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# Efficiency of Sustainability Cues in Consumer Choices of Seafood—Consumer Segments and Willingness to Pay in Southern China

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**Abstract:** Achieving sustainability goals in the food system should be informed by consumer demand that signals the market trend and drives systemic changes. This study examines the efficiency of sustainability cues in influencing consumer choices of seafood among consumers in Southern China. The preference and willingness to pay for each seafood attribute are estimated using the Latent Class Logit model. The results show that respondents strongly believed in governmental certifications and were more willing to pay for domestic seafood certified to public standards over imported seafood with third-party sustainability certifications. By integrating individual characteristics into the membership function, this study finds that the preference for sustainability cues and other authenticity cues is related to seafood consumption habits and education. The study highlights the efficiency heterogeneity of sustainability cues, providing valuable insights for formulating public policy and developing marketing strategies that promote sustainable consumption.

**Keywords:** sustainable seafood; willingness to pay; consumers; certification; latent class model



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## 1. Introduction

The marine environment has been a critical source of food and nutrition for humans and remains the most important ecosystem for producing aquatic products. According to a report by the Food and Agriculture Organization of the United Nations (FAO), 146.9 million tons of aquatic animals came from marine fisheries, almost 69% of the total production of aquatic animals in 2020. In addition, aquatic food consumption reached a record high of about 20.2 kg per capita in 2020, accounting for 17% of animal protein consumed by humans; the rate exceeded 50% in some countries in Asia and Africa [1]. Containing 80% of the world's biota, the marine environment is also a huge gold mine for other nutrients (e.g., omega-3 fatty acids, carotenoids, and phenolic compounds), which are sources of functional foods or health supplements [2].

Marine fisheries are also crucial for sustainability. Taking the role of the marine system into consideration, it is the core system that transforms inorganic carbon into organic carbon, whereas fish and seaweed play an essential role in cycling carbon [3]. Despite all these benefits, marine fisheries face severe challenges from human activities, such as degradation through industrially polluted water, oil spills, or plastic pollution. The FAO [1] reported that only 64.6% of global fishery stocks were at a biologically sustainable level in 2019; even 7.2% of underfished stocks were included, while fishery stocks keep declining due to pollution, overfishing, poor management, and other reasons. According to the latest report from the FAO, the volume of marine stocks fished within biologically sustainable levels decreased to 62.3 percent in 2021, and this figure is 2.3 percent lower than that in 2019 [1].

As the primary actor in producing and consuming seafood, China has been at the center of global concerns and debates about marine fishery sustainability. According to the China Fishery Department, China had 511,000 fishing vessels and caught 1.18 million tons of seafood (including inshore and overseas) in 2022, which decreased by 40.85% and 6.8%, respectively, as compared to 2018 [4]. To improve fishing management and achieve high-quality development of marine fisheries, China tightened management on its inshore fisheries and released a white paper titled Development of China Distant-Water Fisheries in recent years. Catches from inshore fisheries have been decreasing in the last five years, and the production of overseas fisheries stabilized at around 2.2 million tons from 2018 to 2022 [4]. However, China's fishery industry is still often accused of overfishing and engaging in Illegal, Unreported, and Unregulated (IUU) fishing. According to the IUU Fishing Risk Index ranking among 152 coastal states, China scored the lowest (3.69) in 2023, indicating a low occurrence of IUU fishing.

Facing these challenges, sustainable consumption has been advocated as an important approach to mitigating and attenuating the impact on the ecosystem to some extent. Growing consumer concern over the environmental issues related to food production and consumption drives the food industry and retailers to shift from traditional production methods to more sustainable ones [5]. This substantial transformation points out the necessity for a strategic and comprehensive tool to ensure higher sustainability. Consumers can perceive the sustainability-related product attributes by the extrinsic product cue, such as an eco-label, which is an increasingly popular tool resulting from this transformation; they contribute to mitigating the information asymmetry between consumers and suppliers [6] and facilitating them to make informed food choices [7]. In essence, sustainability cues are used to validate sustainability claims on the part of the food industry and retail, to guide sustainable consumption, and to promote the performances of products and processes to become more pro-environmental and pro-social [8]. For example, sustainability labeling programs allow consumers to choose products with fewer environmental impacts [9] and play an important role in market-based mechanisms to improve fishery performances [10].

The International Organization for Standardization [11] defined that "environmental statement is multiple-attribute-based and provided by a third-party that assesses overall environmental preferability of a product within a particular product category based on life cycle considerations, and awards a license which authorizes the use of specific eco-labels on products related to environmental performance." There are three types of environmental labels and declarations in the ISO standard: Self-declared environmental claims (Type II environmental labeling), Type I environmental labeling, and Type III environmental declarations [11]. According to ISO 14020 (see ISO 14020 (2022): Environmental Statements and Programmes for Products: Principles and General Requirements.), most sustainability label programs belong to the Type I environmental labeling, which is voluntarily implemented. In this scheme, the certification system includes several key roles, such as the standard setter, accreditation body, third-party certification body, labeling body, and certification holder. The core of a sustainability label scheme lies in its standards, including a defined set of environmental and social criteria [8], which assists consumers in alleviating uncertainty about the environmental function of products and then purchasing environmental-friendly ones [12]. Thus, eco-labeling can be regarded as a heuristic or informational cue towards the environmental characteristics of products.

The efficiency of such cues is highly dependent on the consumer's attitude towards these external "reminders". As dual-processing models propose, when people encounter product information, they process it using systematic and heuristic modes [13]. The systematic mode counts upon reflective, thoughtful, and analytic cognitive processing of information the issue-relevant information presented [14]. In contrast, the heuristic mode leans on a simple, intuitive understanding of the information and generates primary responses by the use of various mental shortcuts and heuristics [15]. Accordingly, considering the complexity and multidimensional nature of the interaction effect between various factors and consumer attitudes regarding eco-labeling is important to comprehensively

understand consumer decision-making and behavior. For example, as a large number of sustainability labels are increasingly being introduced to manifest the quality attributes of food, such as origin, nutrition, and organic information, which are to convey intangible information, consumer's attitudes towards them can be drawn upon evaluation with many efforts, such as knowledge availability [16]. Thus, consumers who have positive intentions to process sustainable cues can easily perceive the meaning of such labels and reveal a greater demand for labeled products than for unlabeled products by a premium on eco-labeled products [17,18], which creates a market incentive for "sustainable" management [19]. Alternatively, the efficiency of eco-labels can also rely on mental shortcuts and heuristics by pre-existing experience (e.g., habits) [20]. This indicates that both knowledge and habits are important attributes of seafood consumers to understand how they trade off such underlying information of these cues and to classify which cues can be effective in increasing purchasing intentions.

Exploring specific responses and acceptance among consumers is necessary to implement appropriate political and marketing information initiatives (i.e., sustainability cues). Since consumers worldwide have accepted eco-labeling programs to varying degrees [19], the sustainable buyers have different characteristics across various labels [21]. Xu et al. [22] advocated for the promotion of more accurate marketing strategies by recommending deep learning in making marketing decisions and predicting consumer behaviors. In light of the economics research on consumer preference studies, different groups of consumers with distinct demographic factors do not value the eco-labels equally, indicating that attitudes towards sustainability goals exhibit nuances across different consumer segments [23]. Thus, identifying different preferences towards distinct sustainability cues among consumers could effectively steer consumer decision-making toward sustainability.

The sustainability cues of seafood are emerging in consumer studies. Surprisingly, compared with land-based agrifoods, consumers often buy non-labeled seafood because of the low availability of eco-labeled ones [23]. While the role of sustainability certification has been widely recognized in the global agenda, the landscape of sustainable seafood consumption and consumers' attitudes toward sustainability cues in China have not been rigorously examined [24].

This study aims to fill the research gaps by analyzing state efficiency and sustainability cues, together with other potentially relevant quality and safety claims, in influencing consumer choices of seafood. The research potentially adds value to the global agenda of SDG and China's national campaign for sustainability transformation. The findings have implications for business sectors related to the marine fishery that are driven toward sustainability.

## 2. Literature Review

The research associated with sustainability cues on foods is mixed. For example, except for price and quality, it was proven that variables like the stock status and origin country should be considered [25,26]. This also echoes the findings of Liu et al. [27] that Chinese consumers often use origin claims to infer product quality and can be classified into three groups according to their preferences on food safety information attributes: certification-oriented, price and origin-oriented, and not interested. In the research of Katrin and Yvonne [28], they pointed out that the protection of endangered species, not overfishing, and rebuilding of depleted stocks were the most important aspects of fishery sustainability from European consumers' perspective. European consumers prefer local seafood, which means fresh, good quality, and less carbon release in their perspective [28]. Consumers are also interested in credence cues such as the sustainable development of natural resources, support to small-scale enterprises, avoidance of incidentally catching non-targeted species, sustainable fishing methods [29], and harvest methods as well [30]. The perception is problematic because sustainability cues are effective in influencing consumers' purchase decisions only when they perceive the information and then process it. Perception may be responsible for the lack of effectiveness.

The eco-labeling program is an effective tool to draw attention to quality information, which is incorporated into consumer purchase decisions. The perception of the information makes up the key component that links internal knowledge to the presented information [15]. For example, Wu et al. [31] estimated the WTP for Infant Milk Formula and found that consumers' knowledge can be vital in influencing purchase intentions on organic certification labels. The finding echoes the conclusion of the mall intercept survey by Thøgersen and Zhou [32]. When consumers' knowledge of certification is high, providing a sustainable label can increase their purchase intention [33]. Similarly, Gutierrez and Thornton [34] found that improving consumer knowledge of MSC labels by explaining the meaning of them can significantly increase respondents' willingness to buy the labeled products.

However, one of the notable points that have been figured out by researchers in the area of sustainability consumption is that improving only the ability to evaluate these sustainability cues is insufficient to manipulate consumer behavior since some of the sustainability cues often lack motivation and cannot be thoughtfully considered in detail [35]. Some studies have found that whilst eco-labels are widely used as a marketing strategy, their effects may not lead to actual environmental outcomes directly or effectively. Lim et al. [36] evidenced that although most US consumers evaluated higher on MSC-certified seafood, the price premium of eco-labeling attached to imported products partially eclipsed domestic products that are not eco-labeled. When both MSC and fishery information are provided, Japanese consumers demonstrated a positive and significant premium consistently across product types; the labeling of MSC alone was insufficient to generate a statistically significant premium [37].

Food purchasing behavior is highly habitualized and requires little consideration of informed cues such that cognitions only play minor roles. The heuristic theory [14] highlights the activated reliance on heuristics with less effort on decision-making [15]. As such, when conscious thinking was unmotivated or had lower cognitive-control abilities, consumers would not respond accordingly to the substantive information but instead fell back on strongly habitual choices. Grebitus and Dumortier [38] highlighted that the patterns of food consumption habits were associated with food choice, as well as illustrated by Tuu [39] in a study exploring the effect of habit strength in explaining consumers' intentions on fish choice. Vecchio & Annunziata [40] found that the WTP for sustainability products can be influenced by the underlying food consumption habits: frequent consumers are more sensitive to sustainability cues than infrequent ones [41]. Therefore, consumer food choice can be influenced by past behaviors in the way of heuristic processing, in part due to the impact of prior attitudes.

As conceptualized in the Transtheoretical Model, behavior change can be framed as a continuous process containing six steps: pre-contemplation, contemplation, planning, action, maintenance, and relapse [42]. Despite the substantial size of seafood markets in China, sustainability consumption remains niche, and sustainability cues adoption might still be in the initial stage. During this period, participants' decision-making is often in the absence of a conscious evaluation, but emotion plays a pivotal role in changing and transforming the construal of the situation to shape a person's behavior [43], or a mental shortcut might be used by the source of message based on the heuristic [13]. Compared with Western developed countries, the Chinese government holds the highly dominant power on developmental issues in China, and the efficiency of formulated policy has been witnessed in many areas, such as consumption development in China [44]. Michael [45] pointed out that the strong role of the Chinese government in both perception and reality needs to be considered in the research on sustainable seafood consumption. Compared with previous studies, Yang et al. [46] found that Chinese people prefer domestic organic labeled food rather than ones from other countries. Thus, unconscious responses to external cues emphasize the significance of trust, familiarity, and affection on the source of information with sustainability claims [47–50].

Currently, there are different certification schemes which were developed by NGOs or governments [51]. Most seafood certification schemes like MSC, ASC, MBA (the Monterey

Bay Aquarium), and Dolphin Safe were developed by NGOs. In the literature, consumers were willing to pay a premium for seafood products carrying these labels. But Wessells et al. [52] found that many individuals indicated higher levels of trust in the Food and Drug Administration (FDA) or the USDA than certifying agencies like the WWF, the MSC, or NMFS (the National Marine Fisheries Service). On the contrary, China does not have its own sustainable seafood certification scheme, and most sustainable seafood carrying eco-labels in the market are imported. Furthermore, studies about the effect of sustainability cues on seafood choice concerned with certification entities are scarce. Accordingly, it is vital to examine and use authorized cues to persuade an individual's or population's intentional change.

Identifying socio-economic characteristics can also have an impact on consumers' intentions for sustainable products. More educated consumers are prone to pay a premium for chicken breasts with higher sustainable standards [53]. However, other studies show that pro-environmental behavior was irrelevant to education level. Several studies suggested that the effectiveness of labels with sustainability information on consumer intentions did not vary based on education level [54–56]. On the other side, Delmas and Lessem [57] found that higher education impaired the intention of choosing a product with sustainability cues.

Part of the literature also examined differences in the effectiveness of sustainability cues related to participant income. Van Loo et al. [58] estimated the WTP for sustainability claims and found that consumers with better economic status are willing to pay a 50% premium than those with lower income. As economic status still plays a vital role in much empirical research, income level, and sustainable purchasing intentions might be weakly correlated. Panzone et al. [55] examined the effect of income and did not find any influence on sustainable food choice, hypothetically. This was also supported by other findings [52,59]. Nonetheless, with a low income, consumers were also found to be more concerned about the environmental impacts of their purchasing behavior and willing to pay a premium for sustainable products [23,60].

In sum, although the sales of eco-labeled seafood such as MSC and ASC are rising in China, there are very few studies on consumers' behavior and its association with eco-labeling. As such, this study is expected to make the following contributions. Initially, this study is the first one to evaluate consumers' intentions (measured by WTP) on the existing sustainability certification cues for seafood certified by a third party. As the majority of sustainability standards and certifications applied in China are developed outside the country, the adaptation of these schemes to local industries varies across sectors. This study provides insights into the governance of sustainability standards and assessments using the seafood industry as a case study. Second, there is scarce research on the impact of combining sustainability cues from governments or private organizations with other quality and safety claims on consumers' seafood choices. Lim et al. [36] explored the effects of different attributes on consumer seafood choices by including the food origin and eco-label; however, this study was based on the generic eco-label, not the specifically informed sustainability cues. Third, this study identifies and estimates the taste-based consumer segment to determine whether there is unobserved heterogeneity in preferences and intentions for different attributes. Specifically, it uses a latent class logit model with additional socio-demographic variables considered in the class assignment and distributes the respondents into three consumer groups at the end. The WTP of each group is then calculated, providing significant information about the food industry and marketing strategies, sustainability cues, and other quality and safety claims on seafood.

## 3. Methods

### *3.1. Survey Procedures and Choice Experiment (CE) Design*

This survey comprised a choice experiment and complemented questions, including questions about the socio-economic characteristics of the respondents, frequency of seafood consumption, and perceptions of marine fishery risks. Participants were first required to

complete a choice experiment and then answer the complemented questions. The data were collected to identify the relationship between stated choices and the determinants, and then the responding consumers were segmented.

In order to simulate a real purchasing experience, choice experimentation is often designed by presenting a range of product options and asking participants to choose ("purchase") one product option out of them. It is essential to systematically vary a set of independent variables among the product options, which has an influence on the dependent variable [61].

Choice experiments were designed stemming from the Random Utility Theory [62], which postulates that a consumer could derive a certain level of utility from functions or characteristics and strives to maximize utility when choosing among different product alternatives [63]. In particular, each derived utility can be denoted as $U_{ni}$, which means consumer $n$ selecting an alternative $i$ from a set of $J$ alternatives contained in the choice set $C$. The utility a consumer obtains from seafood is divided into $V_{ni}$ (which relies on the attributes of an alternative) and a stochastic component $\varepsilon_{ni}$ (which captures the nonsystematic or idiosyncratic factors that affect utility but are not included in $V_{ni}$). The utility of alternative $i$ can be defined as follows:

$$U_{ni} = V_{ni} + \varepsilon_{ni} \tag{1}$$

As such, consumer $n$ will select an alternative $i$ if $U_{ni} \geq U_{nj}$. $\forall\, j \neq i$. Consequently, the probability of consumer $n$ selecting alternative $i$ is formulated as follows:

$$P_{ni} = P\left(V_{ni} + \varepsilon_{ni} \geq V_{nj} + \varepsilon_{nj}; \forall j \in C, i \neq j\right) \tag{2}$$

In this study, toothfish were chosen as test seafood products since they are common products in local retailers and markets and have a high stock-keeping unit (SKU) according to MSC statistics. The generic seafood, without any specifically descriptive option (such as a specific brand name), varies in seven attributes, including resource status (abundance or depletion), three sustainable certifications (government, enterprise, or a third party), fishing methods (commercial fishing or small-scale fishery), claim about nutrition and safety (Omega-3, unsaturated fat, or heavy metals in a safety range), geographical origin (whether the toothfish was from China or imported from foreign countries), storage type (fresh or frozen), and price (five levels) based on an inventory of shelf prices of toothfish from nearly ten retailers and markets in Huan province in June 2021 (Table 1). All attributes and their levels selected in this experiment are shown in Table 1.

**Table 1.** Attributes and levels of sustainable seafood (toothfish) in choice experiment design.

| Attribute | Level |
|---|---|
| Resource status (REST) | Depletion, Abundance |
| Certification (ISSCF) | Government, Enterprise, the third Party |
| Fishery type (FISHTP) | Small-scale fishery, Commercial fishing |
| Nutrition & Safety (NuSa) | Heavy metals in the safety range, Omega-3, unsaturated fat. |
| Country of origin (ORIGIN) | Domestic, Import |
| Storage (STORE) | Fresh, Frozen |
| Price (PRICE) | CNY 105, CNY 120, CNY 135, CNY 150, CNY 165 |

We conducted an unlabeled experiment with six choice sets and listed the options as "option 1", "option 2", and "none of these" to facilitate a real-world shopping scenario as well as to account for respondents who may not eat seafood. Thirty different choice sets were presented in the experiment after distributing the specific attributes of interest between two options, using an efficient experimental design to optimize the selection of these sets. The design was formed using the software package JMP Pro, Version 15.1.0. One example of a choice set is displayed in Figure 1.

| Attributes | Option one | Option two |
|---|---|---|
| **Resource Status** |  |  |
| **Certificate Issuer** | The Third Party | Enterprise |
| **Fishery Type** |  |  |
| **Nutrition and Safety Statement** | Heavy Metal (for example, mercury) in safety range | Nutrition (Omega-3, unsaturated fat) |
| **Food Origin** | Domestic | Import |
| **Storage** | Fresh | Frozen |
| **Price** | RMB: 135 | RMB: 120 |

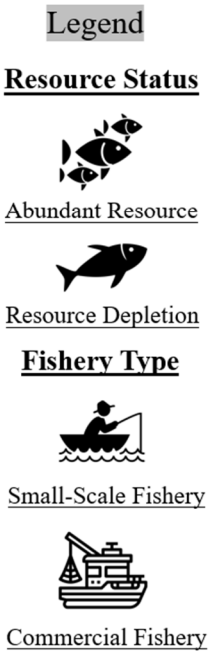


**Figure 1.** Exemplary questions of choice experiment.

### *3.2. Sample*

For the formal experimental field study, a total of 344 marketing interviews were conducted in Changsha, Southern China, in August 2022. The face-to-face interviews were conducted by four or five previously trained undergraduate economics students recruited from a local university. Changsha, a second-tier city, is a typical provincial capital city with rapid economic development and the same consumption trends as the first-tier cities. This city was chosen also because it is one of the Chinese cities with the highest seafood consumption. In addition, two retailers, representing higher-end and lower-end consumption, were chosen to encompass a broad spectrum of consumers from various socio-economic groups. Respondents with a high income level were the target group of this research since this consumer group is more likely to choose sustainable seafood with a significant price premium. However, it is mandatory to take this deliberate sampling into account when explaining the results of this study.

Before the investigation, the interviewers were well informed to ensure that sample selection would meet the appropriate, rigorous scientific standards. The interviews covered the full range of opening hours on workdays and weekends at each food outlet to minimize the influence of time on shopper characteristics. Respondents were intercepted at two retailing outlets, were additionally given instructions asking them to consider which choice they would purchase for each seafood product presented in order to induce shopping behavior, and completed the choice experiments themselves on the iPad (computer-assisted self-interviewing) to avoid an interviewer bias and a social desirability bias. Participants' anonymity was guaranteed. To prevent survey suspension caused by unexpected calls and other events, the E-questionnaire was designed to allow for information reservation so that the respondents were able to renew the survey.

The survey closed with 340 valid cases (Table 2), which yielded 6120 total observations (6 choice sets per respondent × 3 choices per set = 18 CE observations per respondent).

Table 2 shows that 65% of the sample was female, which aligns with the norm that women are primarily responsible for food purchasing in most households. The sample was stratified, with 55% aged between 18 and 35 and 45% over 36; the older group was slightly skewed towards higher education (33.5% with a university degree), which may be attributed to the field we selected to survey. Nearly a third of respondents reported a moderate financial status (household income between CNY 50,000 and 100,000 per year).

In general, the population of each state was found to be well-represented. The majority of participants were frequent eaters of fish; almost half of them ate fish at least once a week (Table 2). These statistics were inconsistent with our expectations, suggesting that regions may not affect fish consumption.

**Table 2.** Variables and descriptions.

| Variable | Coding | Description |
|---|---|---|
| REST | Effect coding | Resource status of cod. (a) Abundance and (b) Depletion (baseline) |
| GISS & TISS | Effect coding | Sustainable certification categories. (a) Government, (b) the third party, and (c) Enterprise (baseline). |
| FISHTP | Effect coding | Fishery type on production. (a) Commercial fishing and (b) Small scale fishery (baseline). |
| NUSA | Effect coding | Nutrition or safety claims. (a) Omega-3, unsaturated fat and (b) Heavy metal in safety range (baseline). |
| ORIGIN | Effect coding | Food origin. (a) Domestic and (b) Import (baseline). |
| STORE | Effect coding | Storage type. (a) Fresh and (b) Frozen (baseline). |
| PRICE | | Price. CNY 105/120/135/150/165 |
| NONE | Dummy coding | Would not buy (Yes = 1). |
| FREEAT | Ordered coding | Fish consumption (1 = "seldom eat fish", 2 = "eat fish once a month", 3 = "eat fish three or four times a month" and 4 = "eat fish more than twice a week" |
| AGE | | Age (range 16 to 80+ years) |
| EDU | Ordered coding | Education (1 = "Junior high school and below", 2 = "College", 3 = "Bachelor degree" and 4 = "Master degree or above") |
| INCOME | Ordered coding | Household annual income (1 = CNY $\leq$ 50,000, 2 = CNY 50,001–100,000, 3 = CNY 100,001–150,000, 4 = CNY 150,001–200,000, and 5 = CNY $\geq$ 200,000) |

### 3.3. Method

Multinomial and latent class models were employed to measure the heterogeneity in the preferences of consumers to classify individuals into several latent classes. Therefore, each class consisted of a group of consumers with homogeny [64].

In LCA, the probability of consumer $n$ falling into class $s$ and choosing alternative $i$ can be expressed as follows:

$$P_{nit} = \sum_{s=1}^{S} \frac{\exp\left(\beta'_s x_{nit}\right)}{\sum_j \exp\left(\beta'_s x_{njt}\right)} R_{ns} \quad (3)$$

where $\beta_s$ is the specific parameter vector for class $s$, and $R_{ns}$ is the probability that the consumer $n$ falls into class $s$.

Taken together, the utility functions in this study can be specified as follows:

$$U_{ni} = \beta_r REST_{ni} + \beta_g GISS_{ni} + \beta_t TISS_{ni} + \beta_f FISHTP_{ni} + \beta_{ns} N\&S_{ni} + \beta_o ORIGIN_{ni} + \beta_s STORE_{ni} + \beta_p Price_{ni} + \beta_n None + \varepsilon_{ni} \quad (4)$$

where $REST$ captures the resource type of seafood, $FISHTP$ is the fishery type, N&S the claim of nutrition or safety, $ORIGIN$ is an effect coding variable indicating the seafood geographic origin, $STORE$ is the storage type of seafood, and $PRICE$ indicates the price of the seafood. The coefficients of the sustainability certification are $GISS$ for government certification and $TISS$ for third-party certification; the base for these two variables is enterprise certification. The $None$ variable indicates not choosing any alternative.

To extend the basic latent class model without incorporating additional independent variables in the class assignment and to observe the different responses to the manifest variables, we employed a function with prior probabilities varied with the socio-demographic characteristics of the respondents. Such socio-demographic characteristics included age (in years), education (ordinal scaled into four levels with the lowest, junior high school, as the benchmark group), and household income (ordinal scaled into five income levels with the lowest, CNY $\leq$ 50,000, as the benchmark group). Additionally, we included a

seafood consumption variable in the latent class model. Four patterns were formed using ordinal coding, with 'seldom eating seafood' as the base category to picture the frequency of seafood consumption.

The number of classes is typically chosen based on the minimum value of the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), which are the most widely used criteria in determining the number of classes. In this study, three latent classes were chosen for our model, and Class 3 served as the baseline and thus included no scores. The parameters were estimated using maximum likelihood estimation, and the variables used in both MNL and LCM model estimations are outlined in Table 3, using NLOGIT version 6.0.

**Table 3.** Socio-demographics description in Changsha, China.

| Variable | Group | Percent | Mean |
|---|---|---|---|
| Gender | | | |
| | Male | 35.00% | |
| | Female | 65.00% | |
| Age | | | 35.21 |
| | 18–24 | 28.24% | |
| | 25–34 | 27.94% | |
| | 35–44 | 19.41% | |
| | 45–54 | 12.35% | |
| | ≥55 | 12.06% | |
| Education | | | |
| | Junior high school and below | 32.06% | |
| | College | 23.24% | |
| | Bachelor's degree | 33.52% | |
| | Master's degree or above | 11.18% | |
| Household income (per year) | | | |
| | CNY ≤ 50,000 | 20.88% | |
| | CNY 50,001–100,000 | 31.18% | |
| | CNY 100,001–150,000 | 21.76% | |
| | CNY 150,001–200,000 | 13.24% | |
| | CNY ≥ 200,000 | 12.94% | |
| | Freq. seafood eating | | |
| | Seldom | 16.76% | |
| | Once a month | 34.71% | |
| | Three or four times a month | 41.18% | |
| | More than twice a week | 7.35% | |

In order to provide economic information on each product attribute, willingness to pay (WTP) can be calculated based on the result of LAC. This is achieved by dividing the estimated parameter of each product attribute by the estimated price coefficient:

$$\mathrm{WTP} = -2 \times \frac{\beta_t}{\beta_p} \tag{5}$$

where $\beta_t$ is the part-worth utility $t$, and $\beta_p$ is the part-worth utility of the price attribute. A Delta method was adopted to obtain the standard errors of derived WTP values. The WTP for each product attribute provides the seafood industry with valuable information regarding product declaration strategies.

## 4. Results

### *4.1. Average Preference Estimates*

The second column of Table 4 presents the results from the MNL model, indicating that respondents generally valued abundant fish resource labels, the government certification program, quality and safety claims, and domestic and fresh cues. Nonetheless, the third-party certification program had a negative effect on consumers' preferences, and a fishing system did not increase consumers' utility significantly. Moreover, as expected, the influence of the price variable (PRICE) was significantly negative, which is in line with the economic theory.

**Table 4.** Results of the multinominal (MNL) and latent class model (LCM).

| Variable | MNL | LCM | | |
|---|---|---|---|---|
| | | Class 1 | Class 2 | Class 3 |
| *Main effect* | | | | |
| REST (abundant fish resource) | 0.05 ** | 0.07 | −0.08 | 0.04 |
| GISS (government sustainable certification) | 0.17 *** | 0.28 *** | −0.09 | 0.05 |
| TISS (the third-party sustainable certification) | −0.07 * | −0.20 *** | 0.50 | 0.13 |
| FISHTP (commercial fishing for production) | −0.03 | 0.06 | −0.24 | −0.18 ** |
| NUSA (nutrition or safety claims) | 0.16 *** | 0.20 *** | 15.45 | 0.09 |
| ORIGIN (domestic seafood origin) | 0.14 *** | 0.09 ** | 0.08 | 0.25 *** |
| STORE (fresh storage type) | 0.11 *** | 0.22 *** | 0.34 | −0.05 |
| PRICE | −0.01 *** | 0.02 *** | 0.01 | −0.05 *** |
| NONE (would not buy) | −1.31 *** | −1.40 * | 19.23 | −9.33 *** |
| *Class probability model* | | | | |
| FREEAT (high seafood consumption) | | 0.38 * | 0.18 | |
| AGE (years) | | 0.02 | −0.03 | |
| EDU (high education) | | 0.40 ** | −0.39 | |
| INCOME (high annual income) | | 0.17 | 0.03 | |
| LC1 | | −2.54 *** | | |
| LC2 | | | −0.52 | |
| Log Likelihood | −1819.84 | −1542.17 | | |
| McFadden Pseudo R-squared | | 0.312 | | |
| AIC | 3657.7 | 3158.3 | | |
| BIC | | 3366.3 | | |
| Class Prob. | NA | 55.5% | 6.9% | 37.6% |
| No of observations | | 2040 | | |

***, **, * Significance at 1%, 5%, 10% level.

The left side of Table 5 presents the MNL model results, indicating that respondents were willing to pay most for governmental certification (CNY 50.00), followed by the proposed quality and safety assurance (CNY 44.98), domestic (CNY 41.27) fresh seafood (CNY 30.62), and with an abundant resource type label (CNY 14.38). In terms of fishing production, respondents preferred seafood produced by small fisheries over that by commercial fisheries and were unwilling to pay CNY 8.33 for commercial fishery production. According to WTP, the order of preference for different levels of the attributes was consistent with the estimates in Table 4.

**Table 5.** Willingness to pay (CNY) of the MNL and LCM.

| Attributes | MNL | LCM | | |
|---|---|---|---|---|
| | | **Class 1** | **Class 2** | **Class 3** |
| REST (abundant fish resource) | 14.38 | 7.84 | 11.66 | 1.65 |
| GISS (government sustainable certification) | 50.00 | 33.07 *** | 13.07 | 1.92 |
| TISS (the third-party sustainable certification) | −20.78 | −24.18 ** | −68.24 | 5.20 |
| FISHTP (commercial fishing for production) | −8.33 | 7.22 | 33.07 | −7.06 ** |
| NUSA (nutrition or safety claims) | 44.98 | 23.41 *** | −2126.00 | 3.35 |
| ORIGIN (domestic seafood origin) | 41.27 | 10.56 * | −10.63 | 9.92 *** |
| STORE (fresh storage type) | 30.62 | 26.07 *** | −47.43 | −1.88 |

*Note:* ***, **, * Significance at 1%, 5%, 10% level.

### *4.2. Preference Heterogeneity Estimates*

The LCM model results provide estimated parameters for each individual in the sample, demonstrating heterogeneous preferences among consumers. Table 4 shows that the probability of a randomly chosen respondent belonging to a given class was 55.5%, 6.9%, and 37.6%, respectively. Notably, the largest percentage of respondents belonged to Class 1 (sustainable seafood certification advocates). The minority of respondents belonged either to Class 2 (sustainable seafood neutrals) or Class 3 (sustainable fishing production advocates), implying that sustainable seafood products have a large growth potential. Regarding other attributes, the estimates for country of origin were positive among all three segments, which was in line with our expectations. In contrast, the labels, storage type, and price effect varied across classes, with one class showing a negative or no effect and the other a positive effect. Education levels and seafood consumption (i.e., how often they eat seafood) were useful predictors to determine class membership. On the contrary, household income and age were not useful predictors to determine class membership.

As shown in Table 4, participants in Class 1 had the strongest preferences for the sample; they were evidently concerned about how and by whom their seafood was verified, with the government certification being the most favorable authenticity cue. On the contrary, the seafood's resource status and fishing production did not show any effect on the Segment 1 respondents' intentions. Moreover, the authenticity cues in all have been considered in decision-making processing, with the storage type being regarded as the most influential one. Moreover, the sticking point is that respondents in this segment preferred sustainable seafood products with a higher price rather than those with a lower price. They also reported having consumed seafood more often and had a higher education level than Segment 3.

Respondents in Segment 2 (Class 2) were not attentive to any attributes examined in this study, even though the third-party sustainable certification showed a positive effect, and the others showed negative effects. Respondents in this segment reported more frequent experiences with seafood consumption and had a higher education level than in Segment 3. Respondents in this segment did not have any differences with Segment 3.

Respondents belonging to Segment 3 (Class 3) were unconcerned about who verifies the sustainability of seafood but were concerned about how their seafood was produced. Their product choices were heavily influenced by the small fishing type rather than the commercial fishing type, with other sustainable cues being of insignificance. Regarding other authenticity cues, respondents in this segment preferred sustainable seafood, indicating the country of origin and lower-priced over higher-priced products. Although the coefficient for the fresh storage cue was positive, it was not statistically significant, indicating that Chinese consumers do not naturally prefer fresh or frozen-storage seafood.

### *4.3. Willingness to Pay*

WTP estimates for seafood attributes are presented in Table 5, which shows that WTP differed considerably among seafood attributes and among consumer segments. For example, respondents in the first segment were willing to pay an extra CNY 33.07 for 300 g of government certification labeled sustainable seafood, while the extra WTP within the second and third segments were only CNY 13.07 and CNY 1.92, respectively. Additionally, compared with other segments, Segment 3 consumers had a significantly lower WTP (CNY −7.06) for commercial fishing production of seafood.

## 5. Discussion

While Chinese consumers' preference for government certifications is unsurprising, this research revealed heterogeneity in their stated preferences for sustainable seafood. This study found that Class 2 and Class 3 consumer segments were less responsive to governmental certification than their counterparts in Class 1. While international third-party certification programs primarily affect export market channels and consumers with a higher income level, the spillover effects on ordinary consumers are gradually formed. Bai et al. [65] examined whether certificate issuers can impact consumers' intentions on milk traceability in China. Wu et al. [66] explored Chinese consumers' attitudes towards quality and safety attributes of traceable pork. Liu et al. [27] investigated how consumers respond to vegetable, pork, and dairy product traceability information related to food safety based on the best–worst scaling approach. Interestingly, these scholars found that consumers in China preferred to pay more for food certified by the government. Chinese consumers' trust in governmental standards appears to remain in the agrifood sustainability domain. Chu et al. [67] found that Chinese consumers have a high level of trust in and willingness to pay for government certification. This can be explained by the fact that sustainability is an abstract and diffuse term, and the efficiency of generic sustainability cues will be weakened by the consumer's uncertainty [68]. As such, according to the heuristic theory, people respond to unfamiliar information based on mental shortcuts and heuristics based on pre-existing experience [13]. In China, many developmental issues (e.g., climate change and environmental protection) are governed by the public sectors [43], forming heuristic information that influences consumers' decision-making. Where governmental information on specific sustainable cues is provided, the efficacy of standards and certification would increase due to the familiarity and credibility of the information, leading consumers to believe in the sustainability of the consumed food they [33].

The negative impact of third-party certification on WTP identified in this study triggers reflections on the governance of sustainability standards and assessment in China. One possible reason is that the existing certification programs related to seafood sustainability in China are issued by international NGOs like MSC and ASC. Although a great number of global third-party certification programs of sustainability operate in China, the communication of these programs with consumers remains weak, resulting in confusion and prejudice among consumers towards international third-party certifications. In this vein, people have less confidence in relying on their attitudes, even though many favorable thoughts have already been generated [15]. Another problem might be that Chinese consumers lack the necessary knowledge associated with the sustainability of specific sectors, e.g., the marine industry, and this further undermines the transparency of the existing international certification programs [15].

The seafood products certified against sustainability standards like MSC, ASC, and BAP are commonly absent in the Chinese market, except for some international retailers (e.g., Sam's Club and Costco) and local high-end retailers (e.g., City Super and Ole'). Among those ranking in the top 100 China supermarkets in 2023 by the China Chain-Store and Franchise Association (CCFA), only 10 retailers provide an online search method for sustainable seafood. Therefore, it is unsurprising that most consumers overlook the market for third-party-certified sustainable seafood. The low market share could lead to negative estimates of the third-party sustainability certification by inhibiting consumers'

access to the certification. For example, MSC reported that the number of MSC-labeled products in the Chinese market accounts for less than 1.5% (according to MSC (2021, 2022), the number of MSC-labelled products sold in China is approximately 300, while 20,447 worldwide) of the global total. Given the low share and lack of accessibility of third-party certified products, consumers may experience uncertainty regarding their certified seafood, leading to doubt and reduced trust in the effectiveness of sustainability cues. Additionally, this could be explained by the dual-processing model that when people are under low elaboration conditions, the effect of mood would be more pronounced on attitudes [15].

Contrary to our findings, interestingly, the previous studies pointed out that consumers preferred imported seafood, accounting for the food safety and possible contamination of the domestic food supply [69]. High-quality, safe seafood was considered to be wild (as opposed to farmed), marine species (as opposed to freshwater species), and imported (as opposed to domestically produced), particularly from countries considered to have 'clean' waters, such as Australia, Norway, and North America [70]. In this study, the surveyed consumers in China demonstrated a higher willingness to pay for local seafood over imported ones. This echoes the findings of Yang et al. [46] that Chinese consumers are more willing to pay a premium on domestic organic-labeled food than those from other countries. It may be possible that Chinese consumers tended to buy local seafood after several disclosed associations between the detected virus and imported seafood, such as salmon and white shrimp, in June 2020.

The latent class model of consumer choice can reveal heterogeneity among consumers, which is important for devising market segmentation and policy development. Our findings align with some established findings that demographic and socio-economic characteristics (e.g., income, age, education, and consumption habits) are the candidate variables to segment the seafood market. In addition, the three types of sustainability cues appear to be associated with different segmentations of the potential market, especially with respect to education levels and the frequency of seafood consumption. In terms of sustainability certification, the WTP of Class 1 consumers who frequently eat seafood was higher than that of Class 3 ones. The high consumption of seafood can contribute to a consciousness of quality of food and sustainability certification. This finding illustrates that the perception of these sustainability cues is contingent on consumers' familiarity and knowledge structure. Knowledge of the sustainability cues reflects the awareness and ability to communicate their meaning, and this further increases the purchase intention with agrifood sustainable efficacy [68]. This was evidenced by the previous studies that consumers with label-related knowledge can reduce or close the attitude–behavior gap between pro-environmental attitudes and the respective purchasing behavior [31,32,34]. Furthermore, product knowledge and familiarity are two concepts rooted in consumer knowledge [33]. Therefore, it is unsurprising that consumers with higher education levels value sustainability certification more than those with relatively lower education levels. Additionally, although the sustainability certification does not attract much attention from Class 3 consumers, the sustainability cues of the fishery process may inform them effectively to make sustainable seafood choices. This finding conveys a potential effect heterogeneity of the sustainability cues on consumer choices of seafood for different segments.

## 6. Conclusions

Globally, consumers are becoming increasingly concerned about the influence of their consumption on sustainability, such as biodiversity and resource status. This study confirms that the sustainability cues in China positively influence consumers' purchasing intentions for sustainable seafood. However, Chinese consumers consuming sustainable seafood are still driven by mistrust of the safety of seafood production. While the premium was higher for sustainability certification than for origin, consumers are often confused by different governmental schemes of quality and safety. Therefore, sustainability certification is perceived to verify several credence attributes such as origin, quality, and safety based

on and driven by social trust. This signals that room for expansion of the sustainability certification remains to meet the increasing demand for sustainable products.

According to the results, the existing sustainable seafood certification provided by a foreign third party cannot increase the willingness to pay among consumers unfamiliar with or who do not trust such information, and it may even result in negative attitudes. Therefore, the marketing strategies could provide information certified by public parties (e.g., government) and/or possibly by third parties. If public recognition and acceptability are established among consumers, they can receive objective and familiar information simultaneously, facilitating the shift toward sustainable consumption. Nonetheless, it should be recognized that the main goals should focus on strengthening consumers' awareness of sustainable seafood in practice. For example, the sustainability certification standard can be a public good by providing criteria for the fishery industry to prevent unethical production practices, enabling the industry to normalize industry standards and maintain consumer confidence. Alternately, marketing managers should realize consumers' desire for information and increased transparency of communication strategies, as well as the effect of credence sustainability cues on consumer intentions and seafood choices.

In terms of the limitations of our study, they can guide future research in this area. First, the sample could not represent the overall Chinese population; rather, it represented a population segment with a relatively high income level who may have the financial ability to buy seafood with sustainability cues. Second, it is crucial to address the need for subsequent, direct data collection of consumers' attitudes, values, and trust. Third, the research could be expanded to multiple cities to align consumer preferences for sustainability cues nationwide. Despite these limitations, our study provides valuable insights into the efficacy heterogeneity of sustainability cues, which is critical to setting up public policy and developing marketing strategies to promote sustainable consumption.

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