Article

The Role of Eco-Labels in Making Environmentally Friendly Choices: An Eye-Tracking Study on Aquaculture Products with Italian Consumers

Migena Proi [1], Emilia Cubero Dudinskaya [1], Simona Naspetti [2], Emel Ozturk [1] and Raffaele Zanoli [1,*]

[1] Department of Agricultural, Food and Environmental Sciences (D3A), Università Politecnica delle Marche, Via Brecce Bianche, 60131 Ancona, Italy

[2] Department of Materials, Environmental Sciences and Urban Planning (SIMAU), Università Politecnica delle Marche, Via Brecce Bianche, 60131 Ancona, Italy

[*] Correspondence: zanoli@agrecon.univpm.it; Tel.: +39-07-1220-4929

Abstract: Eco-labels are crucial in helping consumers make sustainable food choices. However, previous literature has shown that eco-labels lack visibility and, frequently, are not easy for consumers to see. The main goal of the present study was to analyse the influence of aquaculture eco-labels' visual elements—size and saliency—on consumers' visual attention and choice. The study uses an eye-tracking methodology, together with a choice experiment and a semiotic analysis. A word association (WA) task was used to explore how each eco-label's graphic design influenced consumers' perceptions. Sixty-one consumers' eye movements were tracked while choosing smoked salmon and seabass products carrying different eco-labels. The results showed that size and saliency largely influence visual attention. The choice of aquaculture products was influenced only by the size of the eco-labels. According to the WA task, the shape, the symbols and the language in which the claim was written influenced consumers' preferences. The findings contribute to marketing and food research, suggesting which visual elements should be considered to increase consumers' interest in eco-labels.

1. Introduction

Since the middle of the twentieth century, there has been a significant increase in global fish consumption [1]. This trend is expected to continue to grow worldwide by 2029 [2], leading to overfishing and causing a decrease in natural fish stock [1]. Due to this problem, aquaculture, or farming of aquatic organisms, has been growing [3,4], becoming the most rapid-growth food sector.

However, aquaculture faces controversy due to its environmental impacts, such as water pollution and natural resource degradation [2]. To reassure consumers that the fish they purchase is sustainable, and to minimise the negative impact of the aquaculture processes, the use of certification schemes and eco-labels has been progressively implemented since 1977 [5].

In particular, the aquaculture sector is characterised by substantial growth in the assortment of eco-labels [6] that differ in their designs (e.g., pictures, verbal representations, shapes and colour). Eco-labels aim to reduce information asymmetry between consumers and producers, providing information related to environmental attributes that consumers otherwise would not be able to observe or test directly [7,8]. Some research has shown that consumers are willing to pay a premium for products with eco-labels (e.g., organic, environmental or sustainable) [9–11]. However, other studies pointed out that, in a chaotic shopping environment such as supermarkets, eco-labels fail to communicate their message

due to low visibility [12,13]. Increasing the visibility of eco-labels could be a way to better guide consumers' visual attention towards eco-labels. The allocation of visual attention is guided by bottom-up and top-down factors [14,15]. Bottom-up factors depend on the characteristic of the stimuli itself (e.g., position, type of label, colour, size, saliency). For instance, Bogomolova et al., in a study regarding unit price label design factors, found that consumers fixated more on colour-coded unit prices [16]. In the same line, Orquin et al. [17], in a study regarding brand-related packaging elements, showed that elements that are put in the central position of the package, with a bigger size and saliency, influenced visual attention. In contrast, top-down factors are based on consumers' involvement, personal goals and previous knowledge [18–22]. For instance, Motoki et al. [23] pointed out that consumers with higher anxiety fixated more on hedonic food.

So far, the literature has focused on analysing the role of top-down factors through experiments where subjects are forced to decide and choose a product [24]. However, consumers' decisions in a shopping situation are often driven by bottom-up factors [25]. Consequently, studying how visual attention to food labels works, and which design attracts more consumers' attention, is a fundamental step in understanding the role of eco-labels in consumer choices [26]. To the best of our knowledge, few studies [24,25] investigate the role of saliency on consumers' attention, and even fewer studies [27] combined the manipulation of size and saliency in the case of food labels. Visual saliency is among the diverse mechanisms that influence the allocation of visual attention and exerts a small but robust effect on which objects are fixated on and when [28,29]. In particular, visual saliency refers to the prominence of an object compared to the surrounding, in terms of colour, intensity and orientation [30]. An example of saliency as a bottom-up factor are bright sales tags [28]. Saliency is independent of the nature of the task: if a stimulus is sufficiently salient, it will get the observer's attention in the visual scene [30]. The surface size is the quantity of the visual environment that an eco-label fills. So far, academic studies have focused on surface size's role in advertising research, pointing out that bigger surface sizes receive more visual fixation [27]. Only a small number of academic studies [27,31] analyse the role of size in the case of consumers' choices of food labels.

Previous studies across different product categories have concluded that labels with higher saliency [27] and size are more likely to be fixated on and chosen than less salient labels [24].

Moreover, other factors, such as semiotics, are equally crucial bottom-up factors in capturing consumers' attention [32,33]. Semiotics is the theory that analyses and explains the mechanism based on which visual representations produce meaning [34]. According to semiotic theory, labels' visual aspects and graphic design play a crucial role in providing information and creating beliefs that drive decisions. Previous research in the food-packing field has concluded that semiotic analysis is appropriate to capture consumers' conscious and unconscious ideas [33].

Despite the large body of literature on food labels, previous research has been mainly focused on analysing consumers' evaluation of eco-labels, neglecting consumers' preference for the visual design of eco-labels [35]. This is especially true for the seafood sector, where most studies examine customer preferences, using their willingness to pay for eco-labels as a reference point [10]. For instance, Ankamah-Yeboah et al. [6], in a study regarding farmed rainbow trout in Germany, found that consumers are willing to pay a higher price for organic aquaculture production. In the same way, Xuan et al. [11], in the case of Vietnamese aquaculture consumers, found that consumers are willing to pay a premium price for eco-labelled shrimp. However, most of these studies focused mainly on one eco-label (i.e., ASC) [36]. Other studies contrasted consumers' preference for farmed eco-labels to other drivers, such as eco-labels of wild fish, country-of-origin or health claims [4,6,36]. To date, no previous study has investigated how the different visual elements of eco-labels in the aquaculture sector influence consumers' choices. This paper adopts an integrated approach, combining eye-tracking methodology with a choice experiment and a semiotic analysis conducted through a word association (WA) task to fill the abovementioned gaps.

Given the variety of eco-labels on supermarket shelves, this research aims to extend the current knowledge in the food area by investigating Italian consumers' perceptions of eco-labels commonly found on aquaculture products The following research questions are explored: how the manipulation of size and saliency of eco-labels affect consumers' visual attention and choice of aquaculture products; which attributes (beyond size and saliency) are considered during the choice of aquaculture products (i.e., price, product itself) and; lastly, which characteristics (e.g., colour, symbols) of eco-labels' visual design are valued by consumers.

The discrete choice experiment (DCE) was developed to elicit consumers' preferences for size and saliency [27]. The word association (WA) task explores spontaneous elicitation of ideas when consumers are presented with the eco-labels. Compared to other methodology, such as closed questionnaires, the word association (WA) task could collect the spontaneous association of a word related to a specific stimulus (i.e., eco-labels) [37].

2. Materials and Methods

The present study combines quantitative and qualitative methods to address the study objective. A discrete choice experiment (DCE) was used to explore consumers' preferences for aquaculture products carrying different eco-labels that vary in size and saliency. During the DCE, consumers' gaze was recorded through an eye-tracker device to understand how bottom-up factors influence participants' visual attention. At the end of the DCE, a word association (WA) task was used to conduct a semiotic analysis to explore consumers' perceptions and beliefs of the different designs of the aquaculture eco-labels included in the study.

2.1. Discrete Choice Experiment

DCEs are a popular method of measuring consumers' choices by asking them to trade-off among different attributes [38,39]. DCEs mimic a shopping situation, allowing the participant to choose the product with the preferred attributes and levels. Moreover, a DCE's results are characterised by high external validity [40].

The method is based on the Lancaster consumer theory [41] and the random utility theory [42]. According to them, for each product, consumers choose the combination of attributes that maximises their utility [43].

2.1.1. Econometric Mode

A mixed logit model (MMNL) was employed to estimate the effects of eco-labels, size, saliency, product type and price on consumers' choices. The MMNL accounts for heterogeneous preferences among respondents.

Choice experiments assume that the utility of the alternative j for the individual i in choice condition s includes two components:

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

where V_{ijs} is the (observable) deterministic component and ε_{ijs} is the (unobservable) random error.

The deterministic component V_{ijs} can be specified as a linear function of the vector of observed variables X_{ij}, and β represents the utility associated with a given attribute:

$$V_{ijs} = \beta_i{}' X_{ijs}. \tag{2}$$

Assuming the linearity of the utility function, the model was specified as follows:

$$U_j = \alpha_{ijs} + \beta_{price}\, Price_{ijs} + \beta_{size}\, Size_{ijs} + \beta_{saliency}\, Saliency_{ijs} + \beta_{ASC} ASC_{ijs} + \beta_{FOS}\, FOS_{ijs}$$
$$+\beta_{GGN\_aquaculture}\, GGN\, Aquaculture_{ijs} + \beta_{GGN\_farming}\, GGN\, Farming_{ijs} + \beta_{fish}\, FISH_{ijs} \tag{3}$$

where *j* refers to the four available alternatives in the choice set, including the no-choice option.

2.1.2. Product and Attribute Selection

Based on a literature review and a previous qualitative study, we selected five attributes (see Table 1): eco-labels, product, price [44], eco-label size [27] and eco-label saliency [27]. As regards the eco-labels, three of them (GGN certified aquaculture; ASC Aquaculture Stewardship Council; Friend of the Sea) are currently available in the European market. GGN-certified farming was not yet available on the market when the study was conducted. The GGN label owner was planning to gradually introduce it to substitute all its other sectoral labels (e.g., agricultural, aquaculture and floriculture). In the case of the ASC eco-label, we used the Italian version of ASC, while, for the other eco-labels, the Italian version was unavailable or not widely used.

Table 1. Product attribute and attribute levels.

Attributes	Levels
Eco-Labels	- ASC, - Friend of the Sea (FOS), - GGN-certified aquaculture, - GGN-certified farming, - No label (baseline)
Product	- Smoked salmon, - Smoked sea bass (baseline)
Eco-label size	- Large, - Small (baseline)
Eco-label saliency	- High, - Normal (baseline)
Price	€ 3, € 4, € 5

Regarding the products, smoked salmon and smoked seabass were chosen, given the Italian supermarket's availability and consumers' familiarity [45].

The eco-labels' attributes—size and saliency—were visually manipulated. For the size, the surface of each of the eco-labels was increased by 100%, obtaining two versions: one of 100% (small) and one of 200% (large). In the case of saliency, Adobe®Photoshop was used to vary the colour intensity of each eco-label, within the same hue. Several versions of the label, in the same shade but with different colour intensities, were created for each label; then, saliency maps were computed on each version. The most salient version of each of the eco-labels was selected using the Graph-Based Visual Saliency (GBVS) algorithm [46]. The GBVS gives a mean saliency for each image based on each pixel's colour, intensity and density. As a result, four versions for each eco-label were created. An example of GGN-certified aquaculture is presented in Figure 1. For each alternative, the eco-labels were positioned on the lower-centre portion of the packaging.

2.1.3. Discrete Choice Experiment Design

Following a D-efficient design (D-error = 0.22) obtained in the Ngene 1.2.1 software [47], 15 choice situations (choice sets) with 3 alternatives each and a no-buy/no-choice option were generated. The alternatives with different attributes and levels were presented to the respondents graphically. A packaging design—already present in the market for similar products—was digitally modified and manipulated to create various choice options to increase similarity with an everyday food-shopping situation. No brand name was used, to avoid product recognition which would thus introduce familiarity biases. Figure 2 shows an example of a choice set as seen by respondents. The choice tasks were presented without time constraints and in a randomised order.

Figure 1. An example of the manipulation of the eco-label Friend of the Sea (FOS) **1**. Large, original saliency; **2**. Large, high saliency; **3**. Small, original saliency; **4**. Small, high saliency.
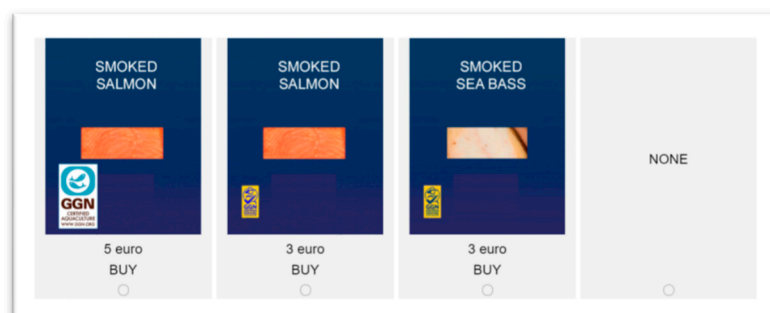
Figure 2. An example of a choice set.

Before the choice experiment questions, a cheap talk was used to reduce the hypothetical bias deriving from the tendency of participants to overstate their preferences during the survey [48]. Moreover, respondents were provided with some information on eco-labels. In particular, the production system to which each label refers (i.e., only sustainable aquaculture, sustainable aquaculture and fishery, and all sorts of sustainable farming) was reported. Participants were instructed that they were going to see a set of alternatives with different attributes and levels, and that they had to select the product they would like to buy as they would do on a regular weekday.

2.1.4. Discrete Choice Experiment Analysis

The data was analysed using the R package in Apollo v. 0.2.8 [49]. The mixed logit model was estimated using 2000 Modified Latin Hypercube Sampling (MLHS) random draws per respondent and random parameters. The parameters of the attributes were specified as random and normally distributed. The only exception was saliency, which was assumed fixed, given that the initial model's results does not falsify the hypothesis of homogeneous consumer preferences regarding this attribute. The price parameter was specified with a negative lognormal distribution. Since the probability function of the mixed logit model does not have a closed form, it is estimated through simulation methods [50].

2.2. Eye Tracking

The data were collected with a Tobii X2-60 Hz eye-tracker to record participants' fixation during the discrete choice experiment. The eye-tracker device was placed unobtrusively below the screen of the computer. Eye-tracking technology is based on infrared illumination, thus eye movements are tracked through the near-infrared light directed toward the eyes [51].

IMotions® Attention Tool v. 8.0 software (IMotions®, Denmark) was used to collect eye-tracking data. Participants were seated at a distance of 60 cm in front of the 22-inch monitor screen.

The eye-tracker sampling rate was 120 Hz. A 9-point calibration procedure was executed for each participant, asking them to fixate on a moving point in the screen. The main goal of the eye-tracking process was to understand consumers' visual responses to the manipulation of bottom-up factors, such as size and saliency. In particular, the eye-tracker device records participants' fixations when their eyes stop and focus on the interest area to extract information [51]. Consumers' fixations are a proxy for visual attention [52].

Areas of interest (AOIs) were defined according to each eco-label. For each AOI, the following measures were calculated: Time to first fixation (TTFF), time spent and average fixation duration. The TTFF corresponds to the time it takes for a respondent to fixate on each eco-label for the first time from the onset of the visual stimuli. In other words, it measures an eco-label's attentional capture or noticeability [53]. It also tells us when each eco-label is fixated on before or after another.

The time spent is defined as the amount of time a respondent looks at a specific eco-label. It is a measure of performance used to analyse the interest in eco-labels [51,54]. The average fixation duration is the sum of the duration of all fixations divided by the total number of fixations. It represents the difficulty in processing the information provided in the eco-label [51]. This means that when information on labels is unclear, consumers face difficulty extracting and interpreting information, which is reflected in higher average fixation durations [55]. All of these metrics are measured in seconds. A repeated measures ANOVA in Stata 16 was performed to compare the effect of size, saliency and eco-labels on the eye-tracking measures.

2.3. Word Association Task

The Word association (WA) task is a qualitative methodology widely used in sociology and psychology [56] to understand consumers' perceptions and behaviour towards food [37]. According to semiotic theory, labels' visual aspects and graphic design play a crucial role in providing information and creating beliefs that drive decisions [32,33] Semiotics is the theory that analyses and explains the mechanism based on which visual representations of any kind produce meaning [34].

The method consists of asking consumers to write down their thoughts and beliefs about a given stimulus to uncover which types of idea association the visual elements (e.g., signs, symbols, colour, verbal representations) create in the consumer's mind [33,57,58]. Different studies identify semiotic analysis as a good tool for determining consumers' idea association regarding visual elements [33]. In the case of the present study, participants were asked to write down, for each eco-label, whatever information or emotion that eco-label conveyed to them [59].

The results were analysed qualitatively [59,60], through frequency analyses [60] of words written down for each eco-label. First, the most recurrent words were extrapolated for each eco-label. Second, different categories of words were created, merging terms considered synonyms by the Italian dictionary. Terms used by more than 5% of participants for each of the eco-labels were considered [59]. The final dataset comprises 8 categories. Counting participants who used these words to describe a specific label resulted in determining their frequency [32].

2.4. Sampling and Experimental Procedure

Data were collected in October 2020 at the Consumer Research and Neuromarketing Laboratory at the Marche Polytechnic University (UNIVPM) in Ancona, Italy. A convenience sample of 61 participants was recruited from students and workers. The main recruitment criteria were that participants were consumers of smoked salmon\sea bass at least once per year and were fully or partially responsible for grocery shopping. All subjects had normal or corrected-to-normal vision and were tested for colour blindness

using the highly reliable Ishihara test [61]. The survey software platform Qualtrics was used for the design and data collection of the study.

After the participants entered the laboratory, they received instructions, signed informed consent and were presented with the experiment as a study on aquaculture and eye-tracking. After the calibration of the eye-tracking device, consumers completed the discrete choice experiment (DCE). At the end of the choice experiment, a multiple-choice question was asked to further examine which feature of eco-labels consumers had taken into account in their choices. In particular, consumers had to choose among the following features: "shape", "colour", "size" and "other". Next, consumers were presented with the four eco-labels and the word association (WA) task was conducted, which asked them to write down, for each of the eco-labels, feelings and thoughts that arose in their mind when observing the eco-labels [62]. To complete the word association (WA) task, no word limit was imposed to participants [62]. Lastly, consumers completed a questionnaire on socio-demographic characteristics. In line with previous literature, participants could finished the study without time constraints [18]. At the end of the study, participants received an Amazon gift voucher of 10 euros for their participation in the study.

3. Results

3.1. Sample Description

Table 2 displays the socio-demographic characteristics of the sample. Sixty-one people participated in the study; 54% of which were female and 46% of which were male. Most participants were aged between 35 and 44 years old, had a doctoral degree and were employed.

Table 2. Socio-demographic description of the sample in the laboratory experiment (*n* = 61).

		Frequency (%)
Gender	Female	54
	Male	46
Age group	18–24 years old	16
	25–34 years old	21
	35–44 years old	26
	45–54 years old	25
	55–64 years old	12
Education	High school	30
	Bachelor	13
	Postgraduate with master	23
	Postgraduate with a doctoral degree	34
Occupation	Employed	79
	Inactive (retired + students + household)	21

3.2. Discrete Choice Experiment Results

Table 3 illustrates the estimation results from the mixed logit model. The no-choice alternative-specific constant was not significant, meaning that respondents did not have a preference for choosing a product alternative instead of opting out. The price had a significant negative coefficient, indicating that higher prices decrease consumers' preferences and choices for aquaculture products. Estimates showed that the size of eco-labels influenced consumers' choices. Meanwhile, the saliency estimate was not significant.

All coefficients of the eco-labels were positive and significant, indicating that respondents preferred eco-labelled products to alternatives not carrying any eco-label. Concerning the product, buying smoked salmon increased respondents' utility, compared to choosing smoked sea bass.

Table 3. Results of Mixed Logit Model.

	Estimate	Rob.std.err.	Robust *p*-Value
Mean estimates (normal distribution)			
α_product (fixed)	0	NA	NA
α_none	−0.146	1.221	0.905
Price	−0.465	0.232	0.045
Size	0.299	0.152	0.049
Saliency	−0.127	0.109	0.243
ASC	5.718	0.923	0.000
FOS	4.432	0.786	0.000
GGN-cert. Aquaculture	4.497	0.827	0.000
GGN-cert. Farming	4.542	0.862	0.000
Salmon	1.534	0.278	0.000
Standard deviation estimates (normal distribution)			
Price	0.793	0.123	0.000
Size	0.802	0.209	0.000
ASC	−1.040	0.255	0.000
FOS	1.873	0.328	0.000
GGN-cert. Aquaculture	0.749	0.163	0.000
GGN-cert. Farming	1.108	0.304	0.000
Salmon	2.266	0.422	0.000
No. of observations		915	
Estimated parameters		16	
Log Likelihood		−808.37	
Rho-square		0.36	
A.D.J. Rho-square		0.35	
AIC		1648.74	
BIC		1725.84	

The coefficient of the standard deviation of the attribute saliency was not significant; thus, it was fixed. The other standard deviation coefficients were statistically significant, meaning consumers are heterogeneous in their preferences for size, eco-labels and product.

Figure 3 shows the results of the multiple-choice questions. According to consumers' responses, the colour (32 per cent, *n* = 25) and the size (29 per cent, *n* = 22) were the two most important attributes of eco-labels. The Italian text of the ASC eco-label appealed to 13 per cent (*n* = 10) of respondents. The attribute shape influenced 12 per cent (*n* = 9) of consumers. Lastly, 14 per cent (*n* = 11) of consumers stated that other elements, such as the presence of fish on the eco-label or their trust in that particular type of eco-label, would also influence them.
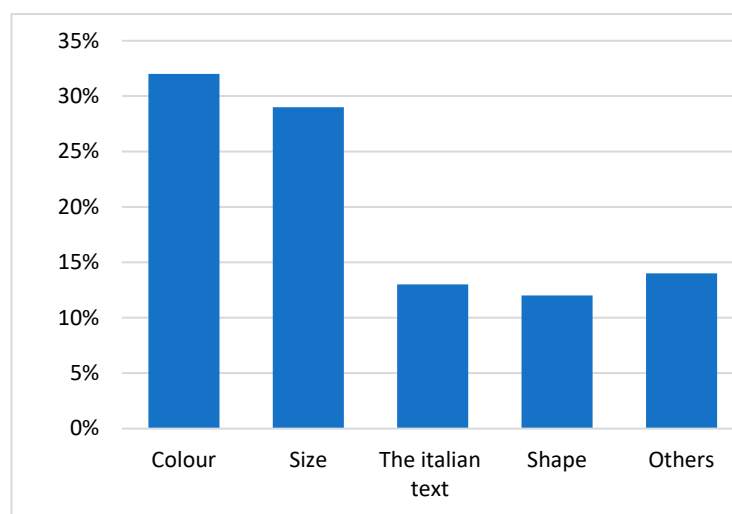
Figure 3. Results of the multiple-choice question: the importance of eco-label features.

3.3. Eye-Tracking Results

Descriptive statistics (see Table 4) showed that it took participants less time to look at the eco-labels when they were presented with a large size and a higher saliency. Consumers also spent more time looking at bigger and higher saliency labels and required less cognitive effort (lower average fixation duration).

Table 4. Eye-tracking measures on specific eco-labels during the DCE: mean (standard deviation).

	Time to First Fixation (s)	Time Spent (s)	Average Fixation Duration (s)
	Original labels		
ASC	6.65 (6.51)	7.98 (11.60)	13.69 (13.62)
Friend of the Sea	8.67 (8.26)	4.18 (6.63)	13.02 (11.94)
GGN-cert. Aquaculture	6.82 (6.14)	5.90 (7.66)	17.4 (20.60)
GGN-cert. Farming	6.78 (6.57)	4.49 (5.65)	14.90 (13.55)
	Eco-labels with higher size and higher saliency		
ASC	5.31 (6.28)	12.56 (15.01)	13.20 (10.03)
Friend of the Sea	3.95 (4.82)	7.53 (9.33)	11.33 (8.17)
GGN-cert. Aquaculture	5.68 (6.85)	19.93 (19.34)	13.93 (12.74)
GGN-cert. Farming	6.40 (6.36)	13.98 (16.56)	12.13 (8.54)

According to the results of the repeated measures ANOVA, Time to first fixation was significantly influenced by size ($F_{(12,745)} = 98.44$, $p < 0.001$). Saliency ($F_{(12,745)} = 3.58$) had a statistically significant influence on Time to first fixation only at $p < 0.01$. Consumers first fixated their gaze on the bigger eco-labels with a higher saliency. There was also a significant interaction among label and size ($F_{(12,745)} = 3.58$, $p < 0.05$).

The time consumers spent on each eco-label is significantly influenced only by size ($F_{(12,745)} = 198.24$, $p < 0.001$), not by saliency($F_{(12,745)} = 0.14$, $p > 0.10$). However, the interaction between saliency and eco-label ($F_{(12,745)} = 9.73$, $p > 0.001$) was significant. In the three-way effect, saliency, size and eco-labels (($F_{(12,745)} = 8.05$, $p < 0.001$) had a significant effect on Time spent. This means that the effect of size and saliency was significant, depend-

ing on the type of eco-label. Lastly, the results of the average fixation duration suggested that bigger eco-labels (F(12,320) = 10.23, $p < 0.05$), but not higher saliency (F(12,318) = 2.30, $p > 0.05$), significantly helped consumers to process the eco-labels cognitively.

3.4. Word Association Task Results

Considering the terms used by more than 5% of participants, 8 categories were considered: "Sea", "Italian text", "Colour", "Fish", "Confidence", "Safety", "Quality", "Sustainability". In particular, "Sea" (23%), "Colour" (18%) and "Safety" (15%) were the most mentioned words by consumers (Figure 4). The first most-named word, "Sea", is mainly associated with the eco-label FOS. In fact, participants appreciated the colours of FOS, the general design and the text on the eco-label, which recall participants of the sea, but not precisely the aquaculture sector. Moreover, the eco-label FOS evoked terms such as "sustainability". In fact, according to consumers (7%), the eco-label design conveyed a perception of sustainability. However, they found the information provided by the eco-label to be too generic.
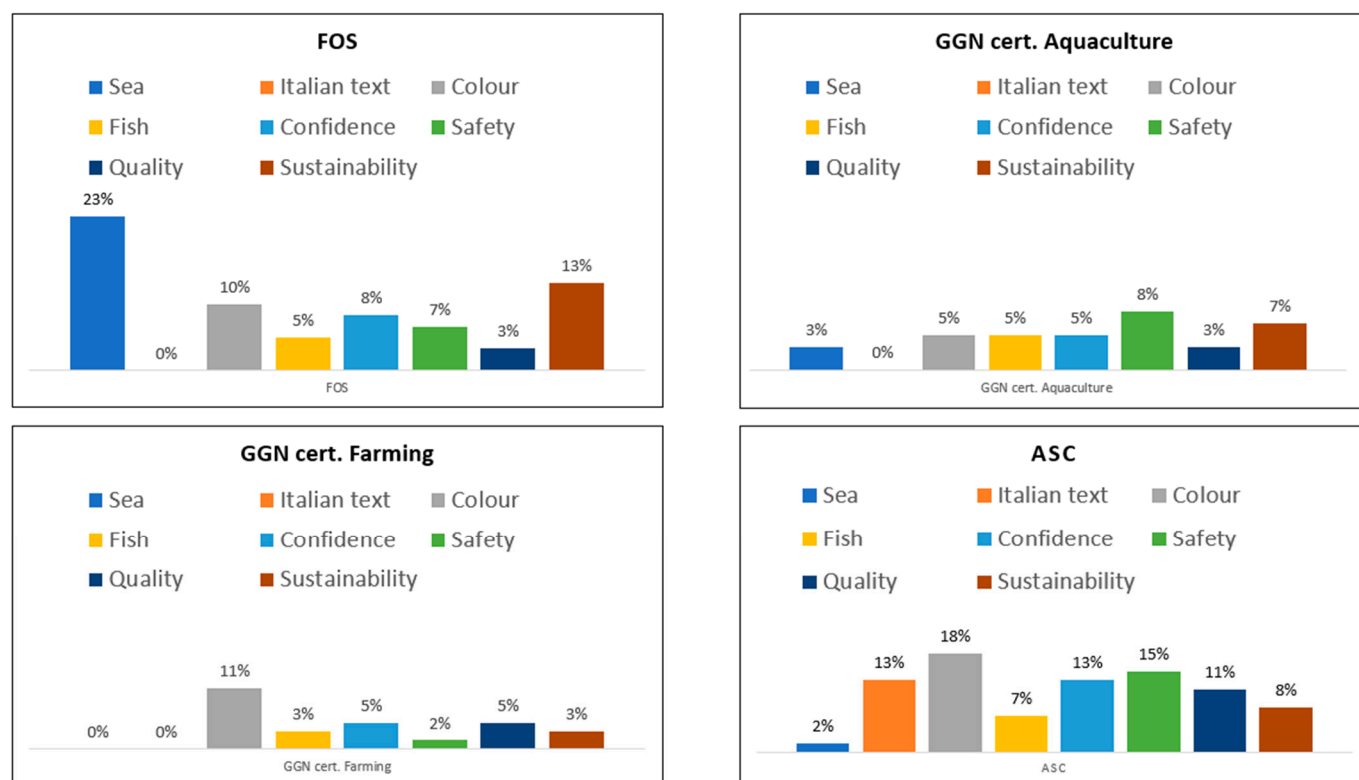
Figure 4. Histogram of the most-used terms during the Word Association (WA) task.

The other two most-used words ("Colour" and "Safety") are related to the ASC eco-label. According to participants' responses, the colour of ASC (no matter the saliency) and the presence of fish on the eco-labels were attractive features, since they recall aquaculture products and give them a sense of "safety" and "quality" in the product. Moreover, respondents also found the eco-label's Italian text ("Acquacoltura responsabile certificata") appealing, since it is easily understandable.

As regards the eco-label GGN-certified Aquaculture, consumers declared that they were attracted by the graphic design. In particular, consumers appreciated the presence of fish on eco-labels, and the colour caught their attention because of the association with aquaculture products. However, participants were confused about the meaning of the word "GGN", even if the eco-label's overall visual elements gave them a sense of safety and sustainability in the product.

Lastly, the most-used word for the eco-label GGN-certified farming was "Colour" (11%). Participants found the yellow of the eco-label attractive. However, the overall visual design was too generic and unrelated to aquaculture products.

4. Discussion

The present study aimed to investigate which visual design elements of eco-labels commonly found in aquaculture products influence Italian consumers' attention and choice. In particular, the size and the saliency of four eco-labels (ASC, GGN-certified aquaculture, GGN-certified farming, Friend of the Sea) were manipulated to check if increasing visibility would influence consumers' visual attention and choices of aquaculture products. Furthermore, a more in-depth understanding of the reasons behind respondents' preference for the eco-labels was sought through semantic analysis.

The results of the eye-tracking metrics showed that most respondents fixated their gaze on the eco-labels, which suggests that eco-labels were relevant information to the consumers' decision-making process [63]. This is in line with previous literature that showed that certification schemes are noticed by consumers of aquaculture products [36,64]. However, as the choice experiments revealed, consumers did not prefer a specific eco-label. Carlucci et al. [65] also found that the main interest of consumers is to choose products that have been certified by a third party, without being biased towards any of the standards (i.e., environmental standards, social standards or economic standards) of the single eco-label. This could be due to consumers' limited knowledge of seafood eco-labels [66]. Further research, however, is required to explore this topic.

As shown by eye-tracking results, consumers' interest in eco-labels could be increased through bigger surface sizes, which increases eco-labels' visibility. Moreover, such eco-labels can facilitate consumers' cognitive processes. This is in line with previous research [27,67] on bottom-up factors that declared that incrementing size better guides consumers' visual attention to stimuli. The size of eco-labels was also a significant bottom-up factor in consumers' choice, since they preferred products carrying bigger eco-labels. This agrees with previous studies [27,68].

Another bottom-up factor that helped eco-labels' visibility was saliency. Indeed, eco-labels with higher saliency are better at attracting consumers' attention [27]. However, according to the ANOVA results, saliency's effect on Time of first fixation was significant only at 10 per cent. Saliency helped to increase consumers' interest in eco-labels only when combined with size and the type of eco-label. Further research with a bigger sample would be necessary to explore saliency's effect on visual attention.

Nevertheless, saliency does not appear to be a relevant attribute in the case of consumers' choices, as revealed by the choice experiment. This means saliency alone is insufficient to influence consumers' preferences. Our results corroborate findings from early research [69,70] that stated that consumers could take advantage of saliency in the case of products for which they already have a preference. However, as also shown by the choice experiment conducted in this study, consumers were not biased towards any specific eco-labels. The interaction among consumers' preferences for eco-labels and saliency is a topic to be further explored to understand in which situation consumers could effectively take advantage of saliency.

Another reason for the lack of significance of the eco-labels saliency could be that the respondents of the present research had to choose among eco-labels that differed in design (e.g., shape and symbols), not only in terms of size and saliency [27]. In fact, according to the closed-ended question and the word association (WA) task, consumers stated to be influenced by the colour itself (not the saliency) and the shape and the language in which the eco-labels were written [32,71]. In particular, the Italian text on the eco-label (i.e., ASC) evoked a product of Italian origin and quality in consumers' minds. As we know from previous literature, consumers have a country of origin bias [38,72], since they use the country of origin as a heuristic to evaluate the quality of a product. The appropriate

language in the eco-label text should be explored further to understand if consumers' preferred sustainability communicated in their mother tongue.

Participants appreciated eco-labels that intuitively recall aquaculture products, such as ASC and GGN-certified aquaculture, and that use colours or symbols (such as fish) connected directly to aquaculture. These results do not disconfirm previous findings [32,73], which suggest that congruency between the colour label and the product help consumers better find products they need through supermarket aisles.

The importance of the visual elements in the choice of eco-labels is aligned with previous literature stating that graphic design plays a crucial role in influencing consumers [71].

5. Conclusions

This study contributes to expanding the current literature on consumer behaviour in the aquaculture sector, focusing on preferences for different eco-labels. In particular, the research of Peschel et al. [27] was further expanded by investigating the role of bottom-up factors (i.e., size and saliency) on other category product (i.e., aquaculture products) and considering different types of eco-labels. Eco-labels play a key role in affecting consumers' purchase, even though a preference for specific eco-labels was not found.

Moreover, the research shed light on other visual elements of eco-labels that consumers are interested in. The results of the study have some practical implications. The findings suggest that increasing the eco-labels' size could promote aquaculture product consumption. Saliency should not be considered by itself, since its role in influencing consumers' behaviour depends also on the size and type of eco-labels. Lastly, aquaculture companies should also consider semiotic associations to overcome eco-labels' lack of visibility. In particular, consumers' processing and attention capture of the eco-labels are improved by the use of colour and symbols that are closely associated to aquaculture products.

By examining the visual mechanism by which these eco-labels could be used to increase consumer preferences for aquaculture products, this research has provided a step forward to communicate aquaculture sustainability in a marketing environment better. The global agri-food system has progressively used eco-labels to give information on credence attributes that consumers cannot verify. The present study's finding provides insights into designing eco-labels to improve their use. Moreover, considering the marina ecosystem's overexploitation has become one of the main issues for society and politicians, consumers' behavioural insights could help enhance eco-labels effectiveness in promoting sustainable production processes.

6. Limitations

The present results are limited to workers and students at Marche Polytechnic University. The study should be replicated in cities with other samples to generalise the findings and increase external validity. Therefore, the study was hypothetical and did not fully reflect real-life circumstances that mimic a natural shopping experience. However, albeit the visual tasks were quite artificial, they were specifically devised to study visual attraction in detail. Further studies on the current topic are therefore suggested to elucidate the pattern of visual attention to eco-labels, conducting studies in a naturalistic setting, such as a supermarket.

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