Chinese consumers and shellfish: Associations between perception, quality, attitude and consumption

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Highlights:

Comprehensively understand shellfish consumer behavior in China.

A low consumption but positive attitudes toward shellfish among Chinese consumers.

Two consumer segments with different consumption preferences for specific shellfish species.

Important product perceptions related to quality, attitude and consumption for shellfish.

Chinese consumers and shellfish: Associations between perception, quality, attitude and consumption

Abstract

This study explores the associations between Chinese consumers' product attribute perceptions and their quality perceptions, attitudes and consumptions toward shellfish. It also presents information regarding their consumption, attitudes and segmentation for twelve shellfish species. Data was collected through an online survey with 643 consumers from three cities: Beijing, Guangzhou and Chongqing. Chinese consumers had low consumption but positive attitudes toward the twelve shellfish species and two consumer segments were recognized: frequent-eaters (42%) and less-frequent-eaters (58%). Significant differences were found in personal income, occupation and attitudes toward specific shellfish species between these two segments. The consumption of shellfish was positively linked to 'familiarity' and negatively linked with 'purchase convenience', 'safety' and 'consumption place (home)'. The attitude toward shellfish was positively associated with 'familiarity', 'sensory attributes', 'consumption accompany' and 'consumption (restaurant)'. The quality perception of shellfish was positively linked with 'freshness', 'ethic' and 'mood'. There were differences in the product attribute perceptions associated with quality perceptions, attitudes and consumption toward shellfish between the two consumer segments.

Keywords

Chinese consumers; attitudes; shellfish; quality; product perceptions; consumption.

1. Introduction

1.1. Research background and objective

China is the largest fishery market in the world and produced 40% of the world's aquatic production in 2016 (69012.5 thousand tons including finfish, shellfish, aquatic plants and other fresh-water and sea products; imported 40.415 thousand tons and exported 42.376 thousand tons) (Fabinyi, Liu, Song, & Li, 2016; FAO, 2016; Federico, 2016; Ministry of Agriculture of the People's Republic of China, 2017). In particular, it has been experiencing a dramatic increase in shellfish production and importation during the past decade (e.g. with the total shellfish production of 22416.2 thousand tons in 2016, a growth of 37.6% from 2004; the per capita shellfish ownership of 16.2kg in 2016, a growth of 30.1% from 2004; the crustaceans importation value of 1503.3 million US dollars in 2015, a growth of 367.85 % from 2004) (Agriculture and Agri-Food Canada, 2014, 2016; Ministry of Agriculture of the People's Republic of China, 2005, 2017). This has provided a great opportunity for global shellfish producers to diversify export destinations from traditional and saturated developed markets (e.g. U.S., Japan and Europe) to this large and expanding market (Burman, 2017; Chopin, 2015; Federico, 2016; Fabinyi, Pido, Harani, Caceres, Uyami-Bitara, De las Alas, & Ponce de Leon, 2012; Taylor, 2015). This trend brings an increased importance to research areas related to shellfish consumer behavior in China.

Pieniak (2008) indicates that conducting shellfish-specific consumer study is important in fishery research due to the possible different consumer beliefs, opinions and reactions between shellfish and non-shellfish products (e.g. a higher risk perception of microbial contamination and allergenicity for shellfish products). Although many consumer-based aquatic product studies have been conducted during the past decade, few of them specifically focus on shellfish. The studies often involve specific shellfish species (e.g. clam, shrimp and mussels) mixed with non-shellfish aquatic products (e.g. finfish) (e.g. Almeida, Altintzoglou,

Cabral, & Vaz, 2015; Nguyen, Haider, Solgaard, Ravn-Jonsen, & Roth, 2015) or many are shellfish-specific consumer studies focusing on single shellfish species (e.g. oyster and mussels) (e.g. Acebrón, Mangin, & Dopico, 2001; Manalo & Gempesaw, 1997). Only a few consumer studies pay attention to shellfish as a general food type, focusing on the impacts of several product attributes (e.g. taste, convenience and freshness) on consumers' choice behaviors of shellfish by using descriptive analyses (e.g. mean values and answer percentages) (Batzios, Angelidis, Moutopoulos, Anastasiadou, & Chrisopolitou, 2003; Gomez-Jimenez & Rodriguez, 2001). To our knowledge, there is no study with a quantitative-modeling approach (i.e. econometric modeling and structural equation modeling) to understand the significant product attributes (with high validity) that influence consumers' quality perceptions, attitudes and consumptions toward shellfish as a general food type.

Furthermore, shellfish-related consumer studies have been mostly conducted within Western countries and there is a need to investigate shellfish consumer behavior in China due to the great differences in dietary cultures and consumer psychology for aquatic products between Chinese and Western countries (Fabinyi& Liu, 2014a, b; Fabinyi et al., 2016; Hu, Yuan, Yu, Qu, Chen, Wang, & Kimura, 2014; Wang, Gellynck, & Verbeke, 2015; Wang, Gellynck, & Verbeke, 2016; Wang, Gellynck, & Verbeke, 2017). However, only few studies can be found to contribute knowledge regarding shellfish consumer behavior in China, many of which focus on the impacts of product attributes and socio-demographics on the consumption of shrimp (Li & Wu, 2015; Lu, Xu, & Yuan, 2013) and the consumption preferences for some specific shellfish species (e.g. shrimp, crawfish, crab, oyster, razor clam, scallop and lobster) (Fabinyi et al., 2016). To our knowledge, no study can be found related to Chinese consumers' product attribute perceptions and the impacts on their quality perceptions, attitudes and consumption toward shellfish as a general food type. There is also a lack of

understanding of Chinese consumers' consumption preference, attitudes and segments for specific shellfish species.

Faced with this gap, this study examines the associations between Chinese consumers' product attribute perceptions and their quality perceptions, attitudes and consumption toward shellfish (as a general food type) by using a quantitative modeling approach (structural equation modeling). It also explores Chinese consumers' attitudes, consumption preferences and segments for twelve shellfish species.

1.2. Hypothetical model and literature review

Building upon theoretical and empirical models on food consumer behavior (e.g. product perceptions, quality perceptions, attitudes, consumption and segmentation) (Almli, Verbeke, Vanhonacker, Næs, & Hersleth, 2011; Bernués et al., 2003; Dekhili, Sirieix, & Cohen, 2011; Cicerale, Liem, & Keast, 2016; Grunert, 2002; Grunert, 2005; Jacobs et al., 2015; Lee & Yun, 2015; Nielsen, Bech-Larsen, & Grunert, 1998; Oude Ophuis & Van Trijp, 1995; Pieniak, 2008; Steenkamp, 1990; Verbeke et al., 2007; Žeželj, Milošević, Stojanović, & Ognjanov, 2012), a hypothetical model was developed for this study, as shown in Figure 1. Chinese consumers' product attribute perceptions are assumed to have direct impacts on their quality perceptions, attitudes and consumptions toward shellfish and are also expected to have indirect effects on their consumption through attitudes and quality perceptions toward shellfish. Furthermore, the impacts of product attribute perceptions on quality perception, attitudes and consumptions are assumed to vary between different Chinese consumer segments for shellfish. The following paragraphs will further describe the rationale for this hypothetical model.

>> Insert Figure 1

Product attribute perceptions are the features of a product in line with consumers' demands and expectations (a different concept from objective product attributes) and have a powerful influence on their attitudes and consumption toward a food product (Becker, 2000;

Bernués, Olaizola, & Corcoran, 2003; Dekhili et al., 2011; Nielsen et al., 1998; Oude Ophuis & Van Trijp, 1995; Steenkamp, 1990). Previous studies have shown the importance of the following product attribute perceptions on consumer behavior for shellfish or aquatic products: sensory attribute (e.g. taste, smell and appearance), health, preparation convenience, purchase convenience, safety, price, familiarity, assortment, perceived ethic (e.g. if environmental friendly or supportive for sustainability), freshness, consumption accompany (e.g. eating with families or important people) and consumption place (e.g. restaurants, home or seafood markets) (Batzios et al., 2003; Birch, Lawley, & Hamblin, 2012; Dasgupta, Eaton, & Caporelli, 2010; Fabinyi& Liu, 2014a, b; Fabinyi et al., 2016; Jacobs, Sioen, Pieniak, De Henauw, Maulvault, Reuver, & Verbeke et al, 2015; Gomez-Jimenez & Rodriguez, 2001; Lin & Milon 1993; Manalo & Gempesaw 1997; Myrland, Trondsen, Johnston, & Lund, 2000; Nguyen et al., 2015; Olsen, 2001; Olsen, 2003; Pieniak, 2008; Verbeke, Vermeir, & Brunsø, 2007). Furthermore, due to the rapid development in online food shopping around the world and China's rapid growth of seafood online retail (especially for imported shellfish e.g. lobster, shrimp and clam) (Amir & Rizvi, 2017; Harkell, 2017), 'purchase convenience online' might also have an important influence on Chinese consumer behavior of shellfish. In this study, a total of fourteen product attributes are included as latent variables within the construct of consumers' product attribute perceptions for shellfish.

Perceived quality is a key factor to build consumer value and satisfaction for a food product, and it is highly influenced by or composed of consumers' product attribute perceptions (Ophuis & Van Trijp, 1995). Perceived product attributes can be classified into intrinsic quality cues (e.g. appearance and size), extrinsic quality cues (e.g. price and brand), experience quality attributes (e.g. taste and convenience) and credence quality attributes (e.g. healthfulness and environmental friendliness) (Ophuis & Van Trijp, 1995). These quality cues and attributes constitute consumers' expected or experienced quality which has a significant influence on

their choice behaviors (e.g. purchase intention, repurchase and general attitudes) for a food product (Almli et al., 2011; Cicerale et al., 2016; Grunert, 2002; Grunert, 2005; Lee & Yun, 2015; Ophuis & Van Trijp, 1995). Previous studies have indicated possible product attributes related to consumers' quality perceptions for shellfish: taste, price, nutrition value, safety, convenience, appearance and freshness (Batzios et al 2003; Gomez-Jimenez and Rodriguez 2001; Lin and Milon 1993; Manalo and Gempesaw 1997).

Attitude is the summary evaluation (positive or negative) of a food product, and it influences consumers' choice behavior (e.g. purchase intention and consumption) for a food product (Žeželj et al., 2012). Attitude also plays an important role in positively influencing consumers' consumptions of shellfish and other aquatic products (Gomez-Jimenez and Rodriguez 2001; Olsen, 2003; Verbeke, & Vackier, 2005).

Consumer segmentation has been widely used in the study of food consumer behavior. Previous studies have shown that consumer behaviors of aquatic products (e.g. interests, knowledge, attitudes and behaviors toward fish and seafood) vary between different consumer segments (Jacobs et al., 2015; Pieniak, 2008; Verbeke et al., 2007). Therefore, Chinese consumer segments are assumed to have different product attribute perceptions, quality perceptions, attitudes and consumptions for shellfish, as shown in the hypothetical model for this study.

2. Methods and materials

2.1. Participants and procedures

A questionnaire was developed in English and translated into Chinese. An online pilot test (n=32) was undertaken with registered panel members of a Chinese research agency in order to improve the questionnaire design and language translation. The final version was programed to an online questionnaire and sent to members of the same panel during December 2016 in three Chinese cities: Beijing, Guangzhou and Chongqing. The three cities were selected

to compare and contrast consumer shellfish behaviors between Chinese first-tier cities (e.g. Beijing and Guangzhou) and second-tier cities (e.g. Chongqing) as there are great differences in the development levels of economies and other social interactions between first and other tier cities in China (Wang et al., 2017). A quota sampling approach was employed by using age (18-30, 31-40 and above 40), gender (male and female), cities (Beijing, Guangzhou and Chongqing) and education (Junior college and below, and University and above) as quota stratification dimensions (Fabinyi et al., 2016; Wang et al., 2017), based on a strict confirmation on participants' socio-demographics through their IP addresses and national ID cards. Only those participants who had carefully filled out the questionnaire were kept by the online questionnaire system. Survey questions were programed in a random order for each survey section (e.g. attitudes, consumption and product attribute perceptions) to increase the validity of this study.

A total of 643 valid responses were obtained for this study, of which 214 were from Beijing (Per capita disposable income monthly: 4038 RMB), 221 from Guangzhou (Per capita disposable income monthly: 3895 RMB) and 208 from Chongqing (Per capita disposable income monthly: 1676 RMB) (Guangzhou Statistical Bureau, 2016, 2017; National Bureau of Statistics of the People's Republic of China, 2016). Table 1 shows the socio-demographics of the sample. No significant difference was found by cross-tabulation with $\chi 2$ tests across the sub-samples of three cities in socio-demographic distribution including marital status, income, gender, age, occupation, education and household size.

>> Insert Table 1

2.2. Measures

Participants' product attribute perceptions of shellfish (as a general food type) were measured with thirty-three items that represent fourteen product attributes, shown in Table 2. These fourteen product attributes have been found to have significant effects on consumer

175 behavior of shellfish and/or aquatic products from previous studies (Amir & Rizvi, 2017;
176 Batzios et al., 2003; Birch et al., 2012; Dasgupta et al., 2010; Fabinyi & Liu, 2014a, b; Fabinyi
177 et al., 2016; Jacobs et al, 2015; Gomez-Jimenez & Rodriguez, 2001; Lin & Milon 1993; Manalo
178 & Gempesaw 1997; Myrland et al., 2000; Nguyen et al., 2015; Harkell, 2017; Olsen, 2001;
179 Olsen, 2003; Pieniak, 2008; Verbeke et al., 2007). Participants were asked to indicate their
180 product attribute perceptions toward shellfish: "For me, shellfish or eating shellfish is/has…".
181 A set of thirty-three items with seven-point semantic differential scales (with a negative left
182 anchor and a positive right anchor) was developed from the design used by Almli et al. (2011)
183 to explore consumers' attribute perceptions towards traditional food. The statement designs of
184 some items, including ethic, familiarity, price, preparation convenience, purchase convenience,
185 sensory attribute, health and mood were also based on measurement items from the Food
186 Choice Questionnaire (Steptoe, Pollard, & Wardle, 1995).
187 >> Insert Table 2

188 Participants' quality perceptions of shellfish (as a general food type) were measured by
189 two items with the same design for the product attribute perceptions (Almli et al., 2011), by
190 using seven-point semantic differential scales with answer anchors: 1) Low quality (negative
191 left anchor)/High quality (positive right anchor); 2) Inconsistent quality (negative left
192 anchor)/Consistent quality (positive right anchor).

193 Participants were asked to indicate their general attitudes towards shellfish (as a general
194 food type): "When I think about shellfish, I feel …". Two measurement items were hired by
195 seven-point semantic differential scales using bipolar adjectives:1) unhappy/happy; 2)
196 dull/excited. This method has been widely employed to explore consumers' general attitudes
197 toward aquatic products (e.g. Jacobs et al., 2015; Pieniak, 2008).

198 Participants' consumption for shellfish (as a general food type) was measured by a self-
199 reported single item: "To what extent do you consider yourself a consumer of shellfish?" with

200 a 7-point Likert scale ranging from “not at all” to “very much”. This design was based on a
201 previous study by Pieniak, Verbeke, Vanhonacker, Guerrero, & Hersleth (2009) to explore
202 consumers’ consumption of traditional food.

203 Finally, the same measurement designs of the attitude and consumption for shellfish (as
204 a general food type) were employed to explore participants’ attitudes (single item:
205 unhappy/happy) and consumption (not at all/very much) for twelve specific shellfish species:
206 shrimp/prawn, fresh water crab, scallop, crawfish, oysters, fresh water winkle, sea crab, razor
207 clam, lobster, sea winkle mussels, snow crab/king crab. It included higher priced, luxury
208 shellfish species which have experienced fast growth rates of consumption (e.g. lobster and
209 snow crab/king crab) and normal shellfish species which are commonly consumed in China
210 (e.g. shrimp/prawn, crawfish and fresh water crab) (Fabinyi et al., 2016; Manzelli, 2017;
211 Whittle, 2015; Xiao, 2015).

212 ***2.3. Data analysis***

213 The statistical software tools SPSS 24 and AMOS 24 were used to perform the data
214 analyses in this study. Firstly, descriptive analyses (with mean values) were used to identify
215 participants’ attitudes and consumption preferences for the twelve shellfish species. Second,
216 segmentation analysis was carried out by using the consumption variables of the twelve
217 shellfish species as segmentation variables, with a two-step approach: a hierarchical clustering
218 (with a Ward’s method and squared Euclidean distance) followed by a K-means cluster analysis
219 (with the initial cluster centers from the hierarchical clustering) (Everitt, 1980; Everitt, Landau,
220 & Leese, 2011; Gellynck & Verbeke, 2001). Cross-tabulation with $\chi 2$ tests and Independent
221 Sample T-tests were used to recognize the significant differences across the consumer
222 segments based on socio-demographic characteristics and individuals’ attitudes toward the
223 twelve shellfish species. Third, confirmatory factor analysis (CFA) was conducted to examine
224 whether the construct with fourteen product attribute perceptions for shellfish (as a general

food type) (see Table 2) had a good fit with the sample of this study (Byrne, 2009; Pieniak et al., 2009; Wu, 2009). Fourth, a structural equation model (SEM) was built to examine the association between the product attribute perceptions and the quality perceptions, attitudes and consumption for shellfish (as a general food type) (Byrne, 2009; Pieniak et al., 2009; Wu, 2009). Path analysis for the total sample and multi-group path analysis for the subsamples of consumer segments were conducted to recognize significant associations between the product attribute perceptions and the quality perceptions, attitudes and consumption for shellfish (as a general food type) (Byrne, 2009; Pieniak et al., 2009; Wu, 2009).

3. Results

3.1. Attitudes and consumption preferences for specific shellfish species

The mean values of the consumption variables of the twelve shellfish species ranged from 1.89 to 4.26, shown in Figure 2. Only shrimp/prawn reached a mean value above 4, followed by fresh water crab, scallop and crawfish with mean values above 3. While the lowest mean values were found for mussels and snow crab/king crab (below 2).

The mean values of the attitude variables of the twelve shellfish species ranged from 4.17 to 5.86 (Figure 2). The highest mean values were found for shrimp/prawn and lobster (above 5.5). Only mussels had a mean value below 4.5.

>> Insert Figure 2

3.2. Consumer segments

As shown in Table 3, a two-segment solution emerged as the result of the cluster analysis based on participants' consumption preferences for the twelve shellfish species. Segment 1 accounted for 42% of the total sample. Individuals in this segment scored higher on all of the twelve shellfish species than their counterparts in Segment 2. In particular, they scored higher than 4 (the average consumption level) on five shellfish species: shrimp/prawn, crawfish, fresh water crab, scallop and oysters. Segment 2 accounted for 58% of the total

sample. Individuals in this segment scored lower than 4 for all of the twelve shellfish species; the mean values of eleven shellfish species were lower than 3. It seems that individuals of Segment 1 were much more involved in shellfish consumption in comparison with their counterparts in Segment 2. Therefore, the Segment 1 was named as 'frequent-eaters'. The Segment 2 was labeled as 'less-frequent-eaters'.

Cross-tabulations with $\chi 2$ tests revealed that income and occupation were statistically significant socio-demographics between the two segments (Table 4). The 'frequent-eaters' segment had a much higher percentage of individuals who had a medium or high monthly income (above 5000 RMB or above 10000 RMB), and/or a high level of position (e.g. managing employees) than individuals in the 'less-frequent-eaters' segment (78% versus 47% for the percentages of high and medium income individuals; 47% versus 23% for the percentages of individuals with higher level positions). In contrast, the 'less-frequent-eaters' segment had a much higher percentage of individuals who had a low monthly income (low than 5000 RMB) and a low or medium level of position (e.g. salaried employee, student and worker) (53% versus 22% for the percentages of low income individuals; 69% versus 44% for the percentages of individuals with low or medium positions).

Furthermore, there were statistically non-significant differences in socio-demographics: marital status ($\chi 2 = 4.861$, $p = 0.088$), age ($\chi 2 = 4.125$, $p = 0.127$) and educational level ($\chi 2 = 2.024$, $p = 0.155$). The 'frequent-eaters' segment had a little higher percentage of individuals who were married, aged between 31-40 years and/or high-educated (e.g. university and above) (75% versus 69% for the percentages of married individuals; 37% versus 30% for the percentages of individuals aged between 31-40 years; 57% versus 52% for the percentages of higher-educated individuals). In contrast, the 'less-frequent-eaters' segment had a slightly greater percentage of individuals who were single, aged between 18-30 and low-educated (junior college and below) (18% versus 12% for the percentages of single individuals;

39% versus 33% for the percentages of individuals aged between 18-30 years; 48% versus 43% for the percentages of lower-educated individuals).

Independent Sample T-tests revealed statistically significant differences between the two segments in attitudes for all the twelve shellfish species (Table 5). The 'frequent-eaters' segment had attitudes for all of the twelve shellfish species more positive than the 'less-frequent-eaters' segment. The mean values were higher than 5 for eleven shellfish species in the 'frequent-eaters' segment (except for mussels with a mean value of 4.5); while they were higher than 4 for eleven shellfish species in the 'less-frequent-eaters' segment (except for mussels with a mean value of 3.93).

>> Insert Table 3

>> Insert Table 4

>> Insert Table 5

3.3. Confirmatory factor analysis

Table 6 shows results of the CFA for the construct with fourteen product attribute perceptions for shellfish (as a general food type) (see Table 2). The values of goodness of fit indices were acceptable: higher than 0.9 for CFI and lower than 0.08 for RMSEA (Byrne, 2009; Pieniak et al., 2009; Wu, 2009). As shown in Table 7, correlation coefficients between thirteen factors (except 'consumption place') were below 0.8, so severe multi-collinearity was not a case for the thirteen factors in the data (Pieniak et al., 2009). Standardized factor loadings of the observed items of these thirteen factors ranged from 0.715 to 0.967. The AVE scores of these thirteen factors were all higher than their squared correlation coefficients with other factors (except the factor 'consumption place'), with composite reliability (CR) measures higher than 0.8. In particular, there were very high CR scores (higher than 0.9) for the factors with semantically similar measurement items (e.g. high/low price versus expensive/cheap and

299 safe/unsafe versus reliable in safety/weak in safety, see Table 2). The discriminant validity was
300 established with the thirteen factors on the construct (Voorhees, Brady, Calantone, & Ramirez,
301 2016).

302 Nevertheless, the factor 'consumption place' had a low CR score (around 0.5). Its AVE
303 score (0.350) was lower than its squared correlation coefficients with most of other factors.
304 Therefore, the discriminant validity was not established with the factor 'consumption place' on
305 the construct (Voorhees, Brady, Calantone, & Ramirez, 2016). Furthermore, this factor had
306 severe multi-collinearity with factors 'consumption accompany' and 'mood' within the data of
307 this study, with correlation coefficients above 0.80 (Pieniak et al., 2009). In particular, the
308 correlation coefficient between 'consumption place' and 'consumption accompany' was
309 greater than 1. Schumacker & Lomax (2016) pointed out that a correlation coefficient greater
310 than 1 between latent variables might be caused by linear dependency among their observed
311 variables in a SEM (e.g. CFA). In our case, it might be the result of the very similar survey
312 designs for the two factors and also the possible linear dependency among some of their
313 measurement items (observed items) (e.g. between the 'bad/good to eat with families' and
314 'bad/good to eat at home', both related to 'family and home') (see Table 2). Furthermore, the
315 observed item 'bad/good to eat at home' had a low standardized factor loading (below 0.5) on
316 the latent variable 'consumption place' (Wang, De Steur, Gellynck, & Verbeke, 2015). This
317 might be caused by the two measurement items 'bad/good to eat at home' and 'bad/good to eat
318 at restaurant' not being semantically and practically similar ('home' versus 'restaurant'). Due
319 to the significant role of consumption place (particularly restaurants) on aquatic product
320 consumption in China (Fabinyi & Liu, 2014a, b; Fabinyi et al., 2016; Hu et al, 2014; Li & Wu,
321 2015; Skallerud, Myrland, & Olsen, 2012) and the exploratory nature of this study aimed at
322 addressing the lack of understanding on significant product attribute perceptions and their
323 impacts on Chinese consumers' quality perceptions, attitudes and consumption toward

shellfish (rather than a confirmatory nature e.g. to develop a theoretical model for the product attribute perceptions), these two measurement items were kept and programed as two separate independent (observed) variables, namely: 'consumption place (restaurant)' and 'consumption place (home)', in the SEM mentioned in the next section of this paper (see Figure 3). Table 8 shows the correlation matrix of latent variables based on the adjusted construct of shellfish attribute perceptions. All the correlation coefficients were below 0.80. As such, severe multi-collinearity was not the case in this adjusted construct (Pieniak et al., 2009).

>> Insert Table 6

>> Insert Table 7

>> Insert Table 8

3.4. Structural equation modeling

As shown in Figure 3, a SEM was developed to identify the associations between the product attribute perceptions and the quality perceptions, attitudes and consumption for shellfish (as a general food type), with fifteen latent variables and thirty-eight observed variables. The observed variables of the two latent variables regarding the attitudes and the quality perceptions for shellfish had good internal reliabilities as the Cronbach α scores were high: 0.845 for the quality perceptions and 0.880 for the attitudes (Wang, De Steur et al., 2015; Žeželj et al., 2012).

>> Insert Figure 3

Path analysis was carried out based on the total sample. The SEM performed well, as the values of goodness-of-fit indices were considered as acceptance (below 0.08 for RMSEA and above 0.9 for CFI) (Byrne, 2009; Pieniak et al., 2009; Wu, 2009). The SEM was also performed well with the multi-group path analysis carried out for the subsamples of the two segments (based on their consumption preferences for the twelve shellfish species, see Table

348 3, 4 and 5). The RMSEA and CFI values reached an acceptable fit for all restricted models with
349 the CFI values from 0.916 to 0.936 and the RMSEA values from 0.044 to 0.047 (Byrne, 2009;
350 Pieniak et al., 2009; Wu, 2009).

351 Figure 4 indicates the significant paths in the path analysis and the multi-group path
352 analysis. Regarding the total sample, the consumption of shellfish was positively linked to
353 'familiarity' and negatively linked with 'purchase convenience', 'safety' and 'consumption
354 place (home)'. In other words, those Chinese participants, who perceived shellfish as being
355 'familiar', were more likely to be frequent shellfish buyers than others. In contrast, those
356 Chinese participants who perceived shellfish as being 'safe', 'always available' and/or 'good
357 to eat at home', were less likely to be frequent shellfish buyers than others.

358 The attitude toward shellfish was positively associated with 'familiarity', 'sensory
359 attributes', 'consumption accompany' and 'consumption (restaurant)' in the total sample. As
360 such, those Chinese participants who perceived shellfish as being 'familiar', 'good taste, smell
361 or appearance', 'good to eat with others (e.g. families, important people or friends)' and 'good
362 to eat at restaurants', had more positive attitudes toward shellfish than others.

363 The quality perception of shellfish was positively linked with 'freshness', 'ethic' and
364 'mood' in the total sample. As such, those Chinese participants, who perceived shellfish as
365 being 'always fresh', 'environmental or sustainability friendly' and 'good for mood and relax',
366 had more positive quality perceptions toward shellfish than others.

367 According to the 'frequent-eaters' segment, the consumption of shellfish was positively
368 linked to 'familiarity'. The attitude toward shellfish was positively linked to 'sensory
369 attributes'. The quality perception of shellfish was positively linked with 'freshness' and
370 'ethic'.

371 With regard to the 'less-frequent-eaters' segment, the consumption of shellfish was
372 positively linked to 'familiarity' and negatively linked to 'safety'. The attitude toward shellfish

was positively linked to ‘sensory attributes’. The quality perception of shellfish was positively linked with ‘freshness’ and ‘mood’.

In addition, no statistically significant association was found among the attitude, consumption, quality perception and five product attribute perceptions (health, preparation convenience, purchase convenience online, price, assortment) for shellfish (as a general food type) in either the total sample or the two sub-samples.

>> Insert Figure 4

4. Discussion

Although China has been experiencing a dramatic increase in ownership and importation of shellfish (Agriculture and Agri-Food Canada, 2014, 2016; Ministry of Agriculture of the People’s Republic of China, 2005, 2017), our findings reveal a relatively low level of consumption for the twelve shellfish species by Chinese consumers. This is in line with the dietary pattern in China in which the majority of people consume aquatic product in a much lower volume (11.2kg per capita, mostly finfish) than their commonly consumed food categories such as fresh vegetables (94.9kg per capita), meat (26.2kg per capita), fruits (44.5kg per capita) and grains (124.3 kg per capita) (FAO, 2016; Ministry of Agriculture of the People’s Republic of China, 2005, 2017; National Bureau of Statistics of the People's Republic of China, 2016). Furthermore, imported luxury shellfish has only recently become popular in China and mainly focused on high-end markets such as high-end restaurants (Fabinyi, 2012; Fabinyi et al., 2012 Fabinyi & Liu, 2014a, b; Fabinyi et al., 2016; Federico, 2016; Whittle, 2015; Xiao, 2015). As such, it is reasonable to expect that the majority of participants report a lower level of consumption for those uncommon and relatively new shellfish species (e.g. lobster and snow/king crab).

However, a gap exists between Chinese consumers’ attitudes and consumption toward shellfish. Chinese consumers generally have positive attitudes toward all of the twelve shellfish

species, particularly for luxury shellfish e.g. lobster and snow/king crab albeit with a lower level of consumption (see Figure 2). This gap has also been confirmed by the statistically non-significant association between variables of the attitudes and consumption of shellfish (as a general food type) in the SEM. The positive attitudes might be caused by a particular consumption psychology for seafood (including most of shellfish species e.g. oysters, scallop and lobster) in China. The consumption of seafood (particularly luxury seafood) has the ability to enhance Chinese consumers' face consciousness, as such the consumption is considered to be upscale and people prefer to consume it in restaurants with the purpose to show their high social status or to establish relationships with others of high social status (Bao, Zhou, & Su, 2003; Clarke, 2004; Fabinyi, 2012; Fabinyi & Liu, 2014a, b; Fabinyi et al., 2016). As such, most Chinese consumers have positive attitudes toward shellfish based on this special consumption psychology albeit with a lower level of consumption. The positive attitudes could be a force for the future growth of shellfish consumption in this major market. The gap between attitudes and consumption may also be narrowed by the gradually growth in shellfish consumption by Chinese consumers.

'Familiarity' is the only product attribute that has a statistically significant relationship with both the attitudes and consumption for shellfish in the SEM. In particular, it has a strongly positive influence on the shellfish consumption. This corresponds with previous findings that habits and past experiences are strongly and positively linked to consumers' choice behavior for aquatic products, such as consumption, intention and preferences (Acebrón et al., 2001; Almeida et al., 2015; Honkanen, Olsen, & Verplanken, 2005; Trondsen, Braaten, Lund, & Eggen, 2004). It may also be a reflection of the increased safety concerns for aquatic products caused by the water pollution and frequent food safety incidents in China (e.g. overuse of antibiotics in shellfish, and fake shark aimed at a high demand of luxury seafood) (Fabinyi & Liu, 2014b; Hu et al., 2014; Lin, Liu, Tan, Guo, Li, Ren, & Zhou, 2015). As such, Chinese

consumers may prefer to consume familiar shellfish products and species in order to avoid getting ill by eating shellfish that is an aquatic product type with a higher risk of microbial contamination and allergenicity than other aquatic products (Fabinyi & Liu, 2014b; Hu et al., 2014; Lin, Liu, Tan, Guo, Li, Ren, & Zhou, 2015; Pieniak, 2008; Xu et al., 2012).

Chinese consumers' attitude toward shellfish is positively associated with 'eating at restaurants'. While their shellfish consumption is negatively linked to 'eating at home'. This is in line with the fact that Chinese consumers are more willing to consume aquatic products (especially for seafood and luxury aquatic products) at restaurants than at home (Fabinyi et al., 2016).

Chinese consumers' attitudes toward shellfish is positively linked to 'good sensory experiences'. This confirms the significant influences of sensory preferences (especially the taste) on the consumption of shellfish and other aquatic product found in previous studies (Batzios et al., 2003; Birch et al., 2012; Ding, 2012; Hu et al, 2014; Johnston & Roheim, 2006). Sensory appeal plays a key role for food preference in China, and according to Chinese tradition, a good dish needs to be excellent in terms of appearance, smell and taste (Dang, 2010; Wan, 1995; Wang et al., 2016). Chinese cuisine is one of the world's "Three Grand Cuisines", together with French and Turkish cuisine, and has many cooking methods that enhance people's sensory appeal for shellfish and other aquatic products (e.g. make steamed bun with crab yolk, and wok crawfish and lobster with chili sauce) (Fabinyi, 2012; Fabinyi & Liu, 2014a, b; Fabinyi et al., 2016; Federico, 2016; Wang et al., 2016; Zhao, 2003). Therefore, it is reasonable to expect that there is a significantly positive association between Chinese consumers' attitudes and their sensory perceptions for shellfish.

The attitude for shellfish is also positively linked to 'the good experiences of consumption accompany' (e.g. eating with families, colleagues or friends). Fabinyi et al. (2012) and Fabinyi & Liu (2014 a, b) have indicated the importance of seafood consumption as a

448 vehicle to establish and maintain social networking, such as becoming familiar or keeping
449 relationships with important people or potential business partners by inviting them to a seafood
450 banquet in China. This study is one of the first to confirm the influence of 'consumption
451 accompany' that exists in Chinese consumers' choice behavior (attitudes) for shellfish.

452 Chinese consumers' shellfish consumption is significantly influenced by their 'safety
453 perceptions' for shellfish. This is in line with the great impact of food safety concern regarding
454 aquatic product consumption in recent years in China. Increased food safety concerns have
455 boosted the demand for high quality seafood products that have safety assurance (Hu et al,
456 2014), while it has also led to a decline in the consumption of some luxury aquatic products
457 that may be counterfeit in China (Ding, 2012; Fabinyi & Liu, 2014a, b; Fabinyi et al., 2016).

458 The consumption is also negatively linked to 'purchase convenience'. Previous studies
459 mainly pay attention to the effects of preparation convenience, rather than 'purchase
460 convenience', on the consumer behavior of aquatic products (Almeida et al., 2015; Birch et al.,
461 2012). This study is one of the first to indicate the important influences of 'purchase
462 convenience' on shellfish consumption in China. Furthermore, the 'purchase convenience'
463 dimension is measured by using two items 'Low availability/High availability' and 'Difficult
464 to find in local wet markets or supermarket/ Easy to find in local wet markets or supermarkets'
465 (see Table 2 and Section 2.2). These two measurement items have semantic meanings of
466 'availability for general consumption (for both home and eating out)' and inclined toward
467 'availability for home consumption (e.g. from supermarket and local wet market)'. This design
468 might result in the negative relationship between the consumption and 'purchase convenience',
469 as the consumption of shellfish by Chinese consumers is negatively linked to the consumption
470 place 'home' shown in this study. In addition, the finding might also indicate a low availability
471 for shellfish in local wet market and supermarket due to the underdeveloped cold chain
472 facilities in China (Zhang, 2016).

Chinese consumers' quality perception toward shellfish is significantly associated with two experience quality attributes 'freshness' and 'mood' and a credence quality attribute 'ethic' (Ophuis & Van Trijp, 1995). The high quality of shellfish is positively linked to 'freshness' by Chinese consumers. This is in line with the findings in previous studies that freshness is seemed as being the sign of high quality for shellfish, and it is an important factor when deciding shellfish purchase in both China and other regions (Batzios et al., 2003; Gomez-Jimenez & Rodriguez, 2001; Hu et al, 2014; Li & Wu, 2015). With regard to Chinese consumers, freshness is considered as the first key factor for seafood cooking as it can ensure their favorite 'umami' taste for a seafood dish, far greater than frozen and recently deceased product (Fabinyi & Liu, 2014 a, b; Komata, 1990; Kurihara, 2009; Nakayama & Kimura, 1998; Zhao, 2003).

High quality is also positively linked with 'environmental and sustainability friendly' and 'mood boosting'. This corresponds with findings in previous studies. Extensive consumer-awareness campaigns by NGOs have raised Chinese consumers' ethical concerns toward aquatic products which has resulted in their wish to spend more on green/sustainable-fishery-labeled aquatic products in order to protect society and marine resources (Fabinyi & Liu, 2014a, b; Fabinyi et al., 2016; Xu, Zeng, Fong, Lone, & Liu, 2012). Psychological satisfaction is an important factor for aquatic product consumption (especially for luxury aquatic products) by Chinese consumers (e.g. to show their high social status and to satisfy their cultural beliefs) (Fabinyi & Liu, 2014a, b; Hu et al., 2014). Therefore, it is reasonable that 'good for mood' and 'ethic friendly' are standards for high quality shellfish in Chinese consumers' minds.

Previous theoretical and empirical studies have indicated the significant influence of quality perception on food consumer behavior (Almli et al., 2011; Cicerale et al., 2016; Grunert, 2002; Grunert, 2005; Lee & Yun, 2015; Ophuis & Van Trijp, 1995). However, this study uncovers that Chinese consumers' quality perceptions have no significant influence on their attitude and consumption toward shellfish. This may be caused by the consumption

patterns of seafood (including most of shellfish species) in China. Most of seafood products are consumed at food service sectors (hotels/restaurants/food stalls), rather than at home by Chinese consumers (Fabinyi et al., 2016). As a result, hotel/restaurant/food stall owners are responsible for the majority of quality-assurance activities for shellfish (e.g. ensure its freshness, environment friendly and mood boosting) instead of consumers in their homes. As a result, many consumers do not need to focus on quality-issues for shellfish consumption in China. This might result in the non-significant associations between quality perception, and consumption and attitude toward shellfish by Chinese consumers. Based on the results of this study, marketing promotions based on quality issues could focus on members of the restaurant value chain for shellfish (e.g. the owners of hotels/restaurants/food stalls and their upstream chain members).

Chinese consumers' attitudes, quality perceptions and consumptions for shellfish are not significantly linked to 'preparation convenience', 'price' and 'health'. This may be caused by the particular consumption pattern, psychology and culture for shellfish in China. Most of seafood products are consumed at food service sectors where guests do not pay individually (Fabinyi, 2012; Fabinyi & Liu, 2014a, b; Fabinyi et al., 2016). In particular, seafood dishes are seemed as upscale to enhance consciousness and considered as indispensable parts of the banquets aimed at establishing personal relationships with important people by private businesses and government sectors (often paid by business and government fund expenditures) (Bao et al., 2003; Clarke, 2004; Fabinyi, 2012; Fabinyi & Liu, 2014a, b). As such, many shellfish consumers (particularly the guest consumers) may pay less attention to prices and preparation-issues for shellfish dishes in the food service sectors. This may be the cause of the non-significant relationships between the 'preparation convenience' and 'price' perceptions and the shellfish consumption behavior (consumption, attitude and quality perception) by Chinese consumers in this study. It is also in line with the findings by Wang & Somogyi (2018)

that the ‘expensive’ perception has no significant influence on Chinese consumers’ general image of lobster. Furthermore, the particular consumption pattern, psychology and culture may result in a decrease in the importance of ‘health’ for the consumption of shellfish by many Chinese consumers due to its ‘home and family’-based consumption orientation (e.g. increasing nutrition and protein intake for family members, in particular for children and elders) (Li & Wu, 2015; Myrland et al., 2000). This may be a reason for the non-significant relationship between the ‘health’ perception and shellfish consumption behavior by Chinese consumers.

Chinese consumers’ attitudes, quality perceptions and consumptions for shellfish were not significantly linked to ‘purchase convenience online’. This is in line with the fact that online shopping still accounts for a tiny share (less than 5%) of Chinese consumers’ aquatic product consumption (Fabinyi et al., 2016).

The attitudes, quality perceptions and consumptions were not significantly associated with ‘assortment’. This might correspond with the impact of ‘familiarity’ on Chinese consumers’ attitudes and consumptions for shellfish. They might only consume or consume most of their shellfish species that they are familiar with, although there is a vast variety of shellfish species in the Chinese market today.

There are differences in the influencing factors on the quality perceptions, attitudes and consumptions toward shellfish between the two consumer segments: the ‘frequent-eaters’ segment (with a medium/high income and a high level of position) and the ‘less-frequent-eaters’ segment (with a low income and a low/medium level of position). ‘Safety’ and ‘mood’ appear to have significant relationships with the consumption and quality perceptions toward shellfish in the ‘less-frequent-eaters’ segment, but they do not play a role in the ‘frequent-eaters’ segment. Meanwhile ‘sensory attributes’ has a more significant effect (a higher score on standardized regression weight) on the attitudes toward shellfish in the ‘less-frequent-eaters’ segment than that in the ‘frequent-eaters’ segment. By contrast, ‘perceived ethic’ has a

548 significant effect on the quality perceptions toward shellfish in the ‘frequent-eaters’ segment,
549 while it does not play an important role in the ‘less-frequent-eaters’ segment. These differences
550 may be explained by the theory of ‘Maslow's hierarchy of needs’ (Maslow, 1943); in which
551 low-frequent shellfish consumers (the ‘less-frequent-eaters’ segment) pursue satisfaction with
552 low-level needs (e.g. safety-assured, sensory appeal and self-relaxing), while high-frequent
553 shellfish consumers (the ‘frequent-eaters’ segment) pursue satisfaction with high-level needs
554 (e.g. ethnic friendly) when consuming shellfish. Furthermore, consumers in the ‘frequent-
555 eaters’ segment are more likely to have a high or medium income and a higher level of
556 occupation position than the ‘less-frequent-eaters’ segment; while their counterparts in the
557 ‘less-frequent-eaters’ are more likely to have a low income and a lower or medium level of
558 occupation. This may be caused by the fact that shellfish belongs to an upscale food category
559 and can only be frequent consumed by high and middle-class consumers in China (Clarke,
560 2004; Fabinyi, 2012; Fabinyi & Liu, 2014a, b; Fabinyi et al., 2016; Federico, 2016; Li & Wu,
561 2015; Lu et al., 2013; Zhou, Jin, Zhang, Cheng, Zeng, & Wang, 2015).

562 By focusing on different cultural factors related to shellfish consumption behaviors,
563 some similarities and differences can be found between Chinese consumers and Western
564 consumers. ‘Safety’, ‘sensory attributes (e.g. taste and appearance)’, ‘freshness’ and
565 ‘familiarity (e.g. habits and previous experiences)’ are important positive factors for Western
566 consumers to choose shellfish (Acebrón et al., 2001; Batzios et al., 2003; Gomez-Jimenez &
567 Rodriguez, 2001; Manalo & Gempesaw, 1997). This is in line with the findings from this study,
568 albeit with a Chinese consumer base. Furthermore, ‘health (e.g. nutrition values)’ and
569 ‘preparation convenience’ are two other significant factors that drive Western consumer
570 shellfish consumption (Gomez-Jimenez & Rodriguez, 2001). However, these two factors do
571 not play the same role in the Chinese sample of this study.

572 Nevertheless, our study does have some limitations. Firstly, the similar measurement
573 designs of 'consumption accompany' and 'consumption place' result in severe multi-
574 collinearity between the two factors. Future studies should develop measures with a higher
575 validity in order to avoid a similar problem happened. Secondly, this study focuses on Chinese
576 consumers' product attribute perceptions, attitudes, quality perceptions, segments and
577 consumption for shellfish. It is recommended that future studies also involve other factors that
578 may influence shellfish consumer behavior, such as food choice motives, adoption of food
579 labels, self-image, lifestyle, expressing social status, affordability of eating in restaurants.
580 Thirdly, the online survey used in this study did not include 'origin' and 'farmed/captured' as
581 items of product attribute perceptions, due to the diversity of specific shellfish species on these
582 two attributes (e.g. lobsters are often captured and imported; while shrimps/prawns are both
583 captured and farmed, and both imported and domestic in China); which is difficult to measure
584 for shellfish as a general food type and by the semantic differential scales used in this study.
585 Future studies could explore this issue. Fourthly, the data was collected in three Chinese cities:
586 Beijing, Guangzhou and Chongqing. Future studies could involve more cities or regions, as
587 there may be differences in shellfish consumer behaviors across different geographic regions
588 in China. Fifthly, our study used a self-reported measure of shellfish consumption developed
589 from previous studies for food products. This self-reported measure may be problematic, as it
590 resulted in a quite low level of consumption of shellfish and a gap between attitudes and
591 consumption. Future relevant studies should use or develop a more suitable measure for
592 shellfish consumption in China. For example, a six-point ordered scale may be a suitable tool
593 as it has been successfully used to measure the consumption of a low-frequent-consumed
594 beverage type- European beer among Chinese consumers by Wang et al. (2017).
595
596

5. Conclusion

This study is one of the first to contribute to a comprehensive understanding of consumers' product attribute perceptions, quality perceptions, attitudes, consumptions and segments toward shellfish in the world's largest fishery market- China. Utilizing a quantitative-modeling approach and cluster analysis, the study provides high-valid findings regarding the significant product perceptions influencing consumers' attitudes, quality perceptions and consumption, and consumer segments for shellfish in China. The findings have reference significance for future shellfish consumer research in China and other regions due to the current lack of understanding of shellfish consumer behavior globally.

The findings can also assist global shellfish marketers and producers to develop effective marketing strategies and promotions in the large and emerging Chinese market. Efforts should focus on ways to enhance Chinese consumers' exposure to and familiarity with their shellfish products (e.g. advertisements and promotion activities) due to the significant effect of 'familiarity' perception on their consumption and attitudes toward shellfish. Furthermore, in addition to the retail development, producers and marketers should pay more efforts on building and maintaining the value chains for food service sectors when marketing shellfish in China, as most consumers in that market consume shellfish from restaurants, hotels and food stalls. Finally, shellfish producers and marketers should develop marketing strategies that specifically target the two Chinese consumer segments 'frequent-eaters' and 'less-frequent-eaters' in order to meet their different needs for shellfish consumption (e.g. high-level needs versus low-level needs).

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Table 1 Socio-demographic details of the sample

		Total sample
Sample size (n=)		643
Gender		
	Male	50%
	Female	50%
City		
	Beijing	33%
	Guangzhou	35%
	Chongqing	32%
Marital status		
	Married	71%
	No, but has a partner	13%
	Single	16%
Age		
	Range	18-66
	18-30	37%
	31-40	33%
	≥41	30%
Personal income (RMB, monthly)		
	0-5000	40%
	5001-10000	41%
	≥10001	19%
Education		
	Junior college and below	46%
	University and above	54%
Occupation		
	Managing employee	33%
	Salaried employee	42%
	Worker	9%
	Student	7%
	Self-employed	5%
	Other	4%
Household size		
	1-2	13%
	3	53%
	4	18%
	≥5	16%

Table 2 Perception measurement items of shellfish attributes (seven-point scales)

Attribute dimension	Code	Left anchor (score 1)	Right anchor (score 7)
Sensory attribute	**SA**		
	SA1	Bad taste	Good taste
	SA2	Bad smell	Good smell
	SA3	Bad appearance	Good appearance
Health	**H**		
	H1	Unhealthy	Healthy
	H2	Low in nutritional value	High in nutritional value
Preparation convenience	**PR**		
	PR1	Difficult to prepare	Easy to prepare
	PR2	Time-consuming to prepare	Not time-consuming to prepare
Purchase convenience	**PU**		
	PU1	Low availability	High availability
	PU2	Difficult to find in local wet markets/supermarket	Easy to find in local wet markets/supermarkets
Purchase convenience online	**PO**		
	PO1	Difficult to buy online	Easy to buy online
	PO2	Difficult to find in online shops	Easy to find in online shops
Safety	**S**		
	S1	Unsafe	Safe
	S2	Weak in safety	Reliable in safety
Price	**P**		
	P1	Expensive	Cheap
	P2	High price	Low price
Familiarity	**FA**		
	FA1	Unfamiliar	Familiar
	FA2	What I don’t usually eat	What I usually eat
Assortment	**A**		
	A1	Narrow assortments to buy	Wide assortments to buy
	A2	Narrow production forms to buy	Wide production forms to buy

Table 2 (continued)

Attribute dimension	Code	Left anchor (score 1)	Right anchor (score 7)
Ethic	**E**		
	E1	Environmental unfriendly	Environmental friendly
	E2	Not supportive for sustainability	Supportive for sustainability
Mood	**M**		
	M1	Bad for my mood	Good for my mood
	M2	Bad for my relaxation	Good for my relaxation
Freshness	**FR**		
	FR1	Inconsistent freshness	Consistent freshness
	FR2	Always non-fresh	Always fresh
Consumption accompany	**CA**		
	CA1	Bad to eat with families	Good to eat with families
	CA2	Bad to eat with important people	Good to eat with important people
	CA3	Bad to eat with friends	Good to eat with friends
	CA4	Bad to eat with business partners	Good to eat with business partners
	CA5	Bad to eat with colleagues	Good to eat with colleagues
	CA6	Bad to eat with parents, partner and child/children	Good to eat with my parents, partner and child/children
Consumption place	**CP**		
	CP1	Bad to eat at home	Good to eat at home
	CP2	Bad to eat at restaurant	Good to eat at restaurant

Table 3 Sizes, mean scores and SD (Std. Deviation) scores of consumer segments based on their subjective evaluation of consumption for the twelve specific shellfish categories

Shellfish category	Segment 1		Segment 2		F	*p*-Value
	Frequent-eaters		Less-frequent-eaters			
	Mean	SD	Mean	SD		
Lobster	3.55	1.54	1.72	1.00	332.487	0.000
Crawfish	4.19	1.56	2.16	1.24	339.002	0.000
Shrimp/Prawn	5.27	1.21	3.54	1.45	256.276	0.000
Fresh-water-crab	4.56	1.22	2.45	1.25	456.399	0.000
Sea-crab	4.00	1.37	1.80	1.16	484.651	0.000
Snow-crab/King-crab	2.78	1.51	1.25	0.60	315.042	0.000
Scallop	4.54	1.15	2.25	1.15	623.839	0.000
Razor-clam	3.83	1.43	1.70	0.96	511.343	0.000
Mussels	2.97	1.62	1.29	0.68	324.057	0.000
Oysters	4.18	1.54	1.91	1.13	463.049	0.000
Fresh-water-winkle	3.93	1.49	2.05	1.11	336.291	0.000
Sea-winkle	3.57	1.48	1.59	0.93	434.616	0.000
Segment size	270		373			
Share of the total sample (n=643)	42%		58%			

Table 4 Socio-demographics of the two consumer segments

	Segment 1 Frequent-eaters (n=270)	Segment 2 Less-frequent-eaters (n=373)
City		
Beijing	36%	32%
Guangzhou	34%	34%
Chongqing	30%	34%
Gender		
Male	50%	50%
Female	50%	50%
Income***		
0-5000	22%	53%
5001-10000	48%	36%
≥10001	30%	11%
Marital status		
Single	12%	18%
No, but has a partner	13%	13%
Married	75%	69%
Educational level		
Junior college and below	43%	48%
University and above	57%	52%
Occupation***		
Managing employee	47%	23%
Salaried employee	33%	48%
Student	3%	10%
Worker	8%	11%
Self-employed	7%	4%
Others	2%	4%
Age		
18-30	33%	39%
31-40	37%	30%
≥41	30%	31%
Household size		
1-2	13%	12%
3	56%	52%
4	15%	19%
≥5	16%	17%

*Note: ***= p<0.001; **= p<0.01; *= p<0.05.*

Table 5 Attitudes for the twelve shellfish species of the two consumer segments: mean scores and SD (Std. Deviation) scores

	Segment 1		Segment 2	
	Frequent-eaters		Less-frequent-eaters	
	(n=270)		(n=373)	
	Mean	SD	Mean	SD
Lobster***	6.10	1.05	5.38	1.50
Crawfish***	5.51	1.42	4.83	1.75
Shrimp/Prawn***	6.16	0.87	5.65	1.36
Fresh-water-crab***	5.89	1.08	5.20	1.53
Sea-crab***	5.71	1.11	4.84	1.56
Snow-crab/King-crab***	5.63	1.33	4.94	1.65
Scallop***	5.85	1.04	5.21	1.50
Razor-clam***	5.14	1.41	4.36	1.70
Mussels***	4.50	1.40	3.93	1.55
Oysters***	5.61	1.18	4.82	1.71
Fresh-water-winkle***	5.11	1.32	4.41	1.63
Sea-winkle***	5.05	1.21	4.40	1.55

*Note: ***= $p<0.001$; **= $p<0.01$; *= $p<0.05$.*

Table 6. Results of the CFA based on the theoretical construct of shellfish attribute perceptions: Standardized factor loading (SFL), Composite reliability (CR) and Average variance extracted (AVE)

Factor and item (code)	SFL	CR	AVE	Factor and item(code)	SFL	CR	AVE
Sensory attribute		0.813	0.591	**Assortment**		0.933	0.874
SA1	0.786			A1	0.945		
SA2	0.771			A2	0.925		
SA3	0.749			**Ethic**		0.877	0.781
Health		0.827	0.704	E1	0.893		
H1	0.861			E2	0.874		
H2	0.817			**Mood**		0.932	0.873
Preparation convenience		0.892	0.806	M1	0.943		
PR1	0.896			M2	0.926		
PR2	0.899			**Freshness**		0.912	0.838
Purchase convenience		0.855	0.748	FR1	0.921		
PU1	0.922			FR2	0.910		
PU2	0.804						
Online Purchase convenience		0.938	0.883				
OP1	0.942						
OP2	0.937			**Consumption accompany**		0.927	0.679
Safety		0.952	0.908	CA1	0.889		
S1	0.962			CA2	0.800		
S2	0.944			CA3	0.857		
Price		0.962	0.926	CA4	0.715		
P1	0.967			CA5	0.788		
P2	0.958			CA6	0.881		
Familiarity		0.894	0.808	**Consumption place**		0.509	0.350
FA1	0.919			CP1	0.696		
FA2	0.878			CP2	0.464		

Note: For the codes of measurement items of shellfish attribute perceptions please refer to Table 2; Goodness-of-fit indices: RMSEA=0.062, CFI=0.946, Chi-square= 1396.237, DF= 404, $p<0.001$.

Table 7. Correlation matrix of latent variables based on the theoretical construct of shellfish attribute perceptions

Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Sensory attribute	1													
2. Health	0.673	1												
3. Preparation convenience	0.512	0.460	1											
4. Purchase convenience	0.526	0.500	0.590	1										
5. Online Purchase convenience	0.390	0.371	0.358	0.551	1									
6. Safety	0.592	0.660	0.542	0.552	0.432	1								
7. Price	0.195	0.097	0.336	0.329	0.235	0.238	1							
8. Familiarity	0.607	0.563	0.603	0.651	0.401	0.672	0.434	1						
9. Assortment	0.441	0.408	0.427	0.696	0.432	0.549	0.383	0.720	1					
10. Ethic	0.611	0.717	0.502	0.532	0.365	0.591	0.268	0.594	0.523	1				
11. Mood	0.677	0.710	0.455	0.474	0.342	0.580	0.176	0.620	0.457	0.782	1			
12. Freshness	0.487	0.503	0.417	0.427	0.345	0.572	0.311	0.605	0.581	0.682	0.658	1		
13. Consumption accompany	0.518	0.613	0.400	0.489	0.357	0.552	0.152	0.529	0.484	0.613	0.695	0.659	1	
14. Consumption place	0.667	0.730	0.567	0.643	0.467	0.660	0.221	0.720	0.564	0.753	0.834	0.706	1.068	1

Note: All correlations are significant at 0.001 or 0.05 level.

Table 8. Correlation matrix of latent variables based on the adjusted construct of shellfish attribute perceptions

Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Sensory attribute	1														
2. Health	0.672	1													
3. Preparation convenience	0.516	0.462	1												
4. Purchase convenience	0.526	0.501	0.590	1											
5. Online Purchase convenience	0.392	0.370	0.355	0.550	1										
6. Safety	0.591	0.660	0.541	0.553	0.432	1									
7. Price	0.193	0.094	0.331	0.328	0.233	0.238	1								
8. Familiarity	0.606	0.562	0.603	0.651	0.401	0.672	0.434	1							
9. Assortment	0.441	0.408	0.425	0.697	0.433	0.549	0.382	0.527	1						
10. Ethic	0.611	0.718	0.503	0.532	0.365	0.591	0.267	0.594	0.523	1					
11. Mood	0.676	0.710	0.457	0.474	0.343	0.580	0.175	0.621	0.457	0.782	1				
12. Freshness	0.487	0.503	0.415	0.427	0.346	0.572	0.312	0.606	0.581	0.682	0.658	1			
13. Consumption accompany	0.518	0.613	0.401	0.489	0.358	0.552	0.151	0.529	0.484	0.612	0.695	0.659	1		
14. Consumption place (home)	0.472	0.508	0.443	0.474	0.303	0.474	0.156	0.557	0.418	0.534	0.594	0.514	0.729	1	
15. Consumption place (restaurant)	0.290	0.340	0.154	0.239	0.266	0.273	0.097	0.208	0.205	0.327	0.355	0.275	0.528	0.323	1

Note: All correlations are significant at 0.001 or 0.05 level.

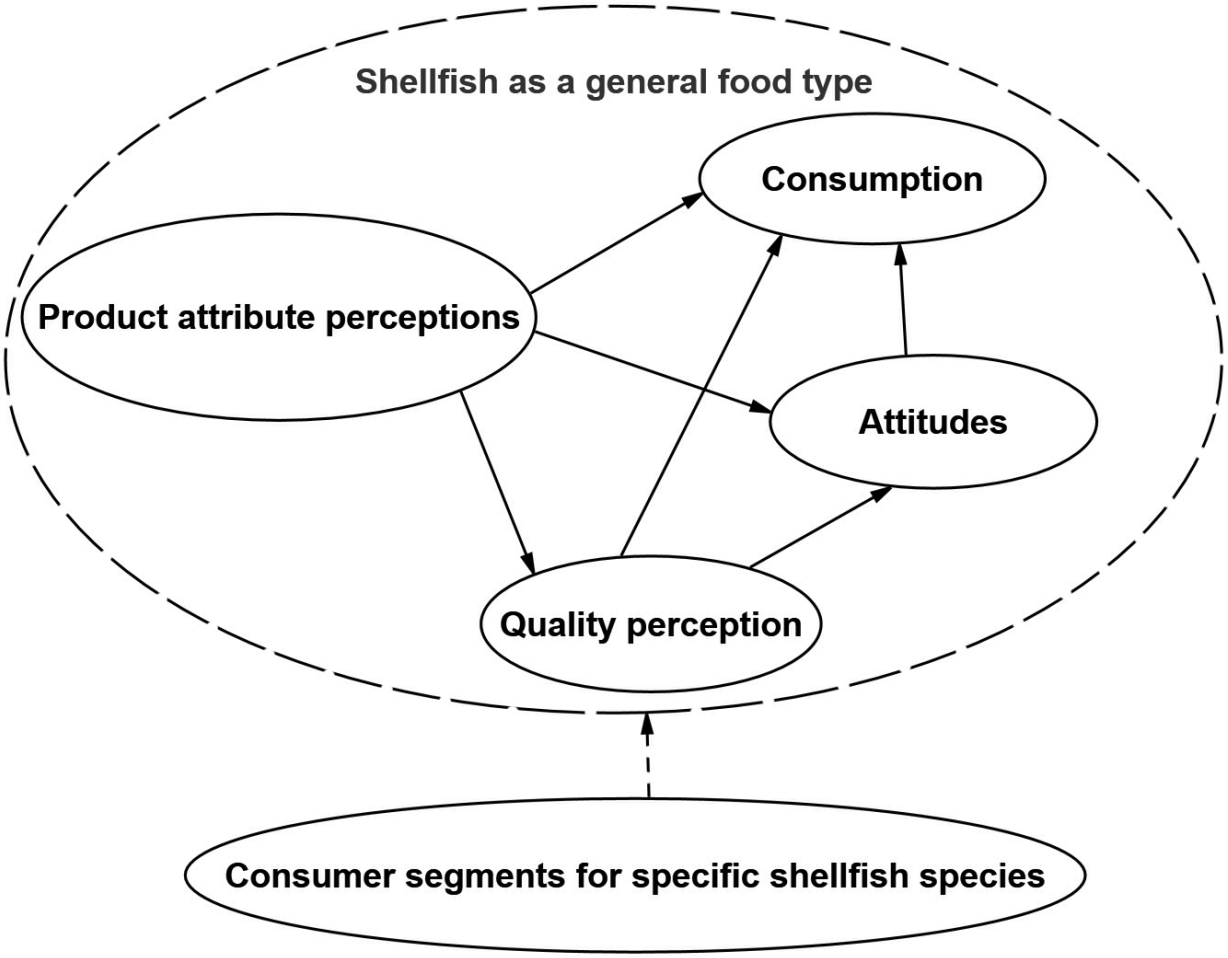

Figure 1 Theoretical model of this study

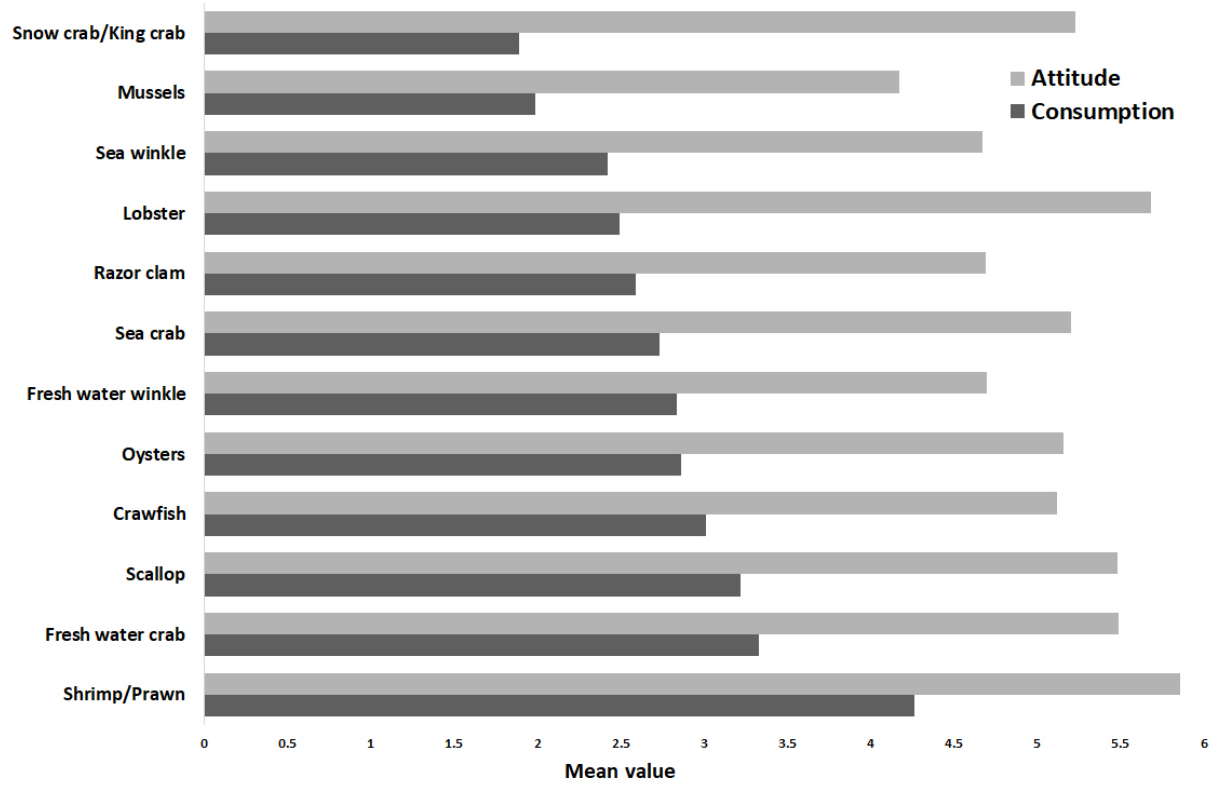

Figure 2 Mean values of attitude and consumption toward the twelve shellfish species

Note: The answer anchors of consumption: 0= not at all and 7= very much; the answer anchors of attitudes: 0=unhappy and 7=happy (for more details please refer to Section 2.2).

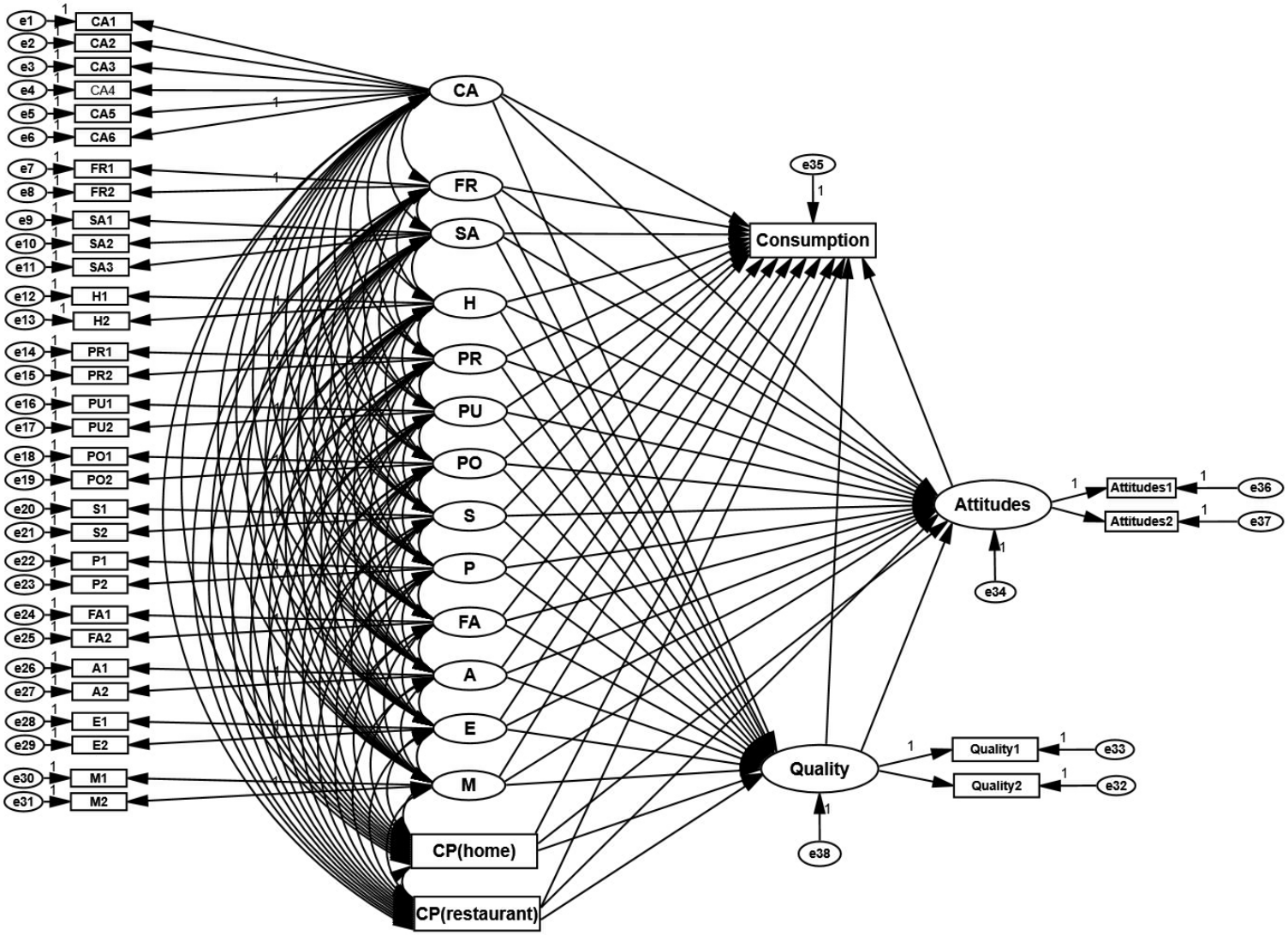

Figure 3 Structural equation model for the (multi-group) path analysis in this study

Note: For the codes of measurement items and/or latent variables of shellfish attribute perceptions, attitudes and quality perceptions please refer to Table 2 and Section 2.2; e1-e38: error variables.

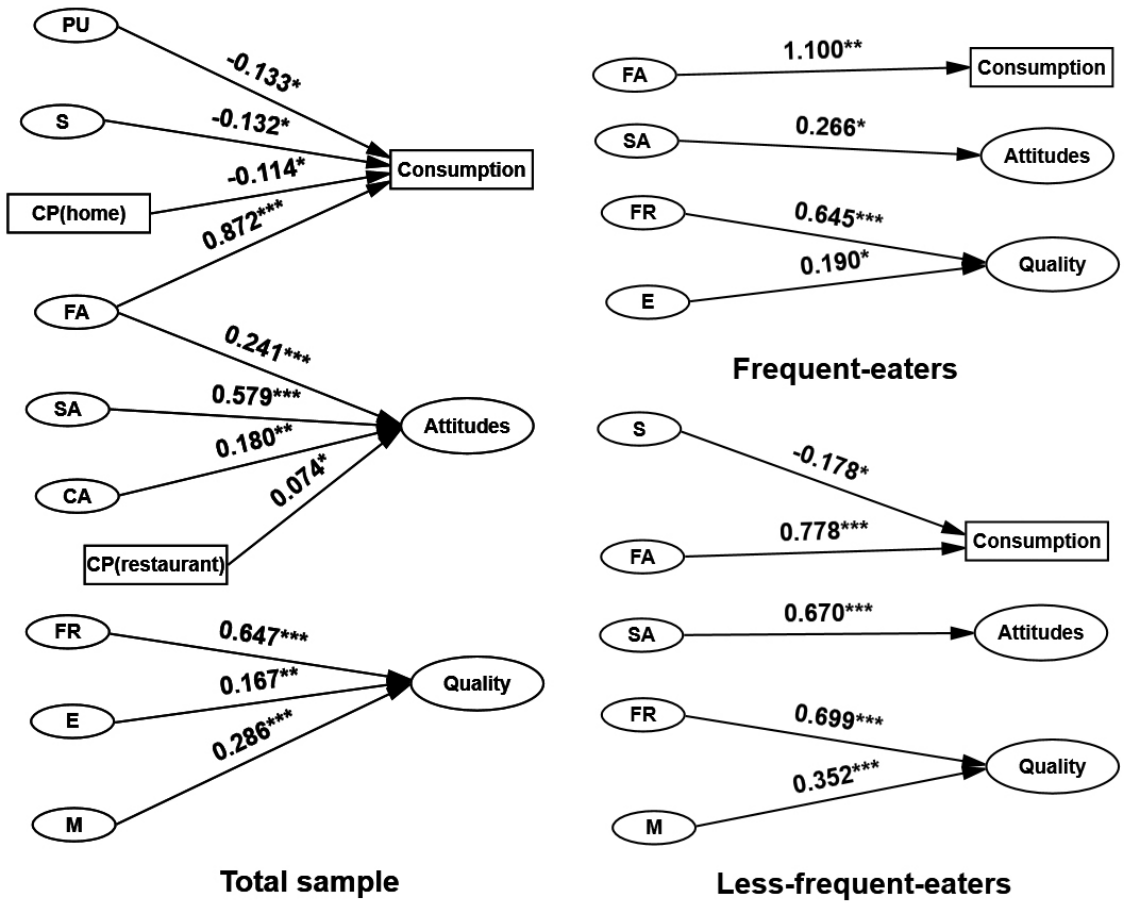

Figure 4 Significant paths of the path analysis for the total sample and the multi-group path analysis for the sub-samples of the two consumer segments (see Table 3 and 4): standardized regression weights

*Note: Please refer to Deegan (1978) and Joreskog (1999) on the standardized regression weight greater than 1 (between FA and Consumption in the model for sub-sample of the shellfish-buyer segment); For the codes of latent variables of shellfish attribute perceptions please refer to Table 2; ***= p<0.001; **= p<0.01; *= p<0.05; Goodness-of-fit indices for the path analysis of total sample: RMSEA=0.059, CFI=0.946, Chi-square=1683.506, DF=515, p<0.001; Goodness-of-fit indices for the multi-group path analysis of sub-samples of the two consumer segments (unconstrained model): RMSEA=0.044, CFI=0.936, Chi-square=2309.099, DF=1030, p<0.001.*