SCIENTIARUM POLONORUM ACTA Acta Sci. Pol., Administratio Locorum 22(2) 2023, 225–240.
https://czasopisma.uwm.edu.pl/index.php/aspal pISSN 1644-0749 eISSN 2450-0771 DOI: 10.31648/aspal.8811

ORIGINAL PAPER
Received: 16.03.2023 Accepted: 25.04.2023

PROPOSAL OF A POINT VALUATION METHOD FOR THE ASSESSMENT OF THE SIGHT-AESTHETIC VALUE OF THE UNDERWATER LANDSCAPES OF LAKES IN THE CONTEXT OF EXPLORATION TOURISM

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ABSTRACT

Motives: Most research on underwater landscapes is conducted in seas and oceans. Sight-aesthetic assessments of the underwater world are very rarely conducted; the literature on the subject is scarce and does not cover inland bodies of water.
Aim: The aim of this study was to develop a point valuation method for assessing the sight-aesthetic value of inland bodies of water. Attractiveness maps can be generated to create and plan tourist development and to identify attractive exploration sites for divers. The proposed method can also be applied to channel underwater traffic to protect valuable areas as well as areas that are characterised by low scenic beauty, but significant ecological functions.
Results: A method for assessing underwater landscapes in inland water bodies was developed and an attractiveness map was generated. Measurements were performed at points randomly distributed in the measurement grid. The results of direct observations made by experienced divers were used in the analysis. The study demonstrated that a point valuation method and attractiveness maps of underwater landscapes of lakes can be developed.

Keywords: perception, lake, point valuation method, questionnaire surveys, Wigry National Park

INTRODUCTION

Landscape assessment is one of the basic procedures in analyses of trends, dynamics, and potential transformation processes caused by the forces of nature and human activity. Landscape assessments should be quantified in various contexts to ensure that the conducted analyses generate reliable results. An assessment of the sight-aesthetic value of a landscape is one of the most important trends

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in interdisciplinary research in geography, geology, sociology, and other fields (Söhngen, 1975). In most planning and development activities, the sight-aesthetic value of a landscape largely determines the purpose of a designated area and its future development. The present study on the aesthetics of the underwater landscapes of lakes is a pioneering attempt to define and develop an assessment methodology. The literature on the classification of underwater scenic attractiveness is scarce, and most research has been conducted on seascapes (Musard, 2014; Falconer et al., 2013; Pungetti, 2012).

The aim of the study was to develop an innovative method for assessing the sight-aesthetic value of the underwater landscapes of lakes, defined as freshwater inland water bodies of natural or anthropogenic origin that differ in surface area and depth, including high-mountain ponds. The generated results can be used to assess lakes that are attractive tourist sites, to promote the development of specialised tourism (scuba diving), and to channel tourist traffic with the aim of protecting the most valuable and sensitive elements of aquatic ecosystems. The maps developed with the proposed method can facilitate decision-making in this type of tourism activity, similarly to other types of planning processes, such as urban planning (Ramachandra et al., 2012). Large-scale questionnaire surveys of divers with different levels of experience and training were conducted to achieve the research objective.

LITERATURE REVIEW

The underwater landscape of lakes needs to be defined to achieve the research objective. The concept of landscape aesthetics should be used due to similarities in the components of terrestrial and underwater landscapes. In this context, a landscape is defined as the visual representation of the current state of the geographical environment. The processes occurring in this environment create a set of characteristics specific to the type, condition, and kind of the landscape (Bajerowski et al., 2007). This approach is used in various fields of research, including sociological and economic research (for example, to analyse the impact of landscape values on property values). Landscapes are also perceived as spatially heterogeneous areas with a mosaic of patches that differ in size, shape, content (substance), and history. The need for hierarchical perception arises (including in terms of sight-aesthetics) when spatial differentiation is evident (Wu, 2013).

Similarly to terrestrial landscapes, underwater landscapes are perceived through different senses. As a result, various landscape components and their relationships can be identified and organised. The perceived information can be synthesised to model the structure and functioning of the perceived space. The physiognomy of a landscape is a concept that has evolved in research. This concept emerged in research on urban landscapes, and it was subsequently used to examine the physiognomy of non-urbanised landscapes. In the present study, this conceptual framework was applied to analyse perceptions of underwater landscapes in lakes (Chmielewski et al., 2019).

Most research on underwater landscapes has been done on seascapes. The attractiveness of marine landscapes is determined mainly by physical features, such as landform, shape, openness, and landscape patterns, as well as perceptual attributes, including a sense of remoteness, naturalness, and the way these landscapes are experienced (Falconer et al., 2013). The underwater landscape is increasingly present in the literature and everyday life through photography, film, and the 3D mapping technology (Musard, 2014). Research into the spatial variation of coastal landscapes of Shkota Island in the Sea of Japan led to the classification of underwater landscapes. Marine lifeforms were identified at class, subclass, type, subtype, genus and species level, and a landscape map was developed. The authors focused mainly on the geological structure and physical formation of the seabed. The influence of plant communities was also described (Ganzei et al., 2020). Although the list of elements is not exhaustive, this approach provides a valuable starting point for further research.

A number of research studies have been conducted in large lakes such as Baikal, Hovsgol, or Teletskoye. Large lakes are characterised by a highly varied

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geological structure, considerable depth, and heterogeneous distribution of fauna and flora. In a pioneering study of Lake Baikal, a schematic landscape regionalisation of benthic and natural water mass assemblages was proposed (Karabanov et al., 1990). In a study of the littoral zones of Lake Baikal, the stages of the lake's development were identified, and its unique biodiversity was described (Potemkina & Saturin, 2008). However, the literature on the sight-aesthetic assessment of large water bodies is scarce. The visual appeal of large water bodies requires further research, in particular in view of the growing popularity of special interest tourism, such as scuba diving.

Valuation methods are often used to assess and classify the sight-aesthetic value of landscapes and to propose methods for assessing perceived landscape values and monitor transformation processes (Wagtendonk & Vermaat, 2014; Sang & Tveit, 2013). This approach focuses on the main components of visual analyses that determine landscape attributes such as form, colour, texture, and lines. A clear and structured form facilitates the perception of the environment (Bell, 2012). From an observer's point of view, three approaches can be adopted to measure the attractiveness of a landscape: (1) direct field inventory, (2) cartographic inventory, and (3) photographic inventory (Qiu et al., 2013; Barroso et al., 2012; Beza, 2010). In the light of the aesthetics theory, the most objective assessment is based on direct landscape observations. However, this approach is laborious because it involves measurements of many small sites. It is generally accepted that valuation methods are characterised by a high degree of subjectivity; however, no method of assessing the geographical environment offers complete objectivity. These observations suggest that the point valuation method is the only rational approach to assessing complex structures (Bartkowski, 1986), especially if the valuation principles have been well defined. Such a study was conducted among divers working in tropical tourist areas. The indicators for the aesthetic assessment of underwater landscapes, including the cleanliness and visibility of underwater landscapes, general health of dive sites, species diversity, and potential ecological damage, were identified (Lucrezi et al., 2019).

MATERIALS AND METHODS

A point valuation method for the sight-aesthetic assessment of the underwater landscapes of lakes was developed in several stages. First, several groups of factors that affect perceptions of underwater landscapes were identified. Within these groups, detailed components were distinguished (Table 1).

The next stage of the study involved a questionnaire survey of 400 divers who were members of diving clubs across Poland. Scuba divers with varying levels of experience in tourist exploration were asked to describe the impact and hierarchy of the identified groups of factors on the sight-aesthetic value of underwater landscapes. This step was necessary to identify features that determine the sight-aesthetic value of underwater landscapes of lakes. The questionnaire relied on the direct comparison method which is widely used in psychology, pedagogy, spatial management, and landscape research. In this approach, the identified objects or components are compared in pairs. The percentage or point contribution of the identified components to the group is determined based on the results of the comparison. A detailed description of this method can be found in many studies involving questionnaire surveys (Brzeziński, 2010; Ferguson & Takane, 1989; Kendall, 1970; Senetra, 2016).

In the next stage, a point valuation table was developed based on the results of the questionnaires. Five groups of factors were ranked, and their contribution to the sight-aesthetic perception of underwater lake landscapes was determined. These groups were ranked according to the percentage of responses. The impact of the components in each group on the sight-aesthetic value of the assessed landscapes was calculated. The resulting rating scale was divided into five categories reflecting the sight-aesthetic value of underwater landscapes. The developed point valuation table was used to assess Lake Muliczne in Wigry National Park in north-eastern Poland.

The surveyed lake was divided into a regular grid of square-shaped basic fields which constituted the survey sites. Due to limited underwater visibility,

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Table 1. Groups of factors influencing the sight-aesthetic value of the underwater landscapes of lakes

Group	Group of factors	Components
1	Animals	fish crayfish snails (mussels) insects none
2	Submerged anthropogenic objects	wooden boat metal boat plastic boat car platform deck information board fixed rope anchor line obstacle made of wood obstacle made of plastic fishing equipment obstacle made of tyres none
3	Natural obstacles	trees plants boulders none
4	Plants	compact meadows of *Charophyte* algae, 0.5 m in height plant assemblages underwater meadows, 1.5–2.0 m in height underwater plants reaching the surface single plants rushes filamentous algae none
5	Shape and appearance of the lake bed	submerged cliffs/walls slope hilly flat boulders rocky sandy muddy

Source: own elaboration.

grid squares had a side length of 50 m. Each of these primary fields was assessed during field sessions by experienced divers. The measurements were carried out during a two-day measurement session in July 2022, based on the developed point valuation table. During direct observations, divers searched for individual components in the designated primary fields and rated them directly. Each grid square received a final score based on the sum of scores assigned to all ranked components (according to the point valuation table). The final scores were used to develop a landscape attractiveness map of the entire lake.

RESULTS

Questionnaire survey

A comparison of all five groups of factors revealed that the lake's visual attractiveness was determined mainly by the components in the Animals group, followed by Submerged anthropogenic objects. The shape and appearance of the lake bed were regarded as least important from the aesthetic point of view (Table 2). The point valuation table was developed based on the detailed results in each group. Weights were calculated for each group of factors based on the percentage distribution of diver responses.

Table 2. Questionnaire results for groups of factors

Group	Percentage of points scored	Weights = (39 x %)/100	Final score in each group of factors
Animals	30	11.70	0–12
Submerged anthropogenic objects	22	8.58	0–9
Natural obstacles	19	7.41	0–7
Plants	19	7.41	0–7
Shape and appearance of the lake bed	10	3.90	0–4

Source: own elaboration.

Development of the point valuation method

The point valuation table describing the influence of individual components on the aesthetic appeal of the underwater landscape of lakes was developed on the assumption that the maximum score was equal to the number of all observable components

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(or the lack thereof, which also influences sight-aesthetic perception). A total of 39 components were assessed in the survey, and the rating scale ranged from zero to 39 points. The maximum total score was distributed according to the percentages obtained (rounded up to 1%) in each group. It was also assumed that the group with the smallest number of components (Natural obstacles – group 3) would be the determinant. Theoretically, all three components in this group (trees, plants, and boulders) could be sighted underwater. In other groups, more than three components are unlikely or impossible to be sighted.

In group 1 (Animals), four components (fish, crayfish, snails, insects) can be observed simultaneously, although such sightings are rare because visibility tends to be low in lakes. Therefore, it was assumed that three group 1 components would denote maximum diversity during a single observation. The fifth component in group 1 was the absence of animals, which automatically excludes any diversity. In group 2 there were 14 components to choose from, including the absence of anthropogenic objects. Therefore, all 13 components could not be observed simultaneously. However, three components could be sighted during the same observation if visibility was good. The same maximum number of sightings was adopted in group 3 (least numerous). Group 4 (Plants) contained eight components, and they could be missing at the observation site. It was assumed that more than three group 4 components could not be observed simultaneously. Furthermore, only three components could be sighted simultaneously in specific plant assemblages. Group 5 (shape of the lake bed) contained eight components – bed types, and they were regarded as least influential. More than one bed type can be observed only along the boundary of two or three different lake bed types. These are special cases, but they are theoretically possible.

In the next stage, the point valuation table was developed based on the number of points scored by each group of factors.

Group 1 – Animals

The maximum score in group 1 was 12 points. The maximum score was distributed equally based on the percentage of indications for each component. The results were rounded up to the nearest integer. Aquatic insects received the lowest rating as a component that exerted the most negative impact on visual perceptions, and the corresponding score was reduced to 0 points. At the same time, fish received an additional point as the highest rated component (Table 3).

Group 2 – Submerged anthropogenic objects

In group 2, the answers were distributed more evenly due to the high number of components (14), their similarity, and their functions during underwater observation. Divers looked for objects that were unusual in the natural environment. Foreign objects incorporated in the aquatic environment can form interesting structures, but they can be identified only if these objects have been submerged for a long time.

Table 3. Point valuation in group 1 – Animals

Component	Percentage of points scored	Percentage of indications after rounding	Weight x %	Score	Final score*
Fish	36.21	36	12 x 0.36	4.32	5
Crayfish	30.72	31	12 x 0.31	3.72	4
Snails (mussels)	19.18	19	12 x 0.19	2.28	2
None	7.64	8	12 x 0.08	0.96	1
Insects	6.26	6	12 x 0.06	0.72	0

* The total score cannot exceed 12 points.
Source: own elaboration.

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Most of these structures are not environmentally friendly, but from the point of view of scenic attractiveness, they could be an interesting feature of the diving programme. Based on the adopted assumptions, the total score of all group 2 components could not exceed nine points, and up to three components could be sighted simultaneously. The final scores are presented in Table 4. To obtain the maximum score, group 2 components had to be arranged in a somewhat different way than group 1 components. Group 2 was large, and percentages were not used. Three subgroups were created based on questionnaire results and significant differences between subgroups. Each component received three points in the first subgroup, two points in the second subgroup, and one point in the third subgroup. The last item (absence of anthropogenic objects) received 0 points.

Group 3 – Natural obstacles

The scoring procedure in group 3 was similar to that applied in group 1. The maximum score was seven points, and all of the listed obstacles could be observed simultaneously. The final scores are shown in Table 5.

Table 4. Point valuation in group 2 – Submerged anthropogenic objects

Component	Percentage of points scored	Percentage of indications after rounding	Subgroups	Final score*
Wooden boat	11.47	11	subgroup 1	3
Metal boat	9.55	10		3
Obstacle made of wood	9.24	9		3
Platform	9.00	9		3
Car	8.85	9		3
Fixed rope	8.08	8	subgroup 2	2
Deck	7.96	8		2
Plastic boat	7.49	7		2
Anchor line	7.20	7		2
Information board	7.20	7		2
Obstacle made of plastic	4.60	5	subgroup 3	1
Fishing equipment	3.35	3		1
Obstacle made of tyres	3.18	3		1
None	2.84	3	subgroup 4	0

* The total score cannot exceed 9 points.
Source: own elaboration.

Table 5. Point valuation in group 3 – Natural obstacles

Component	Percentage of points scored	Percentage of indications after rounding	Weight x %	Score	Final score
Trees	39.83	40	7 x 0.40	2.80	3
Plants	34.19	34	7 x 0.34	2.38	2
Boulders	25.98	26	7 x 0.26	1.82	2
None	0	0	0	0	0

Source: own elaboration.

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Group 4 – Plants

Similarly to group 2, group 4 contained many components, and was divided into subgroups. The maximum score was seven points. Four subgroups were created to account for significant differences in diver responses (Table 6). The fourth subgroup contained components which, according to most respondents, significantly detracted from positive aesthetic experience. The division was based on clear percentage breaks between landscape components. It should also be noted that the absence of vegetation can be a significant asset when observing the underwater world. Divers can focus on other landscape components that may not be visible in the presence of dense vegetation cover.

Group 5 – Shape and appearance of the lake bed

The maximum score in group 5 was four points. Group 5 components were also divided into four subgroups. Similarly to groups 2 and 4, subgroups were created based on significant differences in diver responses (Table 7).

The final aggregate score in the assessment of the sight-aesthetic value of the underwater landscapes of lakes is presented in Table 8. The final score was used to assess each grid square in the lake. In addition, the point valuation scale was divided proportionally into five attractiveness categories to differentiate the results and present their spatial distribution on a map.

Table 6. Point valuation in group 4 – Plants

Component	Percentage of points scored	Percentage of indications after rounding	Subgroups	Final score*
Compact meadows of *Charophyte* algae, 0.5 m in height	23.36	24	subgroup 1	4
None	16.09	16	subgroup 2	3
Single plants	15.07	15		3
Rushes	14.98	15		3
Plant assemblages	11.97	12		3
Underwater meadows, 1.5–2.0 m in height	7.88	8	subgroup 3	1
Plants reaching the surface	5.44	5	subgroup 4	0
Filamentous algae	5.22	5		0

* The total score cannot exceed 7 points.
Source: own elaboration.

Table 7. Point valuation in Group 5 – Shape and appearance of the lake bed

Component	Percentage of points scored	Percentage of indications after rounding	Subgroups	Final score*
Submerged cliffs/walls	19.01	19	subgroup 1	4
Boulders	17.07	17		4
Slope	14.96	15	subgroup 2	2
Hilly	14.76	15		2
Rocky	14.01	14		2
Sandy	10.00	10	subgroup 3	1
Flat	8.97	9		1
Muddy	1.21	1	subgroup 4	0

* The total score cannot exceed 4 points.
Source: own elaboration.

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Table 8. Point valuation and categorisation of the sight-aesthetic value of the underwater landscapes of lakes

Groups of factors	Component	Score	Notes	Point scale in groups
1	2	3	4	5
Animals	fish	5	the total score cannot exceed 12 points	0–12 points
	crayfish	4		
	snails (mussels)	2		
	none	1		
	insects	0		
Submerged anthropogenic objects	wooden boat	3	the total score cannot exceed 9 points	0–9 points
	metal boat	3		
	obstacle made of wood	3		
	platform	3		
	car	3		
	fixed rope	2		
	deck	2		
	plastic boat	2		
	anchor line	2		
	information board	2		
	obstacle made of plastic	1		
	fishing equipment	1		
	obstacle made of tyres	1		
	none	0		
Natural obstacles	trees	3	the total score cannot exceed 7 points	0–7 points
	plants	2		
	boulders	2		
	none	0		
Plants	compact meadows of *Charophyte* algae, 0.5 m in height	4	the total score cannot exceed 7 points	0–7 points
	none	3		
	single plants	3		
	rushes	3		
	plant assemblages	3		
	underwater meadows, 1.5-2.0 m in height	1		
	plants reaching the surface	0		
	filamentous algae	0		
Shape and appearance of the bottom	submerged cliffs/walls	4	the total score cannot exceed 4 points	0–4 points
	boulders	4		
	slope	2		
	hilly	2		
	rocky	2		
	sandy	1		
	flat	1		
	muddy	0		
Point scale in the proposed method – 0–39				

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cont. Table 8

1	2	3	4	5
Categories of the sight-aesthetic value of the underwater landscapes of lakes: category I (highly attractive landscapes) – 32–39 points category II (attractive landscapes) – 24–31 points category III (neutral landscapes) – 16–23 points category IV (unattractive landscapes) – 8–15 points category V (highly unattractive landscapes) – 0–7 points				

Source: own elaboration.

Implementation of the proposed method in the test site

In the study, the developed point valuation method for the sight-aesthetic assessment of the underwater landscapes of lakes was applied during the underwater inventory. The inventory was conducted by four experienced divers operating high-class underwater survey equipment. The assessment was performed in a grid of squares in Lake Muliczne in Wigry National Park in north-eastern Poland. The lake has an area of 25.7 ha, maximum depth of 11.3 m, and average depth of 4.7 m. Lake Muliczne has the highest conservation status because it is situated in a national park, features diverse habitats and microhabitats, and has high scenic value (Choiński, 2006). The lake and the grid of primary fields where direct measurements were performed are presented in Figure 1.

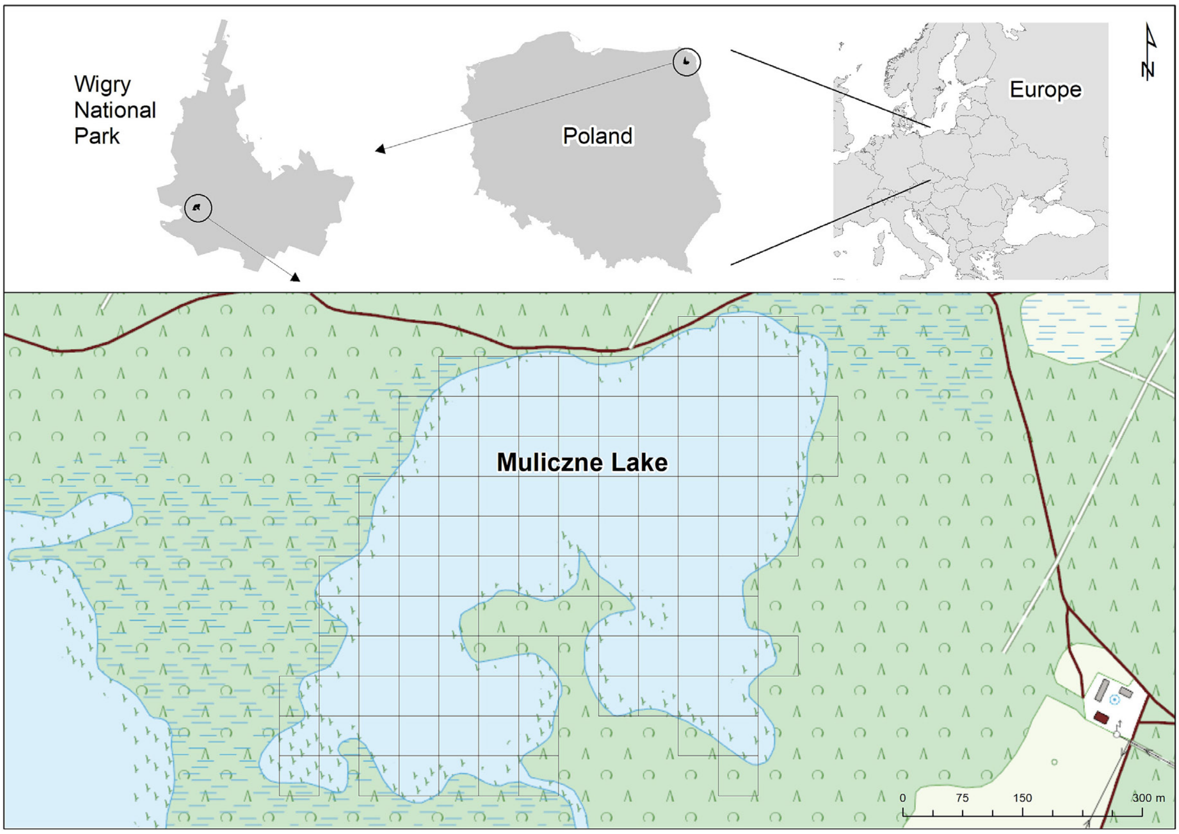

Fig. 1. Map of Lake Muliczne with the survey grid
Source: own elaboration.

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A map of the sight-aesthetic value of the studied lake, divided into five attractiveness categories, is presented in Figure 2. Measurements were conducted at 116 points (corresponding to grid squares – primary fields). The results are presented with graduated colours. The highest score was obtained in category III. The distribution of values in each of the four groups presented in the point valuation table is shown in Figures 3–6. In each primary field, the scores are presented in graduated colours based on the values obtained during underwater measurements. Submerged anthropogenic objects were not sighted in Lake Muliczne, and the relevant scores were not distributed. From the point of view of tourist exploration, these objects constitute an attraction for divers. However, Lake Muliczne is located in Wigry National Park and has the highest conservation status, which could explain the absence of submerged anthropogenic objects. The above observation is confirmed by the results in Figure 2. The highest scores were noted in category II (three primary fields) due to the absence of objects that are attractive for underwater observers. Most primary fields were assigned to the lowest attractiveness category (V).

In the group of factors (Animals) that made the greatest contribution to scenic attractiveness, the highest score was seven points, and it was noted sporadically (Fig. 3). A certain percentage of grid squares received a score of five points. However, no animals were observed in most fields, which confirms that the sight-aesthetic value of these sites was generally low for divers looking for tourist attractions.

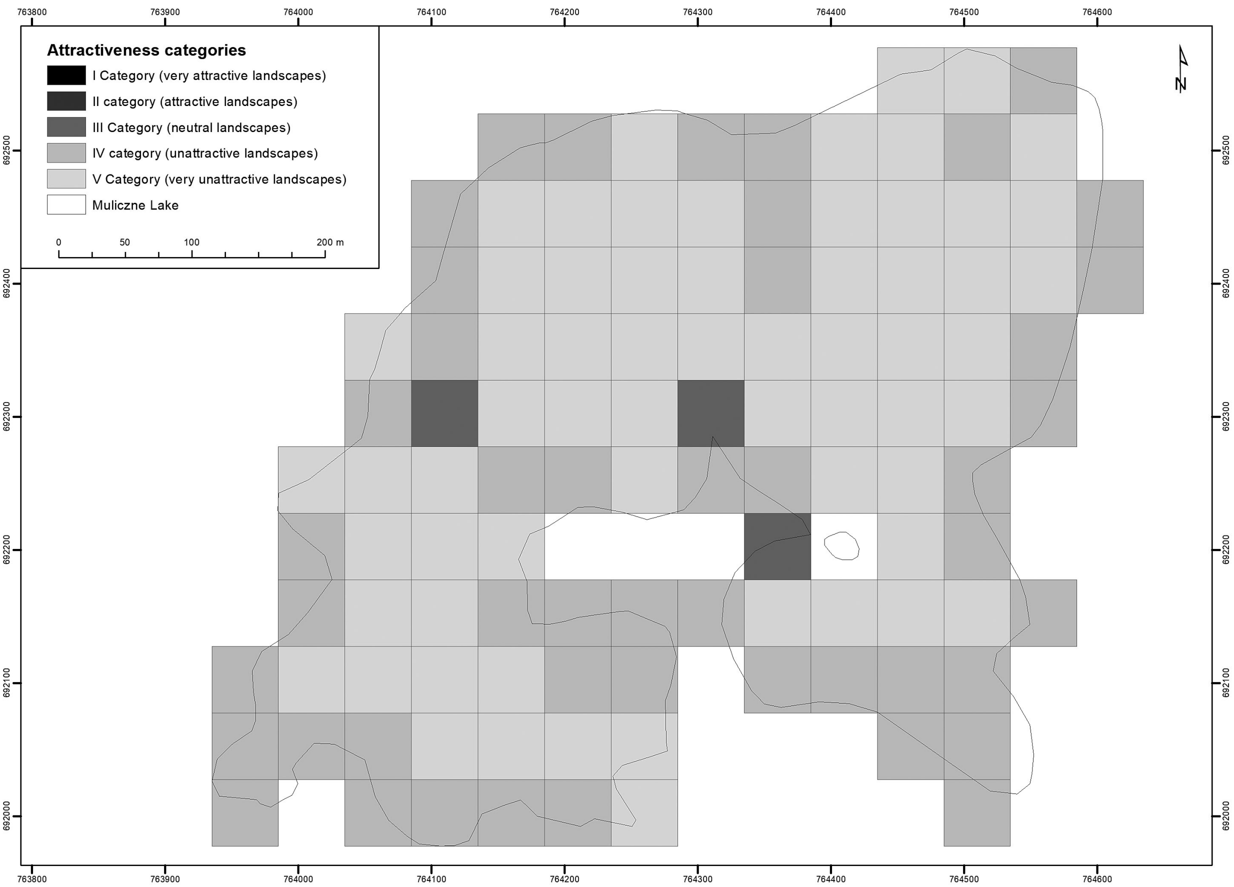

Fig. 2. A map of sight-aesthetic value of the underwater landscape of Lake Muliczne
Source: own elaboration.

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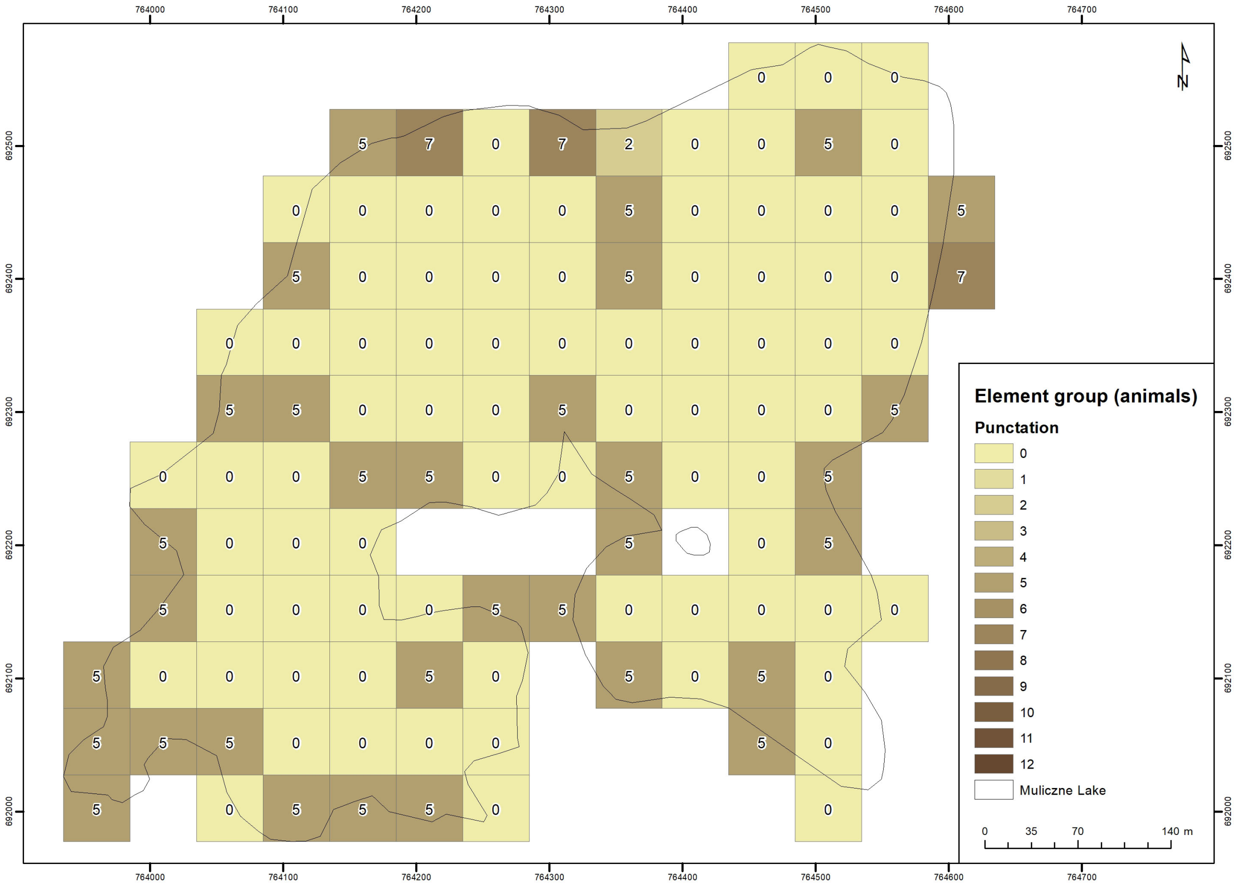

Fig. 3. Distribution of scores in group 1 – Animals
Source: own elaboration.

In group 3, natural obstacles were observed mainly along lake boundaries. The highest score was five points (Fig. 4). Similarly to group 1 (Animals), most primary fields were free of natural obstacles.

Vegetation in Lake Muliczne was also distributed mainly along the boundaries. None of the primary fields received 0 points, which could be attributed to the respondents' preferences. In addition to attractive vegetation, the surveyed divers had a preference for areas without vegetation which facilitate observations of other groups of underwater landscape components. Most grid squares in the central part of the lake were devoid of vegetation, as expressed by the corresponding scores. Unlike in the previous groups, the maximum score in group 3 was seven points (Fig. 5).

An analysis of group 4 factors revealed only minor formations on the lake bed. Muddy formations were often identified, and sandy formations were observed in the littoral zone. None of the fields received the maximum score, and scores were evenly distributed. More distinct formations were noted in the littoral zone of the studied lake (Fig. 6).

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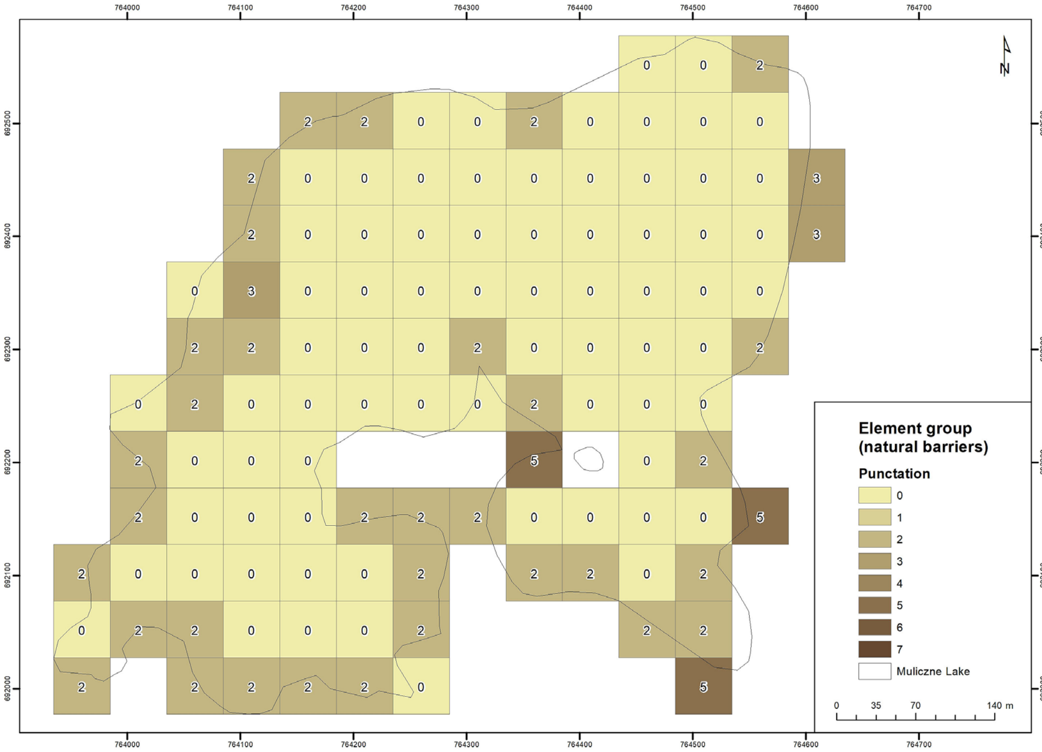

Fig. 4. Distribution of scores in group 3 – Natural obstacles
Source: own elaboration.

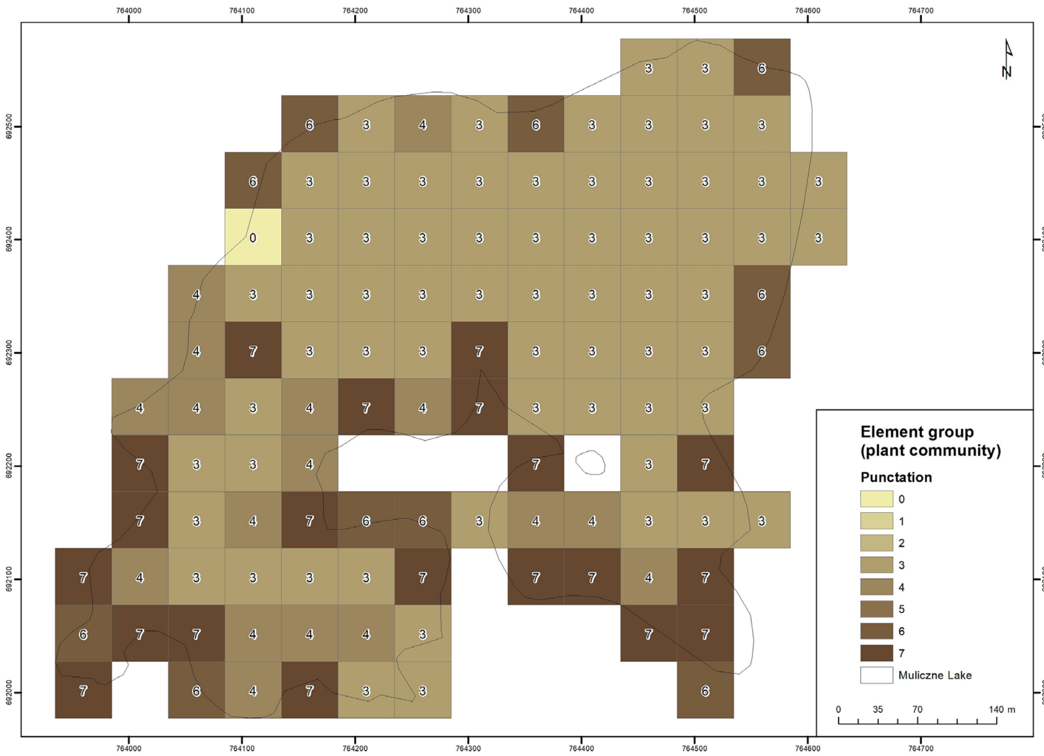

Fig. 5. Distribution of scores in group 4 – Plants
Source: own elaboration.

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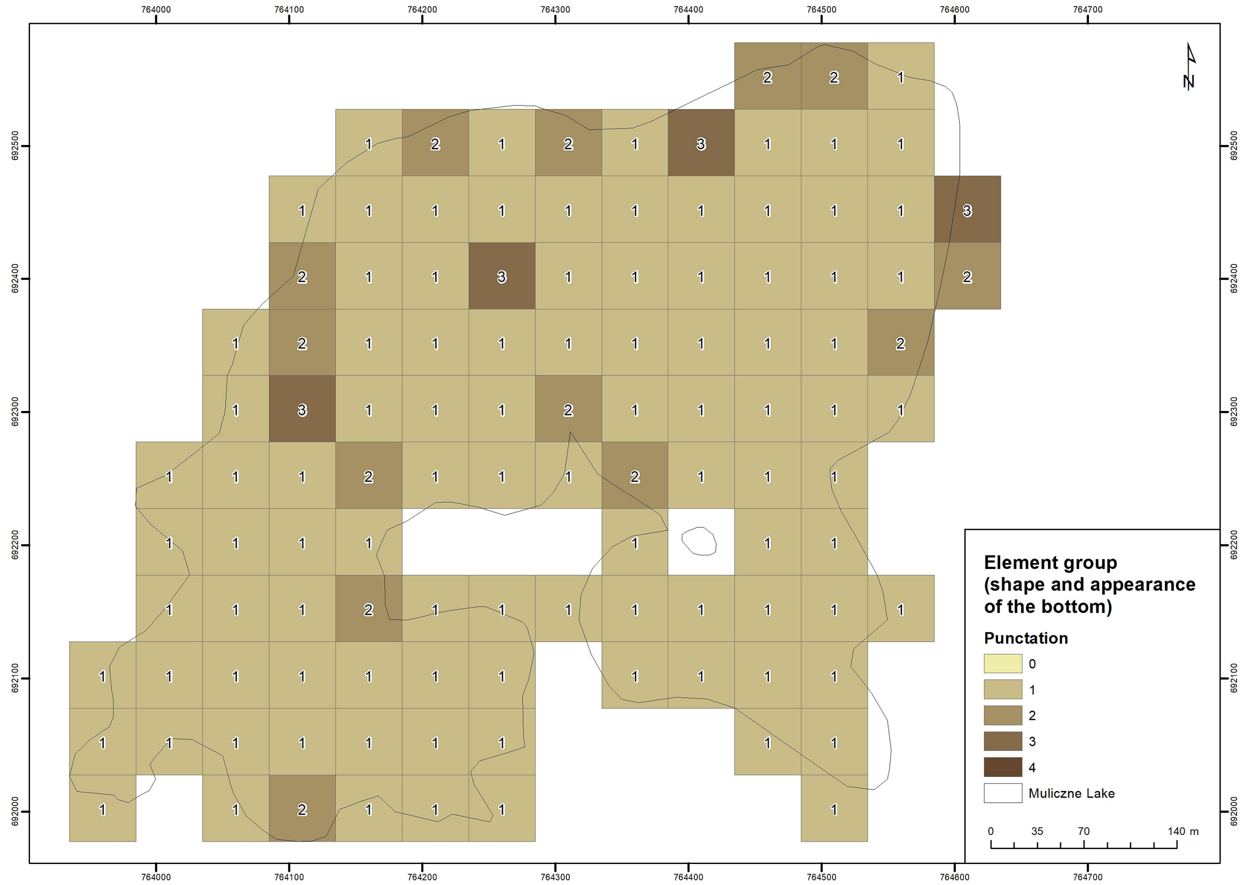

Fig. 6. Distribution of scores in group 5 – Shape and appearance of the lake bed
Source: own preparation.

DISCUSSION

The developed method for assessing sight-aesthetic value was tested on a lake. The results were significant and comparable with those reported in studies of terrestrial landscapes. A similar methodology has been used in many studies evaluating landscape aesthetics. Most of these studies focused on the beauty of the surroundings, attractiveness of natural assets, and the composition of landscape elements. Three main approaches to evaluating landscape attractiveness can be identified. The first approach evaluates the physical characteristics of space and its ability to fulfil specific functions. In the second approach, scenic preferences are identified based on aesthetic characteristics. The third approach evaluates the impact of environmental features on the market value of space (Ellis et al., 2006; Kim & Kaplan, 2004; Wojciechowski, 1994). The proposed methodology makes a reference to landscape assessment methods that involve field surveys, including the Söhngen method, Wejchert Impression Curve, and the criteria for evaluating the visual amenity value of landscape (Senetra & Cieślak, 2004).

The obtained results confirm the observations made by divers during the questionnaire surveys. Lake Muliczne is characterised by relatively low visual attractiveness for tourist exploration. The lake is located in a national park and has the highest conservation status, which implies that it is free of anthropogenic objects that constitute an attraction in special interest tourism. Objects such as boats,

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cars, or tyres are absent due to the limited use and low tourist traffic in such areas. The absence of waste pollution contributes to the ecological value of a water body, but the present study examined the lake's appeal for divers.

The proposed methodology is innovative and forward-looking, but the study had certain limitations. Assessments of aesthetic value should be performed in conditions that enable divers to clearly identify the components of the underwater world. Visibility is significantly limited in lakes, and it is determined not only by the type of lake and water purity, but also by the local environment which generates various types and quantities of pollutants. Field surveys are also limited by the seasons. Despite the above, this pioneering study has important implications for future research. Modern navigation systems and technologies which support rapid and automatic data collection can be implemented in these types of studies to promote the further development of research on the sight-aesthetic assessment of the underwater landscapes of lakes.

CONCLUSIONS

A list of factors and components that influence the sight-aesthetic value of inland bodies of water was developed for the needs of the questionnaire survey. The validity of the proposed methodology was confirmed on a very large sample of 400 respondents who were active divers with different levels of experience. The direct comparison method was used in the survey to deliver reliable results. This method has been used extensively in studies of terrestrial landscapes.

The proposed methodology was applied to develop maps of the sight-aesthetic value of the underwater landscapes of lakes which can be used in the process of channelling tourist traffic. Such maps can be used not only to protect the most valuable aquatic ecosystems, but also to generate information for tourist guides for divers.

The methodology for assessing the underwater landscapes of lakes delivered the expected results. Scenic attributes are one of the most important considerations in tourist exploration, as confirmed by studies that involve direct observation. Scuba divers have a preference for water bodies characterised by an abundance of animals, as well as anthropogenic objects that take on attractive forms over the years and become landscape features. The results obtained in Lake Muliczne confirm these observations. The studied lake is generally free of anthropogenic objects, and is not visually attractive for divers from the point of view of tourist exploration.

Author contributions: author/authors have given approval to the final version of the article. Authors contributed to this work as follows: A.S. developed the concept and designed the study; A.Ź.-S. & P.D. collected the data; A.S., A.Ź.-S., P.D., & M.C. analysed and interpreted the data; A.Ź.-S., P.D., & M.C. prepared draft of article; A.S. & M.C. revised the article critically for important intellectual content.

Funding: The research grant was funded by the National Science Centre, Poland. Agreement number: 2020/37/B/HS4/00231. Project title: The concept of evaluating the sight-aesthetic attractiveness of underwater landscapes of lakes in the context of tourist exploration.

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