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Measuring the Aesthetic Value of Multifunctional Lakes Using an Enhanced Visual Quality Method

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Abstract: Aesthetic value is an important factor that should be considered in lake environments. However, there is a lack of research examining and undertaking investigation of the aesthetic value of multifunctional lake ecosystems. There are two major purposes for this study: (1) to define and investigate the important perceived attributes related to the aesthetic value of multifunctional lakes using a video-questionnaire method and (2) to provide some suggestions for the further development of a visual quality index facilitating decision making in management and policies. An enhanced visual quality method was used in this study to record the conditions of the multifunctional lakes in each location in the study area. The findings of the study defined water color and clarity, percentage of water hyacinth, types of debris, percentage of debris, and facilities and land values as the important attributes related to aesthetic value in multifunctional lakes. In summary, the perceived attributes in the visual ecology criteria indicated more significant relationships with the functional morphology criteria than the financial profitability criteria. The results showed that the video-questionnaire method used in this study is efficient, easy to use, and understandable in terms of identifying and measuring aesthetic value in relation to perceptions of perceived attributes.

Keywords: aesthetic value; multifunctional lakes; people perceptions; video-questionnaire

1. Introduction

Lakes are an important form of freshwater with a range of aquatic ecosystems and eco-hydrological functions [1–3], including being natural regulators of river flows and sedimentation, functioning as nutrient traps in watershed areas, creating aquatic habitats, and even providing high biodiversity in specific environments [4,5]. In addition, lakes are also used for anthropogenic purposes such as for drinking, agriculture, aquaculture, and other recreational purposes such as fishing, sailing, swimming, jet-skiing, boating, paddling, canoeing, and other forms of water-based tourism [6–8]. Therefore, aesthetic value is an important factor that should be considered in multifunctional lake environments. However, anthropogenic activities likely carry numerous threats for lake environments. In developed countries, most lakes have their own specific purpose, while many lakes in developing countries serve multi-purposes for various socio-economic reasons. In order to preserve the natural functions of lake environments, it is necessary to implement sustainable lake management programs in terms of effective, localized approaches.

In recent years, anthropogenic activities have been linked with the degradation of water quality in lake environments [9–12], and this has also affected their aesthetic value. Aesthetic value is very difficult to assess due to difficulties in differentiating sensory responses and with unequivocally attributing these to particular characteristics of a given area [13]. This is why tools are needed to make it possible to assess how a specific multifunctional lake environment can support a particular aesthetic value that directly depends on people's perceptions. While the aesthetic value of lakes has been acknowledged by the public and experts [14,15], the term aesthetic value in relation to water has been defined differently, depending on the purpose of the water being examined. Some researchers have based the aesthetic value of water on its clarity and color [14], while others have focused on socio-economic aspects of water environments [16]. Bernal et al. (1999) developed the Aesthetic Quality Index (AQI), which considers the following three parameters: taste and odor, turbidity, and color. Based on previous studies, it can be assumed that the aesthetic value of lakes is closely related to perceived attributes within lake environments.

One of the most critical issues regarding aesthetic value in this context is determining how people evaluate and perceive waterscapes, especially in the case of multifunctional lakes. Very few attempts have been made in water research to study perceptions of aesthetic value. Most previous research in lake management has been focused on the hydrological processes and quality of water rather than its aesthetic value [17–20]. Therefore, there were two major purposes for this study: (1) to define and investigate the important perceived attributes related to aesthetic value in multifunctional lakes using a video-questionnaire method and (2) to provide some suggestions for the further development of a visual quality index facilitating decision making in management and policies.

2. Materials and Methods

In order to achieve the aforementioned purposes, we provide a schematic diagram that describes the methodological design used in this study (Figure 1). To obtain and analyze the qualitative data necessary to identify and assess the important attributes related to the aesthetic value of multifunctional lakes in the study area, we carried out a preparative survey by interviewing local experts. In the content analysis, all the comments were collected and categorized according to themes referring to the important parameters of the on-site perceived attributes of the multifunctional lakes under consideration.

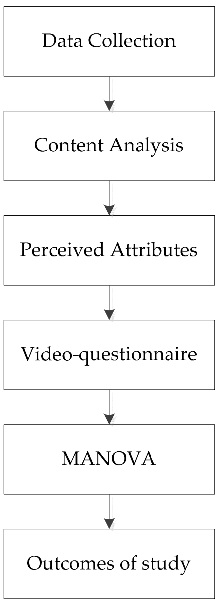

Figure 1. Methodological design of the study. MANOVA, Multivariate Analysis of Variance.

Works previously conducted on human perceptions of multifunctional lake aesthetics have shown that people are able to express their preferences for aesthetic value and health parameters and that their perceptions strongly depend on visual criteria and visual quality assessment methods [15]. For previous visual quality assessment methods, researchers often have used photo-based approaches to measure aesthetic value [21–24]. Over the past few years, this method has been increasingly applied to assess the quality of wetlands [15,21], landscaping in rural residential areas [22], national parks, mountainous, or forested areas [25–29], as well as for other ecological purposes [30–33]. However, while these studies used photographs, the current work uses photographs combined with videos to record the conditions of multifunctional lakes at each location in the study area, as these can provide a realistic representation of the prevailing conditions because videos are able to easily capture the whole environment surrounding the lake. In this study, this approach is called the enhanced visual quality method and is used to investigate the perceptions of different types of respondents. All videos were produced using a Nikon D5100 as the main tool for this study. This tool has continuous autofocus during live view shooting, a huge image sensor, a sharper image, less noise than other alternatives, and has a larger depth of field and dynamic range as compared with a dedicated camcorder or compact camera, which have smaller image sensors. Moreover, it can also provide much faster autofocus while doing video recording and in the live view mode (shooting still images while using the LCD as a viewfinder) than its competition. Therefore, it can be assumed that the quality of the video image from Nikon D5100 is high quality and accurate.

2.1. Respondents

Many environmental evaluation projects use the perceptions of respondents [22,34]. We used locals (residents or other people who were familiar with the area) and visitors as direct respondents and academic experts (lecturers and students from university) and a group of governmental experts as indirect respondents. The governmental experts consisted of staff from the local Environmental Protection Agency from the Depok area and the Environmental Protection Agency from the West Java Region. The expert panel was considered to be familiar with the characteristics of multifunctional lakes. We carried out a quantitative survey of the respondents' perceptions in January and February of 2014. Respondents older than 12 and less than 70 years of age were selected. The demographic details of the 230 respondents in the study are shown in Table 1.

Table 1. Demographic data of the respondents.

Lakes	Direct Respondents				Indirect Respondents		
	Visitors	%	Locals	%	Academic and Governmental Experts	%	Total
Bojong Sari	19	16.5	14	12.2	82	71.3	115
Citayam	21	17	20	16.3	82	66.7	123
Rawa Besar	20	16.1	22	17.8	82	66.1	124
Rawa Kalong	15	13.2	17	14.9	82	71.9	114

2.2. Experimental Procedure

Prior to beginning the interviews and the questionnaire process, a brief introduction, some short definitions, and the purposes of this study were provided to all of the respondents. The indirect respondents were shown videos along with pictures of the conditions in the study area, and then they completed the questionnaire based on this information. In contrast, the direct respondents simply completed the questionnaire based on their personal perceptions. A 7-point modified Likert scale and a concise description of the measurement scale were used to assess the multifunctional lake attributes (Table 2), which describe characteristics based on perceived attributes. A score of one was given to the attribute contributing the worst condition, and a score of seven was given to the attribute contributing the best condition.

Table 2. Measurement scales used for the attributes of the lake environment.

Score	Color of Water (CO)	Clarity of Water (CL)	% of Water Hyacinth (PH)	Types of Debris (TD)	% of Debris (PD)	Facilities (*F*)	Land Value (LV)
1	black	dark	>90	hazardous wastes	>90	very unprofitable	very unprofitable
2	dark brown	partly dark	70–90	motor oil, grease	70–90	unprofitable	unprofitable
3	brown	opaque	50–70	man-made rubbish (plastic, rubber, glass, metal)	50–70	slightly unprofitable	slightly unprofitable
4	light brown	partly opaque	30–50	foam fragments (detergents, aquaculture waste)	30–50	moderate	moderate
5	dark green	cloudy	10–30	natural rubbish (wood, etc.)	10–30	slightly profitable	slightly profitable
6	green	partly cloudy	0–10	Small pieces of litter, leaves, mud	0–10	profitable	profitable
7	light green	vivid	none	none	none	very profitable	very profitable

We performed a content analysis by interviewing local experts in order to select the perceived attributes. The results were the selected perceived attributes, which were categorized using three criteria: visual ecology, functional morphology, and financial profitability. Visual ecology was related to the color and clarity of the water [15], while functional morphology was a measure of trophic status related to the percentages of water hyacinth and the type and percentage of debris. Lastly, financial profitability was based on how the respondents evaluated the monetary value of the attributes of multifunctional lakes, including the land value and the value of related facilities. It was well recognized, however, that some financial profitability criteria should be included for ecosystem conservation in multifunctional lake environments.

The water hyacinth is an aggressive colonizer and was recorded in the selected lakes during the study. Some invasive alien macrophytes, such as water hyacinth or duckweeds, can compete effectively for light in lakes. In addition to its negative effects, the spread of water hyacinth may have complex implications. The percentage of water hyacinth was selected as one of the perceived attributes related to aesthetic value due to its negative impact related to intruding aquatic ecosystems and changing the clarity and color of the water.

2.3. Statistical Method

The data obtained from the questionnaires was processed using the SPSS 17.0 statistical analysis program. Specifically, a Multivariate Analysis of Variance (MANOVA) was conducted because it is generally used to test hypotheses in which one or more independent variables, or factors, are proposed to have an effect on a set of two or more dependent variables. It can be seen as a form of ANOVA with several dependent variables. While ANOVA tests for the difference in means between two or more groups, MANOVA tests for the difference in two or more vectors of means. MANOVA was used in this work to test whether different types of respondents and the locations of multifunctional lakes affect the perceptions of the respondents with regard to a measure of aesthetic value based on various perceived attributes (color of water, clarity of water, percentage of water hyacinth, types of debris, percentage of debris, facilities and land value). In SPSS, there are four multivariate measures: Wilks' lambda, Pillai's trace, Hotelling's trace, and Roy's largest root. The difference between the four measures is the way in which they combine the dependent variables to examine the amount of variance in the data. We also used a Pearson correlation analysis to explore the relationships among the perceived attributes. Due to study limitations, full validity testing of the model including multivariate normality test (QQ plots and Kolmogorov-Smirnov tests of response variables) and homoscedasticity tests were not performed in this paper.

2.4. Study Area

The Depok area is considered to be a part of Jadebotabek, West Java Province, Indonesia (Figure 2). Geographically, it is located in an area corresponding to 6°19′ 00′′–6°28′ 00′′ South (latitude) and 106°43′ 00′′–106°55′ 30′′ East (longitude). It has an area of about 200.29 km^2. The average temperature ranges between 24.3 °C and 33 °C. The average annual rainfall is 2684 mm/year. It is made up of 11 districts. Based on the master plan of the Depok area (2010–2030) from the Depok Environmental Agency, this area is a buffer and water recharge zone for Jakarta City (the capital city of Indonesia). There are at least 19 multifunctional lakes, both natural and artificial, within this area. It is not without reason that the Depok area can thus be called a multifunctional lake area. Numerous multifunctional lakes in the Depok area have a major purpose (i.e., water preservation and conservation for Jakarta City). However, many of them are also used for irrigation, aquaculture, tourism, water sports, and as depositories for industrial and domestic waste. We selected four multifunctional lakes in the Depok area four our case study (Figure 3). The location and physical characteristics of the selected multifunctional lakes can be seen in Table 3. It should be noted that the competition for space resulting from the uncontrolled growth of human activities in this area has led to degradation in the multifunctional lake environment.

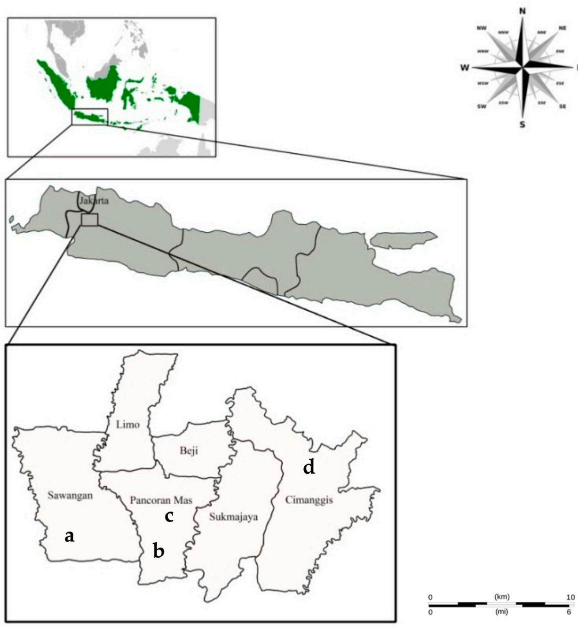

Figure 2. Location of the lakes in the study area [8]: (**a**) Bojong Sari; (**b**) Citayam; (**c**) Rawa Besar; (**d**) Rawa Kalong.

(**a**)

(**b**)

Figure 3. *Cont.*

(c)

(d)

Figure 3. Existing condition of lakes in the study area: (**a**) Bojong Sari; (**b**) Citayam; (**c**) Rawa Besar; (**d**) Rawa Kalong.

Table 3. The location and physical characteristics of selected lakes in the Depok area.

Lake	Location	District	Area (ha)	Average Water Depth (m)	
				Wet Season	Dry Season
Bojong Sari	6°39′ S; 106°75′ E	Sawangan	28.3	4.0	3.0
Citayam	6°27′ S; 106°48′ E	Pancoran Mas	7.0	4.0	1.2
RawaBesar	6°24′ S; 106°49′ E	Pancoran Mas	17.0	4.5	3.5
Rawa Kalong	6°25′ S; 106°52′ E	Cimanggis	8.3	3.0	2.0

3. Results

The results from the MANOVA analysis are presented. In the Wilks' lambda criteria, the intercept showed Wilks' $\lambda = 0$; F (7, 458) = 19416.4; $p < 0.001$, and the power to detect the effect was 1. The multifunctional lakes showed Wilks' $\lambda = 0.2$; F (21, 1316) = 57; $p < 0.001$, and the power to detect the effect was 1. The respondents showed Wilks' $\lambda = 0.4$; F (14, 916) = 40; $p < 0.001$, and the power to detect the effect was 1. The interaction between both showed Wilks' $\lambda = 0.4$; F (42, 2151.7) = 10.2; $p < 0.001$, and the power to detect the effect was 1. A value of zero means that there is no variance that is not explained by the independent variable. The results indicated that the selected independent variables had low significance with regard to each defined contrast.

Table 4 shows the entire mean difference among the perceived attributes. It should be noted that CO is the color of the water; CL is the clarity of the water; PH is the percentage of water hyacinth; TD is types of debris; PD is the percentage of debris; *F* is facilities, and LV is land value. In the facilities attribute, the mean difference between the direct respondents and indirect respondents was significant at the 0.05 level (i.e., 1.3 for visitors compared to indirect respondents and 0.9 for local compared to indirect respondents). Similar results also were found for the land value attribute, where the mean difference between the direct respondents and indirect respondents was significant at the 0.05 level (i.e., 1.7 for visitors compared to indirect respondents and 2.1 for local compared to indirect respondents). Therefore, there were statistically significant differences between the direct respondents (visitors and local) and the indirect respondents for the facilities and land value attributes. There were no significant differences between the direct respondents and the indirect respondents, especially in the color and clarity attributes. Water color in a study area was categorized as dark green to green (mean score = 5.4). Water clarity was classified into opaque to partly opaque (mean score = 3.6). Percentage of water hyacinth was about 10% of the total area of the multifunctional lakes (mean score = 5.2). Most respondents selected foam fragments as the major type of debris in the study area (mean score = 4.1). The percentage of debris was below 10% (mean score = 5.4). With regard to the facilities surrounding the multifunctional lake environments, most respondents determined that they had no effect or were only slightly profitable (mean score = 4.9). Slightly profitable means slightly rising land prices. Lastly, most of respondents considered the land value in the study area to be slightly profitable (mean score = 5.1).

According to the results of the correlation analysis, there was a statistically strong relationship between all of the perceived attributes (Table 5), although the degree of color attribute had a stronger relationship with clarity (r = 0.4) compared to the other attributes. There was also a strong relationship between the percentage of debris attribute and the types of debris attribute, which showed the strongest relationship (r = 0.6), while the facilities attribute and percentage of water hyacinth attribute showed the weakest relationship (r = 0.2). In summary, the perceived attributes in the visual ecology criteria (CO and CL) showed more significant relationships with the functional morphology criteria (PH, TD, and PD) than with the financial profitability criteria (F and LV). The results suggested that the respondents' perceptions of aesthetic value were more related to the visual ecology criteria (CO and CL) and functional morphology criteria (PH, TD, and PD) than the financial profitability criteria (F and LV). The comparison results were studied among selected multifunctional lakes. The highest aesthetic value score for both types of respondents was obtained for Bojong Sari Lake. It can thus be assumed that Bojong Sari Lake exhibited better conditions for all the perceived attributes compared to the other multifunctional lakes.

Table 4. Significant pairwise respondent differences with regard to the perceived attributes.

Attributes	(I) Respondent	(J) Respondent	Mean Difference (I–J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
CO	Visitor	Local	0.2	0.1	0.2	−0.1	0.4
		Indirect	−0.1	0.1	0.7	−0.2	0.1
	Local	Visitor	−0.2	0.1	0.2	−0.4	0.1
		Indirect	−0.2 *	0.1	0	−0.4	−0.1
	Indirect	Visitor	0.1	0.1	0.7	−0.1	0.2
		Local	0.2 *	0.1	0	0.1	0.4
CL	Visitor	Local	0.2	0.1	0.1	0	0.5
		Indirect	0.2	0.1	0.1	0	0.4
	Local	Visitor	−0.2	0.1	0.1	−0.5	0
		Indirect	0	0.1	0.9	−0.2	0.2
	Indirect	Visitor	−0.2	0.1	0.1	−0.4	0
		Local	0	0.1	0.9	−0.2	0.2
PH	Visitor	Local	0	0.1	0.9	−0.2	0.2
		Indirect	−0.2 *	0.1	0	−0.4	−0.1
	Local	Visitor	0	0.1	0.9	−0.2	0.2
		Indirect	−0.2 *	0.1	0	−0.4	−0.1
	Indirect	Visitor	0.2 *	0.1	0	0.1	0.4
		Local	0.2 *	0.1	0	0.1	0.4
TD	Visitor	Local	0.5 *	0.2	0	0.2	0.9
		Indirect	0.2	0.1	0.5	−0.1	0.4
	Local	Visitor	−0.5 *	0.2	0	−0.9	−0.2
		Indirect	−0.4 *	0.1	0	−0.7	−0.1
	Indirect	Visitor	−0.2	0.1	0.5	−0.4	0.1
		Local	0.4 *	0.1	0	0.1	0.7
PD	Visitor	Local	−0.4 *	0.1	0	−0.6	−0.2
		Indirect	−0.5 *	0.1	0	−0.6	−0.3
	Local	Visitor	0.4 *	0.1	0	0.2	0.6
		Indirect	−0.1	0.1	0.4	−0.2	0.1
	Indirect	Visitor	0.5 *	0.1	0	0.3	0.6
		Local	0.1	0.1	0.4	−0.1	0.2

Table 4. *Cont.*

Attributes	(I) Respondent	(J) Respondent	Mean Difference (I–J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
F	Visitor	Local	0.4 *	0.1	0	0	0.7
		Indirect	1.3 *	0.1	0	1	1.5
	Local	Visitor	−0.4 *	0.1	0	−0.7	0
		Indirect	0.9 *	0.1	0	0.6	1.2
	Indirect	Visitor	−1.3 *	0.1	0	−1.5	−1
		Local	−0.9 *	0.1	0	−1.2	−0.6
LV	Visitor	Local	−0.4	0.2	0.1	−0.8	0
		Indirect	1.7 *	0.1	0	1.4	2
	Local	Visitor	0.4	0.2	0	0	0.8
		Indirect	2.1 *	0.1	0	1.8	2.4
	Indirect	Visitor	−1.7 *	0.1	0	−2	−1.4
		Local	−2.1 *	0.1	0	−2.4	−1.8

Notes: Based on observed means. The error term is Mean Square (Error) = 1.045. Sig. is significance. * The mean difference is significant at the 0.05 level.

Table 5. Pearson correlation results for the attributes.

		CO	CL	PH	TD	PD	F	LV
CO	Coefficient	1						
	Sig. (2-tailed)							
CL	Coefficient	0.4 **	1					
	Sig. (2-tailed)	0						
PH	Coefficient	0.3 **	0.4 **	1				
	Sig. (2-tailed)	0	0					
TD	Coefficient	0.4 **	0.5 **	0.4 **	1			
	Sig. (2-tailed)	0	0	0				
PD	Coefficient	0.3 **	0.5 **	0.4 **	0.6 **	1		
	Sig. (2-tailed)	0	0	0	0			
F	Coefficient	0.2 **	0.5 **	0.2 **	0.4 **	0.3 **	1	
	Sig. (2-tailed)	0	0	0	0	0		
LV	Coefficient	0.2 **	0.4 **	0.2 **	0.4 **	0.3 **	0.5 **	1
	Sig. (2-tailed)	0	0	0	0	0	0	

Note: ** Correlation is significant at the 0.01 level.

4. Discussion

The results of this study show that aesthetic value is one of the important variables that should be considered when examining multifunctional lakes. The presented results also strengthen the results from a previous study [8] in that the physicochemical parameters are not sufficient to measure comprehensive quality index of a lake without considering perceived attributes of the lake. Three criteria (visual ecology, functional morphology, and financial profitability) in the perceived attributes also can be used as indicators of the density of obstructing objects in the multifunctional lake environment. The concept of visual attributes in multifunctional lakes related to aesthetic value indicators such as color of water, clarity of water, and other perceived attributes, were shown to be important elements of waterscape perceptions and preferences. This study demonstrated that visual assessment can help in the decision-making processes of involved respondents. The enhanced visual quality method using a video-questionnaire helped indirect respondents to develop an understanding of the overall description, so they could score the perceived attributes of the lakes in the study area.

Some previous studies have used visual assessment methods as a direct way to assess the visual quality of scenic areas [22,27]. In order to investigate the reliability of the enhanced visual quality method, a video-questionnaire combined with supported pictures was implemented to assess the aesthetic value of multifunctional lakes in the Depok area, Indonesia, based on the perceptions of respondents. We assumed that the technical skills involved in producing the video files from a video camera used with the questionnaire would not have any substantial impact on the results, since previous studies have been carried out indicating that this issue plays a minor role in the perceptions of respondents [34,35]. The evaluation of the visual waterscape by different respondents was characterized by a heuristic, enhanced visual quality method and the use of systematic descriptive inventories using a video-questionnaire method.

Based on the results, the worst conditions were in Rawa Kalong Lake, especially with regard to the visual ecology and functional morphology criteria. With regard to the financial profitability criteria, it was likely that both visitors and local residents had similar perceptions of the facilities and land value in the study area, which supported their expectation of "intrinsic economic value" in their own areas, such as the prospect of increased land prices in property surrounding the multifunctional lake environment. In contrast, the indirect respondents were more likely to provide very little detail about the "intrinsic economic value" in the study area. Based on the direct interviews, high expectations were closely related with land-use or land purpose. For example, locals (residents) in the vicinity of Bojong Sari Lake felt that their land was likely to become a commercial area. In the Bojong Sari Lake area, buildings such as hotels and those used for other recreation/tourism purposes were still developing. In the Rawa Kalong Lake area, industry sectors were growing significantly. Meanwhile, Rawa Besar Lake and Citayam Lake were located in urban centers where there are a lot of social activities.

It was noted that the indirect respondents judged the financial profitability criteria (facility and land value) based only on the appearance of these attributes in the video clips for each study area. In other words, the indirect respondents had very little or no idea about the existing land prices and the functions of facilities in the study area because they do not live there. The direct respondents, who consisted of visitors and local people had much more information about the land value or price of property in the study area. According to the respondents, due to the inherent beauty of things like waterfront sunsets, aquatic and avian life, and simply hearing the flow of water, property values on lakefronts are simply worth more to people than inland property. These reasons well explained why direct respondents gave different responses than indirect respondents concerning land value attributes.

The video-questionnaire implemented in the study was quite efficient, easy to use, and understandable in terms of identifying and measuring aesthetic value in relation to perceptions of the perceived attributes. The overall perceptions of both locals and visitors were similar, especially in the type of debris attribute. However, there was difficulty in measuring intrinsic value within the study area, such as the facilities and land value attributes. The main reason for this was that the indirect respondents were not familiar with the land and property values in these locations. Meanwhile, direct respondents, especially locals, truly had enough knowledge of the intrinsic value of the locations.

5. Conclusions

Waterscape multifunctional lakes play an important role in understanding the aesthetic value of multifunctional lakes. In order to analyze and measure, for instance, the aesthetic value due to the presence of small-scale aquaculture in multifunctional lakes, it is necessary to know how perceived attributes of multifunctional lakes affect the overall assessment of multifunctional lake management. The findings of our study defined selected perceived attributes related to aesthetic value in multifunctional lakes.

The method presented in this work was a cost-effective one compared to the approaches used in many previous studies, which require long travel times to transport all the participants to the study area [25,27]. From an ecological perspective, water is an element of considerable visual importance and has a key role in biodiversity in multifunctional lakescapes [36]. By including water color and clarity in the visual ecology criteria when measuring aesthetic value, we were able to consider these issues in the current study. Our findings also confirmed that the use of a visual approach in identifying and measuring the aesthetic value of multifunctional lakes is very helpful in terms of providing information related to the development of improved multifunctional lake management practices.

In addition, the different motivations of the respondents, especially visitors, probably influenced their perceptions when assessing aesthetic value, which can also be explored further in the future. In addition, the lack of awareness of certain factors on the part of locals (residents) and visitors may be related to their socio-economic conditions and educational backgrounds. However, overall, it was anticipated that the results and method presented in this work can help in the development of an integrated approach to multifunctional lake management and policy making. Managers and designers can create and maintain landscapes in multifunctional lake areas that fulfill multiple purposes associated with their ecosystem services by manipulating empirically derived aesthetically relevant attributes and cultural and social influences on preference to achieve specific environmental and aesthetic goals that are also category-specific.

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Conflicts of Interest: The authors declare no conflict of interest.

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