture). Therefore, the objective of this study is to fill this knowledge gap.

To achieve its objective, the study aims to assess the market potential for farmed fish by analyzing consumers' preferences and their WTP for organic and conventionally farmed shrimp. Such knowledge will contribute to the planning of marketing strategies, especially ones related to pricing, for organically farmed fish in domestic markets, which will ultimately benefit producers, retailers, and consumers. The study investigates Bangladeshi market segmentation by estimating the relative value of farmed fish attributes, such as aqua farming processes, prices, and aqua farming systems, all of which could influence consumers' preferences. A sample of 660 consumers from Chattogram, Dhaka, and Rangpur, Bangladesh, were interviewed in an experimental design. The collected data were analyzed with a rank-ordered logit (ROL) model.

The literature review is presented in the following section, followed by a description of consumers' perception of organic food in Bangladesh. The econometric model and data collected are then presented. Subsequently, the research results are analyzed and discussed, followed by the conclusion, which includes the study limitations and proposals for future research directions.

2. Literature Review

Organic food consumption has increased because of various food scares and consumers' awareness of food safety (Azzurra et al., 2019). The food industry is tainted by its use of artificial toxic chemicals that affect human health adversely and cause unexpected deaths (Ashraf et al., 2019; Rahman et al., 2015). A significant reason for consumers' organic food consumption is the issue of health, which influences their purchasing behavior (Carboni et al., 2000). Furthermore, organic food consumption is vital, as it increases sustainable diets and ensures food sustainability (Mørk et al., 2017). The European Union follows a strict policy for the organic sector, taking into consideration organic food and the eco-friendly behavior of consumers (Azzurra et al., 2019). Such practices increase social well-being and foster economic resilience (Schader et al., 2014).

Consumers' purchasing behavior goes through a psychological process which includes recognizing needs; searching for ways to meet these needs by collecting and understanding information; making and implementing plans; making decisions on product purchase; purchasing the product; and giving feedback post-purchase (Basha et al., 2015). In the context of organically farmed food, consumers' purchasing behavior has been investigated by several researchers. For example, Rana and Paul (2017) report that consumers' attitude has a clear impact on their purchase intentions, including the cognitive approach, which indicates thinking, and the affective approach, which helps to form the feeling component (Aertsens et al., 2009). In organic food purchases, the roles of affective and cognition attitudes are compensatory (Dean, Raats, and Shepherd, 2008), while Michaelidou and Hassan (2008) claim that health consciousness, food safety concerns, and ethical self-identity influence consumers' attitude toward organic food. Moreover, the qualities of organically farmed food, such as higher nutrition and better taste, and the avoidance of chemicals and pesticides in the production process, also influence consumers' purchase intentions. For instance, in the United States, consumer demand for natural and organic foods has substantially increased due to renewed and increasing interest in nutrition, public health, animal welfare, and the impact of traditional agriculture on the environment. However, such health and environmental concerns have an insignificant effect on the consumption of organic food because of the limited knowledge about such food in emerging markets (Le-Anh and Tam Nguyen, 2020; Yilmaz and Ilter, 2017).

Consumer's knowledge about organically farmed food indicates their understanding of the level of the exploration and recognition of product characteristics (Muhummad et al., 2016). Therefore, product knowledge plays a vital role in forming attitudes toward organic food (Gan et al., 2016). Consumers who possess adequate information about such food and its production techniques are more prepared to choose organic products (Gracia and de Magistris, 2007; Saleki et al., 2012). Such findings lead us to assume that low, medium, and high levels of product knowledge will influence consumers' preference for conventional, safe, and organically farmed fish, respectively. Liu et al. (2017) highlight that despite perceiving organic products to be beneficial for both health and the environment, consumers' preferences for such products are subjective, as they have inadequate knowledge about the production standards of eco-labels. For instance, in Vietnam, consumers of organic food face problems due to their lack of related knowledge; many cannot even differentiate between organic and safe foods (Q & Me, 2018; Takayama, 2017). Such lack of knowledge creates a lack of trust (Vega-Zamora et al., 2019) and confusion because of the multiplication of labels, leading consumers to perceive that organic products imply only high prices (Díaz et al., 2012). Furthermore, limited knowledge about organic production techniques negatively affects organic purchases, particularly in developing countries (Gracia and Magistris, 2007; Yin et al., 2010).

In addition to knowledge, consumers' demographic variables also affect their preferences for organic food (Davies et al., 1995; Thompson, 1998). Females are more prepared to pay for organic apples, while males are more likely to pay for organic beef (Illichmann and Abdulai, 2013). Moreover, consumers from highly educated groups (Annunziata et al., 2019), especially women with more extensive education; those from higher-income households; and older consumers are all prepared to pay more for the welfare of farmed fish. They believe that eco-friendly fish are fresher and have a better life (Solgaard and Yang, 2011). However, households with children are not willing to pay a price premium for organic products (Sriwaranun et al., 2015).

A number of previous studies have been conducted on consumers' WTP for organic food. In one, Japanese consumers were shown to be willing to pay 8%–22% more for certified organic vegetables (Sakagami et al., 2006). In addition, Rodríguez et al. (2009) found that consumers from Argentina were willing to pay for organic food, within a broad range of 6%–300%, while another study found that Dominican consumers were prepared to pay 17.5% more for organic products (Boys et al., 2014). Moreover, Canadian consumers were shown to be prepared to pay 10% extra for organic products (Vladicka and Cunningham, 2002). As in the case of organic food in general, organic aquaculture is also presently focusing on consumers' food consciousness. Organic aquaculture production considers animal welfare and public health issues in the production stages. Relevant information is provided by organic labels, increasing consumers' awareness, preferences, and WTP (Mauracher et al., 2013), thus creating market demand and increasing producers' revenues (Ankamah-Yeboah et al., 2019). In Italy, organically farmed marine fish have great potential, as consumers are willing to pay 2.25 €/kg extra over average premium prices (Defrancesco, 2003). Disegna et al. (2009) report that in the case of organic trout, on average potential consumers are willing to pay 2.55 €/kg more, while Norwegian consumers are prepared to pay extra for organic and freedom-food salmon compared with the conventional version (Olesen et al., 2010).

In 2017, total global aquaculture production increased by 49% compared with 2016, with the total production of organic aquaculture almost 0.62 million metric tons, of which 86% was produced in Asia. As the single most valuable globally traded aquaculture product, farmed shrimp plays a vital role, being mainly produced in southeast Asia and Latin America. Recently, the world has focused on organic shrimp production due to consumers' food awareness. Organic shrimp production began in Ecuador in May 2000 and was followed by other countries such as Indonesia, Peru, and Vietnam (Bergleiter, 2002). The world's main shrimp producers are Thailand and China, whose economies rely mainly on the shrimp industry (Research and Marketing, 2019). As shrimp is an essential exportable product in Bangladesh, the country has practiced organic shrimp cultivation on a limited scale in order to meet consumer demand

and increase its economic contribution. Black tiger shrimp (*Penaeus monodon*) production comprises 71.5% of the country's total shrimp farming and represents more than 90% of the total export earnings from farmed shrimp (FAO, 2019). Shrimp farmers in the Bangladeshi economy mostly rely on wild shrimp stock because of the limited capacity of shrimp production (Alauddin and Hamid, 1999). In 2006, the production of wild marine shrimp was 3,200 tons, while the production of farmed Bagda and Golda shrimp was 38,000 and 12,000 tons, respectively (DoF, 2006).

3. Organic Agriculture and Fish in Bangladesh

Organic farming in Bangladesh was introduced in the late 1970s with the support of various NGOs such as PROSHIKA and UBINIG in order to provide seasonal vegetables in a suitable, equitable, and productive way following the principles of biodiversity (Iqbal, 2015; Proshika, 2004). Presently in Bangladesh, consumers' preferences are shifting from traditional to organic food because of its unique characteristics, such as safety, concern for the environment, nutrition, and sensory attributes (Mukul et al., 2013). Consumers like organic food because of its better taste, health benefits, and its attractiveness as a fashionable product. Organic products have great potential as exports as well as in local markets in Bangladesh. Both young and older people consume organic products, with more men preferring organic food; as the fish buyers in the family, they are more willing to pay a price premium for organic foods than women (Ahmed and Rahman, 2015; Iqbal, 2015). Furthermore, consumers' level of education, income, consciousness, and household size, together with the price, and, for example, the breed of fish, in relation to food safety and quality assurance, affect the WTP for organic food (Sarma and Raha, 2016). Prince and Krairit (2017) report that consumers with children, older people, and men who have the regular habit of buying organic meat are encouraged to buy such products in Bangladesh. They add that organic food attributes such as health benefits, verbal recommendations, purchase convenience, and availability significantly affect consumers' intention to buy organic meat. The lack of awareness and knowledge about such products and their price premium significantly and negatively influence people's intention to buy organic foods (Ahmed and Rahman, 2015; Iqbal, 2015). Many consumers claim that organic products are in insufficient supply in Bangladeshi local markets, and that they are limited to particular shops, and continue to be poorly certified. Therefore, consumers have low trust in organic food producers and sales personnel (Ahmed and Rahman, 2015; Sumi and Kabir, 2018).

In Bangladesh, the shrimp sector contributes greatly to income from the foreign exchange market, consequently expanding food production, and improving the livelihoods and income of farming households and associated groups (Ahmed, 2013; Ahmed et al., 2018; Islam, 2008). This sector is the second-largest export industry, generating US$380 million annually, which is 5.6% of the total value of exports (DoF, 2006), with 1.2 million people directly, and 4.8 million households indirectly linked to the sector (USAID, 2006). Although the advent and expansion of the many types of aquaculture of fish and shrimp are not sustainable (Hossain and Hasan, 2017), and outbreaks of disease are the main hindrance for shrimp culture (Alam et al., 2007), shrimp farming in Bangladesh enjoys high demand in the global market, especially in Europe. However, in recent years, international demand for Bangladeshi shrimp has decreased from US$417 million in 2017–2018 to US$365 million in 2018–2019 (Rahman, 2019). Such a decline is the result of failing to meet the international demand for world-class certification of products and the competition generated from the introduction of the farming of "Litopenaeus vannamei" (white leg shrimp) (Rahman, 2019). Moreover, the shrimp industry in Bangladesh has faced substantial economic losses because of infections from viral diseases such as the White Spot Syndrome Virus (Alam et al., 2007; Mazid and Banu, 2002). In addition, the industry has faced low yields, lack of adequate technology, price fluctuations in international markets, bans imposed by the European Union, and lack of government stimulus (Alam et al., 2007; Chowdhury et al., 2006; Paul and Vogl, 2011).

International markets demand high standards and quality shrimp products, a fact that should focus producers' attention on strictly following standardized policy and shrimp production regulations. As a result, alternative organic shrimp production was introduced in Bangladesh. In this regard, the Swiss Import Promotion Program regulated by the Swiss government started the Organic Shrimp Project in 2005 to help small and medium enterprises in developing and emerging economies through consulting, training, marketing support, and the facilitation of access to trade fairs (Paul and Vogl, 2012). In Bangladesh, the agro-climatic conditions, biophysical resources, abundant ponds, and available low-lying rice fields with sufficient wild post larvae in coastal areas are very favorable for farming large freshwater shrimp (Ahmed et al., 2008; Ahmed et al., 2010). Therefore, organic shrimp culture in Bangladesh has great potential due to the increased demand from consumers for organic products in the international market (Ahmed et al., 2018; Aschemann-Witzel and Zielke, 2017; Ruangpan, 2007). However, unstable monthly incomes and different sociopolitical forces hinder the purchase of such food products in Bangladesh (Ashraf et al., 2019).

4. Data and Methods

4.1. Participants

The study intends to develop an integrated picture of consumers' preferences for farmed shrimp. To obtain their opinions, three divisions (counties) were purposively selected, Chattogram, Dhaka, and Rangpur. Geographically, Chattogram and Rangpur are located in the southern and northern parts of the country, respectively, whereas Dhaka is located in the center (Figure 1). In terms of shrimp production, Chattogram is the highest-level area, Dhaka the middle-level, and Rangpur the lowest-level (Appendix A). To recruit respondents, consumers' living standards and fish consumption frequency were also considered. Dhaka and Chattogram are in the second- and third-lowest poverty line positions, while Rangpur is at the lowest level (Appendix A).

In addition, in the cities of Chattogram and Dhaka have the highest per capita fish consumption amongst cities in the country, while Rangpur has the lowest consumption (Needham and Funge-Smith, 2014). These varying criteria helped to choose the representative sample and were suitable for our attempt to explore the growing safety consciousness and diverse fish choices in an emerging market such as Bangladesh. The reason for selecting shrimp was that this species is cultured in inland freshwater, coastal brackish water, and marine saline water (on a limited scale). For the data collection, an experimental design method was followed, in which households were selected randomly by conducting a direct interview method. A questionnaire was sent to the respondents, who were asked to complete it, as well as take part in a face to face interview. Only people older than 21 were asked to participate in the survey, since those under 21 are generally not responsible for fish purchases in the family. Each survey took on average 15 minutes.

Before producing the final survey, the questionnaire was translated from English into the native language Bengali with the help of professional language editors. A pretest survey with 48 respondents was then conducted in two cities (Dhaka, with 25 participants, and Chattogram, with 23) to ensure that they understood the content of all the questions, and that no semantic problems or linguistic complexities existed. As no significant difficulties were found, it was decided to keep the original format for the final version. The Dean Committee, University of Chittagong, Bangladesh, approved the ethical standard of the experiment research content. The survey was conducted from August 21 to October 17, 2019. A total of 704 households took part in the survey; however, 44 responses were excluded due to their unsuitability (incomplete data). Therefore, 660 samples were finally used in the study. In a within-subject design study, the experiment provided a dataset of $n = 660 \times 9 = 5{,}940$.

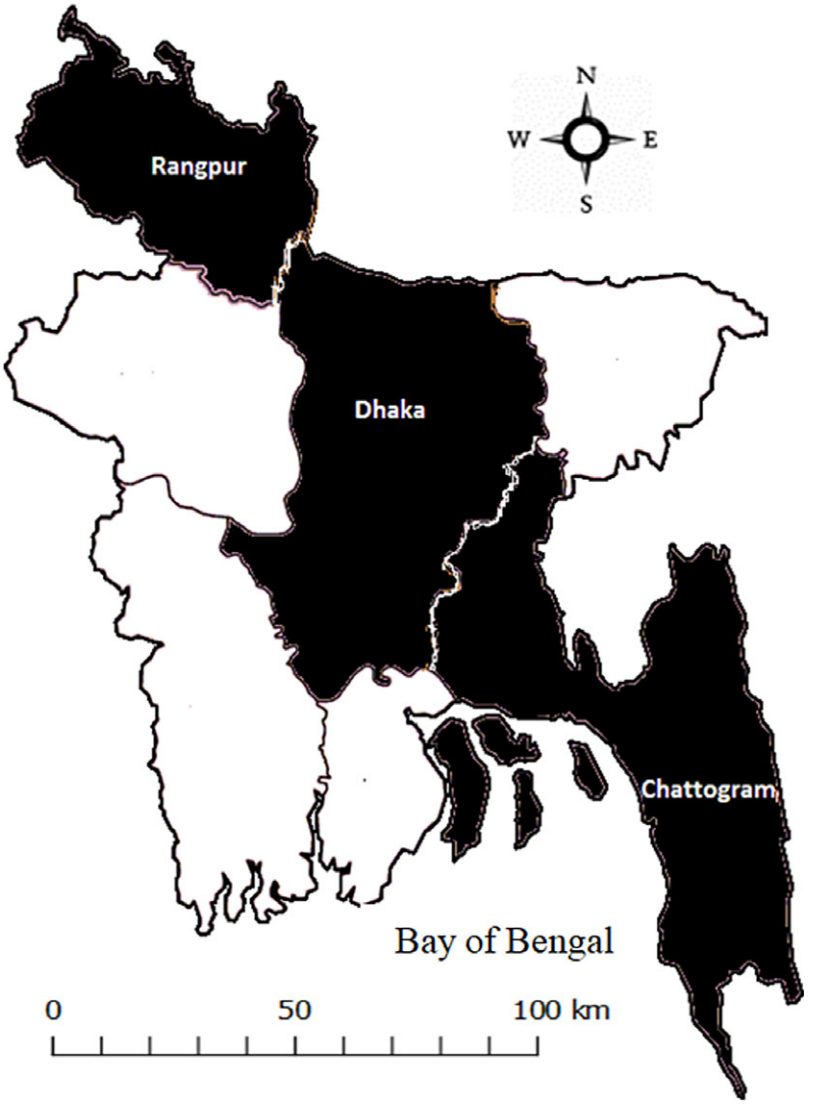

Figure 1. Black shading indicates the study area.

4.2. Questionnaire and Measurements

The first section of the questionnaire consisted of consumers' product knowledge regarding farmed fish, and their attitude toward it. The second section concerned choice of fish based on ranking, focusing on fish attributes. Nine alternatives were presented in a table, and respondents were asked to rank these according to their preferences. The final section was a demographic survey concerning fish-eating behavior. To ascertain the consumers' product knowledge, six questions were posed based on the revolutionary theory of product knowledge taxonomy expounded by Russo and Johnson (1980), using seven-point Likert scale items, ranging from 1 (strongly disagree) to 7 (strongly agree) (Appendix B). To construct general attitudes toward farmed shrimp, five seven-point bipolar scales, from bad to good, negative to positive, unfavorable to favorable, dull to exciting, and terrible to high, were employed to describe respondents' feelings about farmed shrimp in general. The study used exploratory factor analysis (EFA) to find the best number of

Table 1. Outcome of explorative factor analysis

Observed Variables	Latent Variables	
	Knowledge	Attitude
For me the best thing about farmed fish is its availability.	0.714	
I believe pangas is the most economical farmed fish.	0.892	
The most widely consumed farmed fish, I think, would be tilapia.	0.869	
Feelings about farmed fish from unfavorable to favorable.		0.923
Feelings about farmed fish from negative to positive.		0.918
Feelings about farmed fish from bad to good.		0.896
Feelings about farmed fish from terrible to great.		0.880
Feelings about farmed fish from dull to exciting.		0.878
Eigenvalue	2.047	4.042
KMO score	0.631	0.822
Bartlett's test of sphericity	$P < 0.000$	$P < 0.000$
Total variance explained (%)	68.23	80.830
Determinant of correlation matrix	$0.397 > 0.001$	$0.005 > 0.001$

Note: Extraction method: Principal Component Analysis.

dimensions and their common associations based on responses to particular issues (consumers' knowledge and their attitude toward farmed fish), in order to form a pattern matrix (Hair et al., 2010). The EFA considered three statements related to the construct of product knowledge, with the remainder concerning attitude (Table 1). The mean values of the extracted factors from each variable were then measured for use as independent variables. Respondents who gave scores of 5 or below were regarded as agreeing less or having lower perceived values (low knowledge or negative attitude). In contrast, those who gave scores 5 were deemed to be neutral (medium knowledge or neutral attitude). Finally, scores of 6 and above indicated that participants were in strong agreement or had high perceived values (high knowledge or positive attitude).

In the second stage, three fish attributes (farm type, price, and farming system) and three levels (low, average, and high) in terms of the three attributes were considered in order to design product alternatives. A total of 3^3 (27) hypothetical products could be generated by combining the attributes and levels. In the study, three types of production field, marine, coastal, and inland, were considered. To select the fish attributes and to account for their optimal levels, a focus group discussion was held. For practical analysis, an orthogonal fractional factorial design was used, which considered only the main effects of the attributes. This decision was based on the evidence that the main effects explained the variance in the choice model at a level of between 70% and 90% (Dawes and Corrigan, 1974). The program employed (SPSS, version 26) helped reduce the minimum number of choice sets from 27 to 9. Following the study of Balcombe et al. (2010), the participants were instructed to think about the choice scenarios as if they were real. Textual and visual information (see Figure 2) were given to the participants for them to have an idea of the fish type and aqua farming systems used in the choice experiment.

In the third section, the respondents' demographics and socioeconomic characteristics in relation to fish consumption frequency and the markets where they shopped for fresh fish were explored. Finally, the question of whether they could contribute to saving natural fish stocks from depletion through their personal choice of fish was approached in a binary setting. To rank the choice of product alternatives, nine fish products were presented in a table (see Figure 3). To analyze the ranked choice, the study employed an ROL model. As the most preferred choice was independent

Fish type and aqua farming systems	**Description/state of indicators**
	Conventional farmed shrimp: Refers to the raising and breeding of aquatic animals, in this case shrimp, using many pesticides, ratherthan just traditional fishmeal, to increase the growth of the fish rapidly with no safety control.Therefore, there is no label for conventional fish (Hoque, 2020).
	**Safe farmed shrimp:** Shrimp that are under control in the coastal regions. Pesticide residues, heavy metals and the microorganism content within the food comply with government standards and are safe for consumers, but not sustainable (Yu et al., 2014).
	**Organically farmed shrimp:** As organic fish, there is no or limited use of pesticides, chemical fertilizers and other chemical inputs into the production process, which mean the aquaculture can achieve sustainable growth in the fisheries industry.
	**Inland aquaculture:** This type of aquaculturerefers to the raising and breeding of aquatic animals, in this case shrimp, with the use of ponds, reservoirs, lakes, rivers, and other inland freshwater waterways, rather than the more general coastal aquaculture methods.
	**Coastal aquaculture**: This type of aquaculture includes inshore and offshore operations, as well as culture in ponds or lakes near the coast, or specially constructed polders in the coastal regions where brackish water is used in the production process.
	**Marine aquaculture:** This type of aquafarming refers to the breeding, rearing, and harvesting of shrimp that generally takes place in the open ocean. Such culture is also known as mariculture, in which the medium is purely seawater, as no freshwater is added to make it brackish.

Figure 2. Relevant information (textual and visual) about the fish type and the farmed fish production methods.
Sources of images: Apart from the image related to coastal aquaculture (own source), all other images were taken from freepik: https://www.freepik.com/.

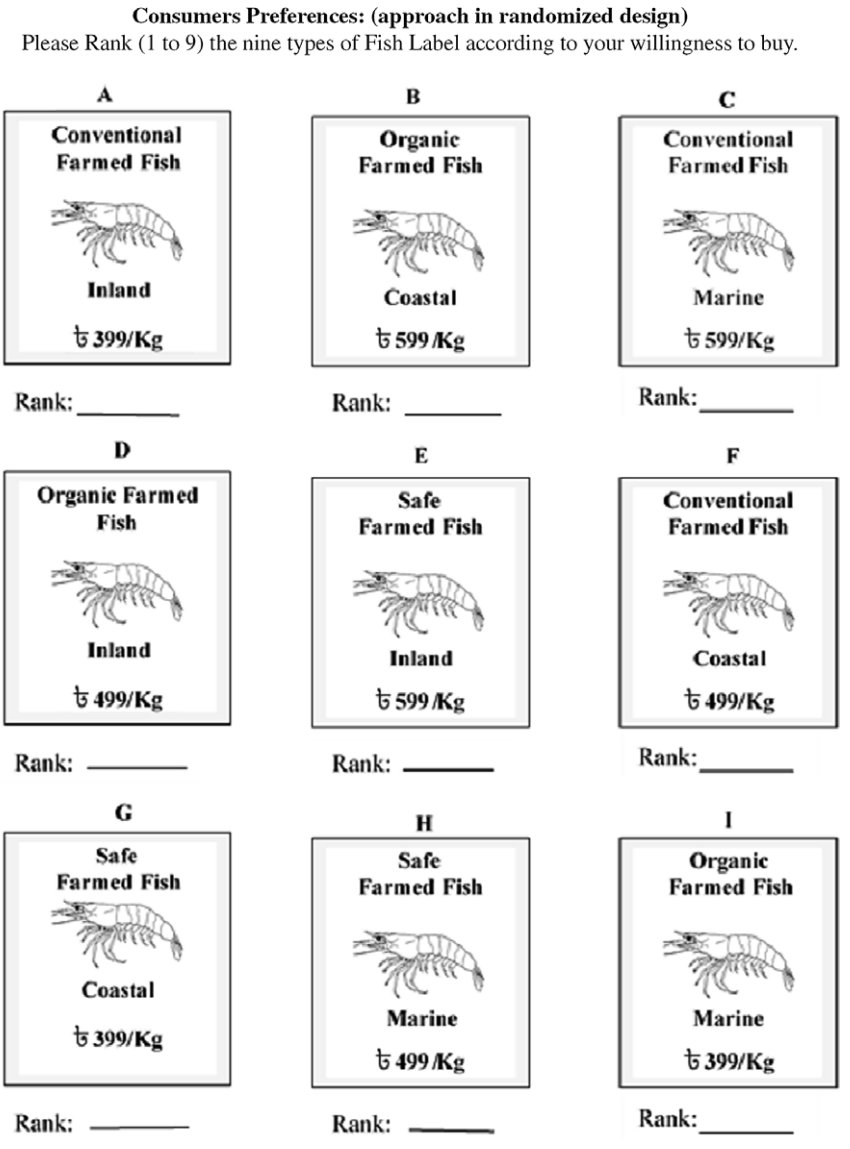

Figure 3. Farmed Shrimp Choices with Focus on Attributes.

of the remaining choices ranked in the model, the independence of irrelevant alternatives property was applicable (Beggs et al., 1981). The ROL model was employed to estimate consumers' fish attributes and the interactions between them, the socioeconomic variables and their WTP in the selected areas of Chattogram, Dhaka, and Rangpur. Interaction terms between the fish attributes and socioeconomic variables were also included in this section because those comprising mobility and self-care were the most salient (Nicolet et al., 2018).

In the experiment, the choice of farmed shrimp was observed only amongst people over 21 years old and responsible for buying fish for the family. However, such a sampling selection could be the cause of sampling bias. Theoretically, the ROL model (equation 5) used in the study could fit, even though the same choices are not made by everyone, and consumers' socioeconomic variables change over time. This unobserved characteristic of the observed sample and nonrandom

sample bias can be adjusted with endogenous covariates in an ordinary sample-selection model (Schwiebert, 2015). In this study, the selection model fits because the preferences of the respondents can differ completely from those who are not responsible for buying fish for the family and who are below 21. Therefore, the differences are for unseen reasons, and it is not clear if these unobservable characteristics may lead to biased results. To control this bias, whether the sample selection mattered was checked by using an extended ordered probit regression (EOPR) in STATA (the Statistical Software, version 16), which outlined whether there was a change in the unobserved characteristics of the respondents' fish choice. In this case, "unobserved" refers to unused factors (gender, the log of income, education, consumption frequency, market type, and awareness of farmed fish) in the estimated model, which may contribute to the analysis of the consumers' choice concerning "choice of farmed fish to save wild fish stock," which is known as an unobserved preference component or responsibility level. These unused factors were observed in the EOPR model as explanatory variables to analyze choice behavior. The endogeneity effect of the probability of the purchase of fish on fish choice was also checked with the EOPR model. The first and second panels in the results show the choice equation and the preference to save wild fish (selection) equation. The results demonstrate an insignificant positive correlation (ρ) between the residuals of overall farmed shrimp choice and the preference to save wild fish stock, at 0.074; S.E. $= 0.242$; z-score $= 0.31$; $p = 0.758$, indicating that selection was not an issue (StataCorp, 2019). Moreover, the almost zero positive correlation between farmed shrimp choice and the preference to buy farmed fish in order to save wild fish stock indicates that farmed shrimp choice is not endogenous with the personal preference for fish to save wild stock, and is not significant ($\rho = 0.005$; S.E. $= 0.074$; z-score $= -0.07$; $p = 0.942$). Such findings indicate that those who are more likely to choose farmed shrimp are more likely to prefer (albeit insignificantly) to save wild fish stock through their personal fish choice (Drukker, 2017).

5. Econometric Model

The study followed the conjoint valuation model, which indicates consumers' decision to maximize their utility. In this case, the respondents were asked to rank the items by order of their preferences, with the most preferred alternative indicating high utility. Assuming that U_{ij} is the rank given to alternative j by respondent i, if there are J alternatives, then U_{ij} may consider integer values from 1 through J, where 1 is the "best" and J is the "worst" in terms of ranking (Allison and Christakis, 1994). A model for such data can be generated from a random utility model, the same model that is employed to explain the standard multinomial logit model (Allison and Christakis, 1994). With J possible alternatives, the utility given by alternative j for individual i is defined in a linear function as

$$U_{ij} = V_{ij} + E_{ij}, \tag{1}$$

where each U_{ij} is the sum of a systematic component V_{ij} and a random component $E_{ij.}$ Each E_{ij} is independent and equally distributed with an extreme value or double exponential distribution. Each V_{ij} can be assumed to be a numerical quantity indicating the degree to which respondent i prefers alternative j over other alternatives that reflect utility. To estimate the utility weights and identical prices, the log-likelihood function was used, which is the ROL (Hausman and Ruud, 1987). The utility index of the mth alternative was designated by

$$V_m = x'_m \beta + u_{m,} \quad m = 1, \ldots, \tag{2}$$

where x_m is a K-vector of alternative attributes; $ß$ is a K-vector of utility weights; and u_m is a randomly distributed error term (with an extreme value distribution). The logit probability that alternative j is preferred to alternatives $1, \ldots, j$-1 is

$$F_j[x_{1,\ldots\ldots,}\, x_i'; \beta] = \exp(x_j^i|\beta) \Big/ [\sum_{i=1}^{j} \exp\,(x_i'\,\beta)], j > 1. \tag{3}$$

Denoting the index of the alternative ranked mth by r_m, the probability of observing the rank ordering $r \equiv (\, r_{1,\ldots,}\ \ r_M\,)$ is

$$\Pr(r, x; \beta) = \prod_{m=2}^{M} F_m[x_{rM,\ldots\ldots,} x_{rM-m+1}; \beta], \tag{4}$$

where $x = [x_m;\, m{=}1,\ \ldots,\, M]$, which has the suitable form of the product of $M - 1$ usual logit likelihood functions. Beggs, Cardell and Hausman (1981) developed and applied this model in a field experiment on choice, which was the result of the independence from irrelevant alternatives (IIA) property of the logit specification. In selecting alternatives, mutual exclusiveness was followed, explaining that all other alternatives were rejected by selecting one alternative (Train, 2009). If a sample considers N observations of x, the attributes of the M alternatives, and the rank ordering of alternatives is r, then the log-likelihood index for the sample of n observations is

$$\begin{aligned} L(\beta) &= \sum_{n=1}^{N} \log\big[\Pr\big(r_{n,} x_n; \beta\big)\big] \\ &= \sum_{n=1}^{N} \sum_{m=1}^{M-1} \log\big[F_{M-m+1}\big[x_{r_M,\ldots\ldots,} x_{r_m}; \beta\big]\big]. \end{aligned} \tag{5}$$

This log-likelihood function is the sum of the ordinary logit log-likelihood functions that can be used to estimate the ROL (Hausman and Rudd, 1987), meaning that the parameters estimated in the model are applicable to the probability of the observed ranking. Positive parameters indicate that the predictor variable is likely to increase the probability of ranking the associated product attribute. Alternatively, negative parameters show that the explanatory value tends to decrease the ranking probability (Zhang and Khachatryan, 2019). The parameter estimation commands of "cmrologit" of the STATA programming fit a choice model for rank-ordered alternatives that assumes IIA is true and allows tied ranks.

In addition, "individual choices are correlated with individual-specific explanatory variables, which take the same value across the choice categories" (Franses and Paap, 2001). Marginal values based on estimated parameters reflect the WTP based on product attributes. According to Train (2009), the estimate can be calculated as the negative ratio of the coefficient of an attribute variable ($\beta_{attribute}$) to the price coefficient (β_{price}); the formula is as follows:

$$WTP_{attribute} = -\frac{\beta_{attribute}}{\beta_{price}} \tag{6}$$

6. Results and Analysis

The survey was conducted on a total of 660 households. The stratified sampling distribution was as follows: 34.85% in Dhaka, 33.33% in Chattogram, and 31.81% in Rangpur. The respondents' average age was 33.03, with 74.80% males and 25.20% females. Culturally, males are responsible for buying almost all food (about 80%) for families in Bangladesh (Schaetzel et al., 2014). In terms of profession, 48.30% of the respondents were employed, 21.30% self-employed, with the remainder, and 30.40%, relying on others for their well-being. Most of the participants (98.50%) ate fish at home, with the remaining 1.50% consuming it in restaurants; 85.20% consumed fish more than once a week, while 14.80% consumed it only once a week. 80.30% of the respondents bought fish from the wet market, 4.10% only from supermarkets, with the remaining 15.60% buying from both. These findings are consistent with the results of the study by Hoque et al. (2021). Although 99.20% of the respondents were aware of farmed

fish, 85.10% believed that it was not safer than wild fish. 90.50% of the respondents were concerned about the environment and thought that by preferring farmed fish they could contribute to saving natural fish stocks (Table 2).

Consumers' attitudes toward farmed fish reflect their preferences for consuming it. In general, 14.70% of the respondents had a positive attitude toward farmed fish, which indicates that they perceived it to be of low intrinsic quality because of the use of food chemicals and pesticides in the production process (Figure 4, Appendix C, and Verbeke et al., 2007b). On the other hand, 60% of consumers did not have a negative attitude toward farmed fish, meaning that the majority preferred it or were neutral toward it (Appendix C). Another explanation may be that the framing effects on consumers' perception of farmed fish are relatively high. Figure 5 (Appendix D) shows that the majority of respondents had above-average knowledge of farmed fish. The results also show that only 1% of consumers had in-depth aquaculture knowledge, whereas 40% had a medium level of related knowledge. The literature indicates that in general consumers have poor knowledge of food production processes and food supply chains (Verbeke, 2005). This lack of knowledge is the main obstacle to purchasing organic food, as consumers do not know its true nature and fail to distinguish between organic, fresh, and safe food (Iqbal, 2015; Q & Me, 2018; Takayama, 2017). Although consumers have a medium or a high level of knowledge about farmed fish, they perceive it negatively, showing a knowledge-attitude gap (Hoque and Alam, 2020) (Appendix D).

This study estimated the conjoint survey data in three different models: Model 1 estimates only product attribute effects; Model 2 estimates the product attributes and their interaction effects; and Model 3 estimates the interaction effects between the product attributes and the perceived knowledge, along with the interaction effects of product attributes. In the models, the estimated parameters signify the corresponding attribute's log odds ratio against the reference/base attribute. The odds ratios are the exponential outcomes of the corresponding parameters. The percentage change in the odds ratio compared to reference attribute of one unit change in the quantity variable was calculated by $[\exp(\beta) - 1] \times 100\%$ (Zheng and Wang, 2016). The ROL regression, as specified in equation (5), was estimated, with the results shown in Table 3.

The results of econometric models 1 and 2 demonstrate the effects of the fish attributes and the interaction terms between them. Model 3, the full model, shows that in the product types, conventional farming reduces consumers' utility significantly and that they are willing to pay less for it than for sustainable and organically farmed fish. This finding is consistent with the study by Sangchoul (2019). On the contrary, consumers are more likely to prefer organically farmed shrimp, an outcome which is in the line with various previous studies, which have indicated that organic practices produce much better results than their conventional counterparts (Bengtsson et al., 2005; Gomiero, 2015; Lorenz and Lal, 2016). Subsequently, consumers are willing to pay a price premium for organic fish (Table 4). In this case, the results indicate that they are willing to pay more for organically farmed shrimp, a fact which is also supported by several other studies (Disegna et al., 2009; Denver and Christensen, 2015; Olesen et al., 2010; Mauracher et al., 2013).

In terms of shrimp aquaculture sources, such as inland, coastal, and marine ones, inland aquaculture is more likely to be associated with consumers' preferences than marine aquaculture, since in Bangladesh inland aquaculture is more widespread than other types (FRSS, 2016; Shamsuzzaman et al., 2017), followed by coastal aquaculture. The results imply that consumers have more knowledge and are used to consuming more inland-farmed shrimp than other types due to its availability even in urban localities. The WTP estimates, shown in Table 4, show that consumers prefer to pay more for inland-farmed shrimp, at Bangladeshi Taka (BDT) 826/kg, and for the coastal aquaculture type, at BDT 542/kg. Such a finding indicates that consumers' WTP for inland and coastal-farmed shrimp is higher than the mean WTP for farmed shrimp. In the model, the odds of the price are −0.001, which is negatively small, but significant, and indicates that at a higher price consumers' preferences would be lower, which supports the presumption of standard economics.

The interaction term between conventional farming and inland aquaculture is positively significant, meaning that they are complementary. Consumers are more likely to prefer inland

Table 2. Descriptive statistics of the demographic and psychographic variables and the preference patterns for fish

	Bangladesh	Chattogram	Dhaka	Rangpur
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Sample size (households)	660	220	230	210
Age (mean ± Standard deviation)	33.03 ± 9.77	31.73 ± 11.56	33.45 ± 8.37	33.93 ± 8.97
Gender (%)				
Male	74.80	53.60	85.20	85.70
Female	25.20	46.40	14.80	14.30
Do not want to mention	00.00	00.00	00.00	00.00
Education in years (mean ± Standard deviation)	13.12 ± 3.97	12.73 ± 3.19	15.73 ± 2.65	10.91 ± 4.45
Income ('000) (mean ± Standard deviation)	29.95 ± 20.96	28.75 ± 20.63	36.81 ± 26.04	23.66 ± 10.03
Profession (%)				
Employed	48.30	33.20	72.60	37.60
Self-employed	21.30	17.30	17.80	29.50
Others	30.40	49.50	9.60	32.90
Overall fish consumption (%)				
Once per week	14.80	13.00	12.60	19.00
More than once per week	85.20	87.00	87.40	81.00
Buy fish from the market (%)				
Wet market	80.30	78.20	70.90	92.90
Supermarket only	04.10	00.00	11.70	00.00
Both	15.60	21.80	17.40	7.10
Agree that farmed fish is safer than wild (%)				
Yes	14.90	24.20	16.50	3.30
No	85.10	75.80	83.50	96.70
I am aware of farmed fish (%)				
Yes	99.20	99.50	99.10	99.00
No	0.80	00.50	0.90	1.00
Through my personal choice of fish, I can contribute to the saving of natural fish stocks from depletion (%)				
Yes	90.50	97.30	97.00	76.20
No	9.50	2.70	3.00	23.80
Where do you eat fish most often? (%)				
Home	98.50	99.10	97.00	99.50
Restaurant	1.50	0.90	3.00	0.50
Fast food/Takeout	0.00	0.00	0.00	0.00
	N = 5,940	N = 1,980	N = 2,070	N = 1,890

Table 3. Estimated results of the exp (coef) of product attributes and consumer preferences for fresh farmed shrimp

	Model (1) with Product Attributes Only		Model (2) with Product Attributes and Their Interactions		Model (3) with Product Attributes and Interactions with the Perceived Knowledge	
Variable	coef	*z*-ratio	coef	*z*-ratio	coef	*z*-ratio
Conventional farming	−0.271***	−7.53	−0.410***	−5.74	−0.346***	−4.43
Organic farming	0.246***	6.89	0.191***	4.24	0.203***	2.62
Inland aquaculture	0.821***	19.62	0.816***	13.11	0.826***	13.23
Coastal aquaculture	0.525***	12.66	0.531***	8.63	0.542***	8.78
Price	−0.001***	−8.94	−0.001***	−3.53	−0.001***	−3.23
Conventional*Inland			0.220**	2.04	0.226**	2.08
Conventional*Coastal			0.183**	2.04	0.180**	2.00
Organic*Marine			0.172**	2.00	0.197**	2.27
Conventional*Low knowledge					−0.069	−0.21
Safe*Medium knowledge					0.162**	2.21
Organic*High knowledge					0.085	1.14
	$N = 5940$, Number of cases = 660, LR χ^2 (5) = 682.21, P (χ^2) = 0.00; Log-likelihood = − 8108.099		$N = 5940$, Number of cases = 660; LR χ^2 (8) = 693.11, P (χ^2) = 0.00; Log-likelihood = −8102.653		$N = 5940$, Number of cases = 660, LR χ^2 (11) = 704.90, Log-likelihood = −8096.754	

*** 1% level of significance, ** 5% level of significance, * 10% level of significance. The safe farming process and marine aquaculture are the reference case.

conventional farmed shrimp. They are also more likely to prefer shrimp which is produced in coastal brackish water. However, the level of the preference for conventionally farmed shrimp produced in inland aquaculture is higher than that for coastal aquaculture. For conventionally farmed shrimp produced in inland freshwater, consumers are willing to pay an extra BDT 226/kg, followed by conventionally farmed shrimp from coastal areas, at BDT 180/kg. Such findings indicate that conventional farming is dominant for inland-farmed fish; therefore, because of its availability, consumers are more likely to prefer conventional inland shrimp. The results also demonstrate that organic farming and mariculture are complementary. In addition, organic shrimp, particularly that produced in mariculture with saline water, is mostly preferred. Therefore, with regard to the organic shrimp production area, there should be more focus on the marine sector than the inland and coastal sectors in order to attract consumers' preferences. Moreover, in the case of organically farmed shrimp, consumers are most likely to pay a higher premium for that originating from the marine sector than for coastal conventional farmed shrimp. Such a finding is supported by Defrancesco (2003) and Stefani et al. (2012), who show that marine farmed fish command price premiums.

A negative insignificant interaction term between conventional farming and consumers' low knowledge indicates that even consumers with low product knowledge do not like to buy conventionally farmed shrimp. They are aware of the conventional farming process, in which high levels of food chemicals and pesticides are used, which can harm public health and even cause loss of life (Ashraf et al., 2019; Rahman et al., 2015). The knowledge of consumers about the product

Table 4. Consumers' marginal willingness to pay (WTP) for 1 kg of fresh farmed shrimp

	Fresh Shrimp		
Variables	WTP	S.E.	Confidence Interval (95%)
Conventional farming	−346.00	144.915	[−664.956, −27.043]
Organic farming	203.00	87.202	[11.061, 394.932]
Inland aquaculture	826.00	236.090	[306.368, 1345.631]
Coastal aquaculture	542.00	171.831	[163.801, 920.198]
Price	–	–	–
Conventional*Inland	226.00	155.268	[−115.744, 567.744]
Conventional*Coastal	180.00	113.550	[−69.922, 429.922]
Organic*Marine	197.00	124.247	[−76.465, 470.465]
Conventional*Low knowledge	−70.00	329.560	[−795.357, 655.357]
Safe*Medium knowledge	162.00	88.052	[−31.802, 355.802]
Organic*High knowledge	85.00	78.814	[−88.469, 258.469]
Number of observations = 5940; Number of groups = 660			

WTP and the standard error (S.E.) estimate with the delta method.

also plays a crucial role in their WTP. Those with low knowledge are less likely to buy conventionally farmed shrimp, as they are worried about the medical residues in them (Solgaard and Yang, 2011).

The significant interaction term between safe farming and medium product knowledge indicates that they are complementary. Consumers with such a level of knowledge significantly prefer safe-farmed shrimp, which indicates that safety labeling will be effective in increasing demand for it. In general, in farmed fish choice consumers look for safety labels (Hoque, 2020). Such findings emphasize safe labeling, which is consistent with several previous studies (Newman et al., 2014; Onozaka and McFadden, 2011; Schjøll, 2017; Xie et al., 2016). People are willing to pay more for safe-farmed shrimp, as the safety labeling associated with the product provides the information that the shrimp are produced under government standards and are safe for consumption. Interestingly, Bangladeshi consumers are willing to pay a higher price premium for safe shrimp over the organic type. Finally, consumers with high product knowledge are more likely to consume organically farmed shrimp. This finding is consistent with the study of Kesse-Guyot et al. (2013) and also emphasizes that those with high levels of knowledge have a greater preference for consuming organic products, and are willing to pay a price premium for them (Kriwy and Mecking, 2012).

Table 5 shows consumers' preferences and their WTP for farmed shrimp in Chattogram, Dhaka, and Rangpur. The results in the Rangpur column show that the main impact of price is insignificantly positive on the probability of choosing farmed shrimp, which contradicts the fundamental economic insight that consumers prefer cheaper shrimp when all attributes are equal. People in Rangpur are the poorest the country; therefore, they are more likely to prefer low priced shrimp. Accordingly, they are willing to pay less for organic shrimp and more for the conventional type. Such results imply that consumers in Rangpur use price as a proxy of fish quality, with a higher price related to higher quality, which is consistent with various previous studies (Carpio and Isengildina-Massa, 2009; Jo and Sarigollu, 2007; Rao, 2005; Zhou et al., 2002). Conventional farming decreases the utility of shrimp to consumers in Dhaka and Rangpur significantly; however, in Chattogram this influence is insignificant. Although consumers in Chattogram and Dhaka are willing to pay less for conventionally farmed shrimp, interestingly those in Rangpur are willing to pay

Table 5. Rank-ordered logit model estimates of Chattogram, Dhaka and Rangpur with fish attributes

Choice of Fish in the Rank-Ordered Logit (ROL) Model						
	Model with fish attributes and interactions between the attributes and socioeconomics variables and their WTP					
	Chattogram		Dhaka		Rangpur	
Variable	Coefficients (S.E.)	WTP	Coefficients (S.E.)	WTP	Coefficients (S.E.)	WTP
Conventional farming	−0.051 (0.129)	−51.00	−0.541*** (0.125)	−270.50	−0.456*** (0.166)	456.00
Organic farming	0.162 (0.137)	162.00	0.500*** (0.167)	250.00	−0.147 (0.148)	−147.00
Inland aquaculture	0.463*** (0.109)	463.00	0.341*** (0.099)	170.50	2.475*** (0.128)	−2475.00
Coastal aquaculture	0.906*** (0.110)	906.00	−0.081 (0.100)	−40.50	1.131*** (0.117)	−1131.00
Price	−0.001*** (0.000)	–	−0.002*** (0.000)	–	0.001 (0.001)	–
Conventional*Inland	0.007 (0.187)	7.00	0.263 (0.185)	131.50	0.025 (0.201)	−25.00
Conventional*Coastal	0.123 (0.151)	123.00	0.513*** (0.153)	256.50	−0.141 (0.166)	141.00
Organic*Marine	0.372** (0.151)	372.00	−0.414*** (0.148)	−207.00	0.930*** (0.156)	−930.00
Conventional*Low knowledge	0.000 omitted	–	0.284 (0.546)	142.00	0.004 (0.433)	−4.00
Safe*Medium knowledge	0.059 (0.127)	59.00	0.019 (0.156)	9.50	0.260* (0.145)	−260.00
Organic*High knowledge	−0.138 (0.129)	−138.00	0.393** (0.163)	196.50	−0.217 (0.143)	217.00
	$N = 1{,}980$, Number of cases = 220, LR χ^2 (10) = 180.70, P (χ^2) = 0.00; Log-likelihood = −2726.051		$N = 2{,}070$, Number of cases = 230, LR χ^2 (11) = 328.19, P (χ^2) = 0.00; Log-likelihood = −2780.328		$N = 1{,}890$, Number of cases = 210, LR χ^2 (11) = 800.59, P (χ^2) = 0.00; Log-likelihood = −2288.088	

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Parameter estimates from the ROL model.

more. Such results mean that consumers in Chattogram and Dhaka are more concerned about conventional farming than those in Rangpur. Nevertheless, people in Rangpur assume that the price of conventional shrimp could be lower, while those in Chattogram underestimate the risks of conventional shrimp consumption.

Organic farming increases the utility of shrimp to consumers in Dhaka significantly. However, it decreases utility to those in Chattogram and Rangpur insignificantly. Dhaka households are more educated, and their income level is higher than in the other two regions. Therefore, these households have more access to different options compared with Chattogram and Rangpur. The results also show that in Dhaka organic farming is effective, as consumers are willing to pay a price premium of BDT 250/kg for farmed shrimp. In Chattogram, there is the potential to increase consumers' utility of organically farmed shrimp, as they are willing to pay BDT 162/kg more for it. However, in Rangpur organically farmed shrimp decrease consumers' utility, as they are willing to pay more for such a product (BDT 147/kg). Furthermore, organically farmed fish only increase the utility of highly knowledgeable consumers in Dhaka, as they are willing to pay a price premium for it. On the other hand, marine organically farmed shrimp significantly increase consumers' related utility in Chattogram and Rangpur. Such findings indicate that organic farmed fish will be accepted in Bangladeshi local markets.

7. Discussion

The preliminary findings of the study are that consumers are more likely to prefer inland aquaculture farmed shrimp, followed by the coastal aquaculture version. Inland and coastal shrimp aquaculture is common in Bangladesh, and producers are more familiar with the farming processes than their mariculture counterparts. Shrimp produced in local agricultural land, low-lying floodplains, and ponds are available in the domestic market (Ahmed et al., 2008; Paul and Vogl, 2012; Rahman et al., 2013). The availability of the shellfish creates a demand from local consumers, who are willing to pay a price premium for both the inland and coastal conventionally farmed product. In addition to local preferences, demand for coastal-farmed shrimp is high in the international market (Rahman et al., 2013). The choice of inland- and coastal-farmed shrimp is motivated by cognitive, affective, and normative views. The cognitive view indicates that consumers perceive that the inland- and coastal-farmed shrimp are most useful and tasty for local households. Consequently, consumers perceive that local shrimp are fresher and are of high quality, requiring less treatment for storage, and less time to reach the market and consumers' tables (Martinez et al., 2010). From the affective point of view, inland- and coastal-farmed shrimp usually represent the shrimp cultivation existing across the various regions of Bangladesh, and provide a strong association with national pride, upbringing, and sense of belonging to the community. According to the normative point of view, the purchasing behavior of inland- and coastal-farmed shrimp is correct and altruistic, as it supports both the country's national economy and the income level of local farmers and marketers (Mauracher et al., 2013).

This study also highlights that consumers are willing to pay more for organic farming processes and less for conventional ones (Table 4), as they are concerned about their health and wish to avoid the pesticides and chemicals used in producing conventional food. The price premium for such organic products is a result of the extra costs associated with the production, certification, and segregation of organic foods, together with the supply and demand for organic food and consumers' perception that the quality of organic products is high, as they have more nutrition and better taste. A consistent finding in the study is that generally consumers are more likely to prefer organic fish and are willing to pay more for it. However, interestingly they prefer safe shrimp to the organic type. Another main finding is that with regard to organic fish, consumers prefer the marine production location. Globally, 54.7% of total aquaculture production originates from marine saline or brackish coastal waters (Datta, 2012) where pure water is naturally available,

which is useful for maintaining environmental standards, food safety, quality, control of medical products and pesticides, and the natural taste and nutrition of shrimp (Maroni, 2000).

Consumers' seafood choice decision is mainly enhanced by their awareness (knowledge) of the product. Those with low knowledge of organically farmed shrimp are willing to pay less for the conventionally farmed version, as it is known that a high level of food chemicals, growth hormones, and artificial fertilizers are used in the production process of the latter. However, highly knowledgeable consumers prefer to consume more organically farmed shrimp, and they are willing to pay more for it. On the other hand, consumers with a medium level of product knowledge prefer the safe farmed product and to be able to see the words "safe" or "safety label" displayed. Furthermore, consumers' WTP for safe farmed fish is higher than for organically farmed fish. Such interesting findings indicate that the organically farmed shrimp market is behind other markets due to the lack of knowledge and awareness and general confusion regarding organic standards (Defrancesco, 2007; Risius et al., 2017; Schlag and Ystgaard, 2013) among people in Bangladesh. Peoples' knowledge level depends on which city they live in. A knowledgeable city encourages collective preferences for sustainable actions (e.g., organic production) (Edvinsson, 2006). For instance, Rangpur households have a low level of education, and have a lower wish to save wild fish stock than the other regions. In addition, they also have a low preference for organic shrimp.

Furthermore, consumers with low knowledge are willing to pay less for conventionally farmed shrimp. The results could be explained by the fact that consumers perceive conventional farmed fish to be associated with lower intrinsic quality due to the use of chemicals in the production process. Such a perception provides evidence that consumers with low knowledge use their emotions to judge that the quality of farmed fish is poorer than that of natural fish (Verbeke et al., 2007b). A higher supply of safe fish from aquaculture increases competition in the fish market and aquaculture sustainability (FAO, 2016) and encourages consumers to consider scientific evidence to judge the quality of farmed fish (Verbeke et al., 2007b). Such supply can also create trust among consumers, as this study found that those with a medium level of knowledge were prepared to pay more for safe farmed fish that are cultured following the standards prescribed by the respective authorities. In this regard, authentic labeling from third parties could be a useful tool to provide practical related information.

8. Conclusions

The contribution of the study is its investigation into consumers' preferences for diversely farmed shrimp in the emerging market of Bangladesh, and how much they are prepared to pay for it. To conduct the research, data were collected from 660 households in Bangladesh using a structured questionnaire with a direct interview method in a choice experiment. Among the respondents, 99.20% were aware of farmed fish, and 90.50% were concerned about the environment and wanted to save natural fish stocks through their personal fish choice. Explorative factor analysis using the varimax rotation method was conducted, through which two factors, "knowledge" and "attitude," were formed based on the factor scores. ROL was also performed and estimated consumers' marginal WTP for nine fish alternatives.

The study found that despite limited product knowledge, consumers considered the role of conventionally farmed fish to be negative. Furthermore, medium and high levels of knowledge influenced their choice of safe and organically farmed fish. It was found that consumers preferred to pay more for inland aquaculture farmed shrimp, followed by the coastal aquaculture farmed version, as they had more information about such products and their availability. Organically farmed shrimp increased, while conventionally farmed shrimp decreased, consumers' utility due to health issues and their environmental perception. In particular, consumers preferred organically farmed shrimp cultivated in marine areas and were prepared to pay more for the

product, as they considered that marine saline water was more natural and pure, thus favoring the maintenance of high quality shrimp. The study also found that product knowledge was a critical factor behind consumers' preference for organically farmed shrimp. Those with low knowledge preferred to pay less for conventionally farmed shrimp, as they perceived that they were of low quality because of the greater use of chemicals in the production process. Moreover, highly knowledgeable consumers were prepared to pay more for organically farmed shrimp, while those with medium levels of knowledge preferred safe farmed shrimp, meaning that they trusted this product more, as they had more knowledge of its cultivation under government-prescribed rules. Therefore, consumers were willing to pay more for safe shrimp than for organic shrimp.

With regard to market segmentation, the study found that Dhaka consumers had no preference for conventional inland-farmed fish, but instead preferred the conventional coastal variety. In general, they were willing to pay the highest amount for organically farmed shrimp than any other city in the country; their high level of product knowledge and food consciousness led them to choose organically farmed shrimp. Both coastal- and inland-farmed fish increased the utility of consumers in Chattogram. In relation to organically farmed fish, they believe that mariculture could be the best option. However, organic farming did not significantly increase the utility of farmed shrimp for consumers in Rangpur. Although their WTP for organically farmed fish was positive, their ability to pay was limited because of their poverty.

In general, consumers preferred organic fish farming to the conventional type, but preferred conventional inland-farmed shrimp to the organic marine-farmed version. The study's main contribution is the finding that consumers prefer safe farmed shrimp to the organic alternative. Overall, the positive value attributed to organic farming, but the lower value attributed to organic marine farmed shrimp compared with the conventional inland type indicates that a lack of understanding and low economic status may negatively affect organic fish preferences. In this regard, policymakers, marketers, and producers could improve educational and promotional campaigns so that people can receive balanced information regarding organically farmed fish. As the study found that consumers' preferences for organically farmed shrimp in marine areas are positive, consumers could be persuaded to prefer organic mariculture to conventional inland aquaculture and pay a price premium for it. Therefore, an opportunity might be created for producers to produce and market marine organically farmed fish. Consequently, policymakers and marketers should focus on awareness campaigns and develop promotion policies, such as labeling organic and safe farmed shrimp, which could be undertaken following government and international NGO standards. In this regard, the role of international agencies in promoting organic products would be more useful than that of government authorities. This is because in Bangladesh the existing government certification system for food safety (e.g., Bangladesh Standard Testing Institute [BSTI] approved) is not efficient[2]. Moreover, attention should be paid to creating knowledgeable cities and ways of reducing organic product prices in order to influence people's choices and create suburban organic markets.

The study could be associated linked to attention bias, as it used a choice experiment design in which participants were asked to choose from a limited number of attributes and attribute levels. Therefore, future research could be conducted by following more incentive-aligned valuation methods, such as auctions, real choice experiments, or real contingent valuation methods, to develop WTP estimates. A limitation of the study is that the important and relevant interaction effect of consumers' knowledge level, and the particular city in which they live, on their fish preferences has remained unexplored. Another limitation is that the data were collected from only

[2]The BSTI approves the standard and quality of food products, acting as a government authority. Although BSTI standard certification is often required to launch food products in Bangladesh, many substandard food products have recently been found labeled with "BSTI approved" certification (The Independent, May 13, 2019, https://www.theindependentbd.com/post/199289). Although counterfeit food products have been found labeled with a "Beware of fake products" warning in Bangladesh (Hoque, 2020), the government has not verified the certification scheme with consumers.

three cities in Bangladesh. Therefore, it cannot be stated with certainty that the sample captures all Bangladeshi consumers because of the divergences in economic development, education levels, and food consumption habits in cities around Bangladesh. To represent the varying results, all Bangladesh counties could be included in future research, which will show the potential for organic, safe, and sustainable farmed fish for rural and urban consumers.

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Appendix A: Shrimp Production Areas and Poverty Line of Bangladesh

Annual Production of Shrimp/Prawn Farms, 2016 (Metric tons)					Poverty Line, 2016 by Cost of Basic Needs Method (National Upper Poverty Line) (in %)
Division	Bagda	Golda	Other shrimp/prawns	Total shrimp/prawns	
Chattogram	12000	889.81	3374.10	**16263.91**	**3.5**
Khulna	55601	44616.30	9729.90	109947.2	5.2
Barishal	671.70	2252.70	343.66	3268.06	5.5
Dhaka	0.00	797.86	0.60	**798.46**	**3.2**
Rangpur	0.00	7.73	1.95	**9.68**	**11.9**
Rajshahi	0.00	5.03	0.00	5.03	5.6
Sylhet	0.00	3.00	0.00	3	2.6
Mymensingh	0.00	2.40	0.00	2.40	6.4

Sources: BBS (2019a,b).

Appendix B: Farmed Fish Knowledge Scale

Descriptive statistics of consumers perceived knowledge regarding farmed fish

Observations			Mean and S.D. of Scores
Types	Particulars	Statements	
Whole	Evaluation	With requirement fulfillment, a way of getting vitamin by eating farmed fish is more important to me than waiting for wild fish.	6.02 ± 0.65
	Comparison	Genetically engineered farmed fish is not nutritious as nongenetically modified fish.	3.30 ± 1.45
	Ranking	The best thing about farmed fish is its' availability.	6.52 ± 0.50
Single	Evaluation	The widely consumed farmed fish, I think, would be Tilapia.	6.24 ± 0.46
	Comparison	The fat content of farmed 'Shrimp' will not harm you more than the calories.	4.84 ± 1.16
	Ranking	The 'Pangas' is the most economical of all farmed fish.	6.35 ± 0.65

N = 660

Appendix C: Frequency of Consumers' Attitude toward Farmed Fish

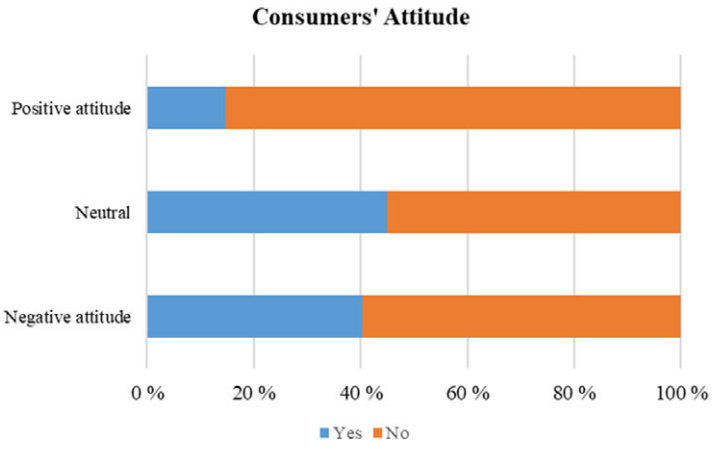

Figure 4. Consumers' attitude toward farmed fish were identified based on binary settings where the horizontal axes indicates the percent of respondents. Respondents' scores of 5 or below were regarded as a negative attitude. In contrast, those who gave scores above 5 were deemed to be a neutral attitude. Finally, scores of 6 and above indicate their positive attitude. The vertical axes measures attitude type.

Appendix D: Percentage of Consumers' Knowledge toward Farmed Fish

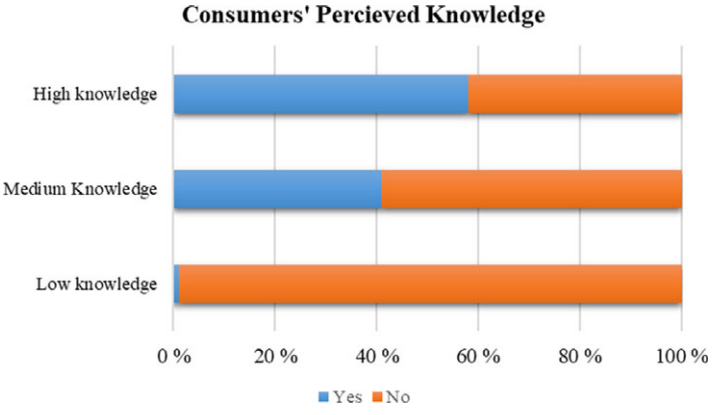

Figure 5. Consumers' knowledge regarding farmed fish was calculated based on binary settings where the horizontal axes indicates respondents' percentage. Respondents' scores of 5 or below were regarded as low knowledge. In contrast, those who gave scores above 5 were deemed to be perceived as medium knowledge. Finally, scores of 6 and above indicate their high perceived knowledge. The vertical axes measures knowledge level.

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