A STUDY OF PEOPLE'S PREFERENCES OF THE ENVIRONMENTAL STATUS OF LAKE HARKU AND THE BENEFITS OFFERED BY THE LAKE AND ITS SURROUNDINGS

Tea Nõmmann[1] Üllas Ehrlich[2] and Sirje Pädam[3]
Tallinn University of Technology and WSP

Abstract

The article examines the demand of people for the improvement of the condition Lake Harku. Lake Harku is located in a densely populated area on the border of the city of Tallinn and it is in a poor state as a water body according to the EU classification. Two stated preference methods, contingent valuation (CV) and choice experiment (CE), were used for assessing the monetary value people place on the improvement of the ecosystem services of the lake as non-market environmental goods. The results of the work confirmed there is significant willingness to pay for the improvement of the condition of the water body. From a methodological point of view, an important finding is that the CV method yielded lower result than the estimated payment option of the CE.

Keywords: Willingness to pay, contingent valuation, discrete choice experiment, lake ecosystem services

JEL Classification Codes: D6; Q5; Q25; Q26; Q51; Q58;

1. Introduction

Lake Harku is located in Haabersti district in Tallinn, only 3 km away from the sea. The area of Lake Harku is 162.9 hectares and it is a shallow lake with an average depth of 1.6 meters and a maximum depth of 2.5 meters. The lake has low shores and a muddy bottom. The lake basin is over 50 km^2. Harku, Soone and Järve streams flow into the lake and Tiskre stream flows out of the lake and to the Baltic sea at Kakumäe Bay. There are springs on the southwestern side of the lake.

Lake Harku is affected by eutrophication, i.e. it contains high levels of nutrients and during the vegetation period micro-algae bloom. Therefore, the transparency of the lake water is one of the smallest of Estonian water bodies – only 20 cm. The water status is very poor in terms of the nutrient content. However, the quality of the bathing water in Lake Harku is rated as generally good according to the Health Board's view. However, in the summer, blue algae tend to grow, which can cause toxins in the water and result in

[1] Tea Nõmmann, PhD candidate, tea.nommann@gmail.com, Tallinn School of Economics and Business Administration, Tallinn University of Technology Akadeemia tee 3, EE-12618 Tallinn, Estonia.
[2] Üllas Ehrlich, PhD, Professor, ullas.ehrlich@ttu.ee, Tallinn School of Economics and Business Administration, Tallinn University of Technology Akadeemia tee 3, EE-12618 Tallinn, Estonia.
[3] Sirje Pädam, PhD, researcher, sirje.padam@wsp.com, WSP Sverige AB, SE-121 88 Stockholm, Sweden

health problems. Incidents of massive blooming of blue algae occur almost every year, during the bathing season, mainly in July or August. Although Lake Harku is popular among recreational fishermen, the proportion of predatory fish in this lake is lower than the average, while the abundance of non-predatory fish (feeding on plants, decomposed organic remains or small invertebrates) is very high.

Although the environmental conditions of Lake Harku is poor according to several indicators, and bathing is often hazardous to people in the summer due to cyanobacteria, the lake and its surroundings are popular recreational areas used by bathers, tanners, sailors, wind surfers, rowers, fishermen and water motorists. During the peak season, the number of people visiting the beach is about 500-800 people a day. The beach has been overloaded periodically.

The purpose of the study is to test two methodologies for assessing people's willingness to pay to improve the benefits (ecosystem services) offered by Lake Harku. To the authors' knowledge this is the first time these two methods are applied simultaneously in Estonia.

The authors formulated two working hypotheses:
1) people have a demand for the improving the environmental condition of Lake Harku and this is reflected in considerable willingness to pay;
2) the two stated preference methods for estimating the willingness to pay, contingent valuation and choice experiment, will give similar results.

In the next section of the paper the authors present methods for measuring non-market values and provide details of the survey. After that, in Section 3, the authors report on the survey results. First general results are accounted for, followed by the results of the contingent valuation survey and the results of the choice experiment. Section 4 concludes the study.

2. Measuring the value of non-market goods

Value, according to economic theory, relates to the benefits individuals derive from goods and services. In a market setting, the choices individuals make reflect their preferences and concerns. When individuals make a choice in relation to what to buy, they appraise the benefits they will receive from a particular choice. The value is what an individual is willing and able to sacrifice for the good or service (Field and Field 2013). According to welfare economics, the maximum willingness to pay (WTP) for an additional unit of a good or service reflects the benefits to the individual. However, when goods and services are not subject to market transactions and they can be enjoyed for free, e.g. bird watching or swimming in a lake, other methods than observing market transactions need to be adopted in order to reveal individual preferences (Hanley and Barbier, 2009, Field and Field 2013). Lake ecosystems are non-market goods which provide benefits for free, but low environmental quality affects people's experience. Algae blooms could imply loss of recreation benefits and damage to biodiversity could reduce existence value. Existence value is a non-use value, sometimes called passive use value, and is based on Krutilla (1967) who suggested that people receive utility from

ecosystem services just because they exist. Considering the very poor status of Lake Harku, it is expected that both use value and non-use value affect people's preferences for improving the status of the lake ecosystem services. For the purpose of environmental valuation, stated preference methods are often preferred for their potential to include both use value and non-use values when estimating the monetary value of non-market environmental goods (Brown 2003). The justification for valuing ecosystem services in monetary terms is to provide information to decision-makers as basis for policy choices.

In this study, people's willingness to pay for the ecosystem services of Lake Harku were assessed using two stated preference methods: a contingent valuation survey and a discrete choice experiment. Both methods estimate people's willingness-to-pay (WTP) using survey questions. The contingent valuation (CV) method assesses the willingness of individuals to make payments for some specified improvement of the environmental status. The discrete choice experiment (CE) asks respondents to indicate their preferences based on improvement of selected attributes of ecosystem services. While CV focuses on the value people place on a specific improvement, CE focuses on how individuals choose between improvement of specified characteristics. Interest in CE has grown in recent decades, partly influenced by the critique that was raised during the CV-debate in the 1990's (Boyle, 2003), partly because the choices in CE are similar to those people do in markets (Holmes et al., 2017). Another advantage of CE over CV is that smaller sample sizes are needed (ibid).

Internationally, the first studies that compared CV to CE in the field of environmental economics were published about 25 years ago. In their literary review, which summarises 26 studies that test the convergence of the value estimates of CV versus CE studies, Lloyd-Smith (2018) and his co-authors, find that studies either find that CE provides larger or similar value estimates as CV. Only one of the studies they refer to found that the value estimate of the CV study was significantly larger than that of the CE (ibid). However, Lloyd-Smith et al. (2018) note that the mixed evidence could be due to the fact that the CV versus CE surveys differ in several dimensions. There are, e.g. generally more questions in the CE format; from four to sixteen, while the CV format usually asks only one question. The econometric models for data analysis differ and so do the number of attributes. In their controlled experiment they test how the information format (text versus table) and the time used for making a choice affects the willingness to pay estimate. The text format represents how information is provided in CV surveys and the table format how information is presented in CE surveys. They find that values (WTP) are not affected by the information format, but when information is presented in text this requires more time from respondents to make a choice. Although their experiment does not provide an answer whether to expect higher, lower or similar values from the two methods, the results of Lloyd-Smith et al (2018) indicate that the format of the survey question probably does not affect the WTP estimate.

2.1. Survey questionnaire

The questionnaire consisted of six parts, in total 38 questions. In the first part, questions were included about people's use of Lake Harku, i.e. how and how often they visit the lake in the winter and summer time and how far they live from the lake. In the second

part, respondents were asked about the importance of the ecosystem services (benefits) offered by Lake Harku and its surroundings. In the third part, the environmental status of Lake Harku was briefly described and people's attitudes were studied in this regard. The fourth part of the survey compiled the respondents' assessments of their willingness to pay, using the contingent valuation method. This part of the questionnaire is discussed in more detail in Section 2.2. In the fifth part, respondents' estimates of their willingness to pay were collected using choice experiments. In Section 2.3. this part of the questionnaire is discussed more closely. In the sixth part, respondents were asked general questions about their marital status, income, education, and other demographic characteristics, which are reported in Section 2.4.

In the survey questionnaire, the same set of attributes of the environmental status were applied to the CV and the CE questions. The indicators were derived from the Estonian Water Act (RT I 1994, 40,655) and a list of lake ecosystem services.

The state of Lake Harku was described with the help of the following three indicators:

- Transparency of the lake water (turbidity of the water)
- Bathing water quality (blue-green algae)
- Species composition of fish (scarcity of predatory fish)

Although the Water Act, provides quality assessments distributed on the scale very good, good, poor, bad and very bad, this study used three levels of water quality: good (good and very good), poor (poor) and bad (bad and very bad) for simplification purposes (see more specifically Table 1.)

Table 1. Lake Harku water quality classes through the three indicators used in the survey.

Lake water quality	Good	Poor	Bad
Water transparency	Clear, visibility more than 130 cm.	Slightly turbid, visibility 20-130 cm.	Very turbid, visibility 20 cm.
Bathing water	Blue algae blooming once every 10 years.	Blue algae blooming once every third year.	Blue algae blooming every year.
Species composition of fish	Predatory fish >33%, Non-predatory <67 %.	Predatory fish 18-32%, Non-predatory 68-82%.	Predatory fish <17%, Non-predatory >83 %.

The current environmental status of Lake Harku is characterized by eutrophication because of an excessive amount of nutrients and blooming micro-algae. For this reason, the clarity of the lake water is one of the smallest in Estonian water bodies - only 20 cm. The water quality is very poor in terms of nutrient content. However, the quality of bathing water in Lake Harku is generally good according to the Health Board. However, in the summer, blue algae tend to bloom, which can generate toxins and cause health problems. Blue algae are blooming at least once a year during the bathing season, mainly

in July or August. The species composition of Lake Harku is characterized by a very low proportion of predatory fish and a very high abundance of non-predatory fish (fish that feed on plants, decomposed organic matter or small invertebrates).

2.2. Contingent valuation

In the survey, the contingent valuation method was applied in order to determine how much people are willing to pay for improving the environmental quality of Lake Harku from bad to poor and from poor to good status. This means that every respondent was asked two questions about their WTP. Two scenarios and the associated environmental status of the lake were described in text and shown in pictures. The lake water indicators (see Table 1) of water turbidity and algal blooms were connected to recreational activities and the species composition of fish was connected to recreational fishing. In the first scenario, the water quality would improve from the current bad status to poor and in the second scenario the lake would improve from bad to good status (see Table 2).

Table 2. The connection between the environmental characteristics of Lake Harku and recreational benefits at different levels of Lake status.

Lake status	Bad	Poor	Good
Water quality, recreational and sports facilities on lake shores.	Water very turbid, visibility 20 cm, algae bloom every summer, bathing not recommended, recreation unpleasant.	Water slightly turbid, visibility 20-130 cm, algae bloom every three years, bathing occasionally undesirable, recreation potential but poor reputation.	Water visibility more than 130 cm, Blue algae blooming once every 10 years, bathing always possible, high recreational value.
Fish species compositions/ recreational fishing	Mainly mud fish on fishing rod. Predatory fish <17%, Non-predatory >83 %.	Perch sometimes on fishing rod. Predatory fish 18−32%, Non-predatory 68−82%	Fishing is enjoyable. Predatory fish >33%, Non-predatory <67 %.

For both scenarios, respondents were asked how much they would be willing to pay as an additional payment, to finance the improvements needed to be undertaken. Fees were provided in advance (5 €, 10 €, 15 €, 20 €, 25 €, 30 €, 35 €, 40 €, 45 €, and € 50). For each fee on the payment card, respondents could choose between the options "I would definitely pay", "I might pay" and "I certainly would not pay". The respondents were informed that the payment scheme for the fee had not yet been designed.

2.3. Choice experiment

The choice experiment was put together by presenting the water quality recreation levels and recreational fishing potentials. In order to obtain the trade-offs of the choice

experiments, respondents were asked to solve six different choice tasks (see sample trade-off questions in Table 3) describing alternative options at which level Lake Harku ecosystem benefits could be used and what would be the additional annual payment that respondents would have to pay. The selected tasks were similar, but they differed in the levels of three indicators (attributes). NGENE software was used to create alternative statistically efficient design options (Holmes et al., 2017). To enhance the quality of the results of the selection tasks, the questionnaire used two orderings of tasks. One set of questionnaires began with one task and continued with the second. The other set of questionnaires used the reversed ordering of choice tasks. The use of different sets of choice tasks reduces the risk of ordering bias occurring in response to, for example, the respondent's potential fatigue.

Table 3. Sample task.

Indicator	Variant A	Variant B	Status Quo
Water quality, recreational and sports facilities on lake shores.	Good	Poor	Bad
Species composition of fish and recreational fishing	Poor	Poor	Bad
Your annual fee	€ 20	€ 10	€ 0
Your choice	1	2	3

The indicators used in the selected tasks were the benefits offered by the Lake Harku ecosystem services, the ability to provide them to the population was characterized by the environmental conditions and an annual remuneration for better benefits. Thus, one of the indicators was the recreational and sporting opportunities on the shores of the lake, characterized by water quality (water turbidity and algal blooms) and the second indicator was recreational fishing characterized by the species composition of fish (see Table 3). The third indicator was the annual payment that the respondent would pay for each alternative. The choice "Status quo" would not lead to additional costs for the inhabitants, but in such a case society would not be able to fund the improvement of the condition of the lake and the state of the lake could deteriorate.

2.4. Sampling

Data on people's willingness to pay were collected in all districts of Tallinn, in the western municipalities of Harju County and among the inhabitants of the three cities of Harju County. The questions of both the CV and the CE format were presented in one common questionnaire. A sample of 401 people were selected in such a way as to ensure the representation of the inhabitants in Harju County. The sample was selected on the basis of the population of local governments (the 11 western municipalities of Harju County and Tallinn) aged 18-74. According to the Statistical Office of Estonia, there were 433,014 people living in this territory in 2015.

The survey was conducted by internet polling in July-August 2015. The survey was conducted in two sections (200 + 201 respondents). After the first 200 responses, the

survey was stopped and the alternatives for the six choice experiment tasks were changed (choice experiment tasks) using a new design. In other respect, the questionnaires were identical in two sections. A total of 401 people responded to the survey, most of whom (89%) were Tallinn. Of these, 54% were women and 46% were men. A more detailed breakdown for different demographic characteristics is presented in Table 4.

Table 4. Socio-economic characteristics of the respondents

		Percentage of responses	Number of respondents
Gender	Male	46%	186
	Female	54%	215
Education	Primary	0%	0
	Secondary	1%	6
	Secondary technical	20%	82
	Higher	22%	87
Age	18-24	11%	45
	25-34	23%	93
	35-44	20%	81
	45-54	16%	66
	55-64	17%	67
	65-74	12%	49
Average monthly income (net), €	299 or less	6%	25
	300-499	14%	55
	500-699	13%	52
	700-899	14%	56
	900-1099	13%	53
	1100-1299	10%	39
	1300-1599	8%	33
	1600-1999	11%	43
	2000 or more	11%	45

3. Survey results

Various software including Excel, STATA, and NLOGIT were used to analyze the survey results.

3.1. General survey results

The survey showed that a total of 20% of the respondents did not come from the neighbourhood of Lake Harku, with 8% of the respondents specifying that they were visiting other waterbodies. 67% of respondents have been to Lake Harku at some point in time, and nearly a quarter of respondents have been to Lake Harku for the last year, the rest of the last three years or even earlier. 13% of the respondents do not go to the lake, but often pass by it. The visitors of the lake were also asked how often they are at the lake during the winter and summer periods. On average, it can be said that in the summer, 89 respondents visited the lake often, i.e. 4 times a week, and the remaining 85 respondents averaged 6 times throughout the summer. Over the winter period, out of the 90 respondents, 4 respondents visited very often, that is, several times a week, and the remaining 86 respondents averaged 4 times throughout the winter.

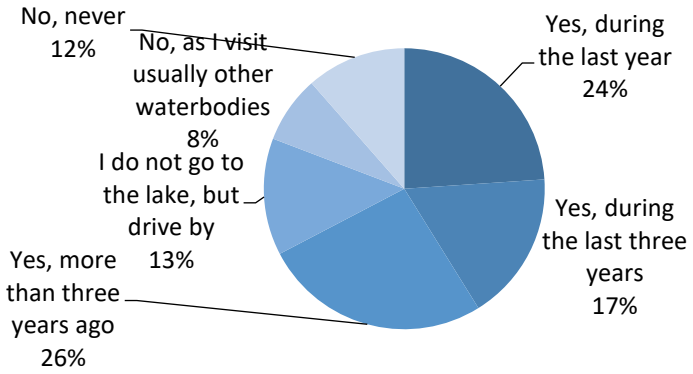

Figure 1. Visiting Harku Lake among the respondents

From ecosystem services of Lake Harku the following four services are considered to be the most important: 1) the opportunity to go swimming / bathing; 2) enjoy a beautiful natural view; 3) relax, sport and spend free time at the water; and 4) go for a sunbathing. These were considered very or rather important by over 80 % of the respondents. The least important services of the lake were stated the possibility of using reeds and, surprisingly, fishing opportunities, that was one of the services asked by the survey. It is possible that the sample was too small to capture the preferences or values of the recreational fishermen.

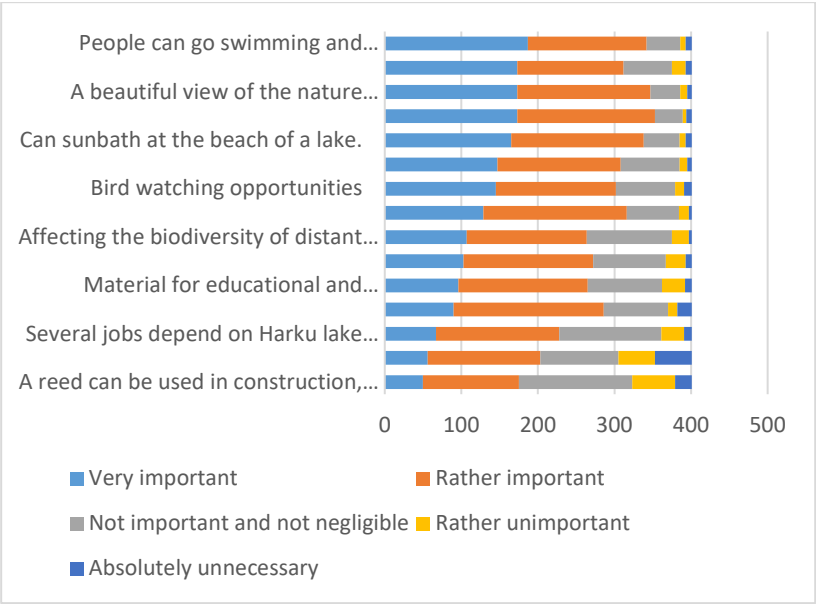

Figure 2. The importance of ecosystem services of Lake Harku by the respondents

The survey also examined people's knowledge of the state of the environment in Lake Harku. The surprising result was that, although a description of the current state of the environment in the Lake Harku was already outlined, 4% of the respondents said that the situation in Harku Lake was good. This may also have been due to the fact that although the water is unsuitable for bathing during the blooming of the blue algae, the Health Board assesses the water quality as good at other times. 37% of respondents thought that the situation in Lake Harku was poor and 30% rated it as bad. 29% of the respondents could not assess the condition of Lake Harku. In a separate assessment of the environmental indicators given in Table 1, about 70% of the respondents considered the bathing water quality, 54% water turbidity and 40% of the species composition of fish to be a very or rather serious problem.

3.2. Willingness to pay according to Contingent Valuation

The survey assessed the willingness of people to pay for a change in the status of Lake Harku in two different scenarios – (i) the improvement from the bad state to a poor state and (ii) improvement from the bad state to a good state (see Table 5). As expected, people agreed to pay more for improving the state of Lake Harku to a good level (Euro 15.22 per person per year). At the same time, it must be admitted that if people are willing to pay for the improvement from the bad state to poor state of the Lake Harku (Euro 13.34 per person per year), they are not willing to pay much more to improve it from poor state

to good state (just under Euro 2). Thus, based on the results of the study, it can be argued that although it is important for humans to have Harku Lake in a good condition, they did not express strongly their willingness to pay much more for this improvement. It may be difficult for the respondents to differentiate between the quality levels, or because of bad environmental status of the lake, the improvement from the bad to poor state is already being considered as an improvement. It cannot be ruled out that the relatively high willingness to pay for scenario (i) is due to the ordering effect (Bateman and Langford, 1997), since ordering was not controlled for in the CV survey. The ordering effect could thus imply that people are pay more attention to the first than to the second question.

Assuming that the size of the surveyed sample is reliable to describe the population of the territory of the study area, the total willingness to pay of the residents of Tallinn and 11 municipalities of Harjumaa participating in the survey is estimated to Euro 5.7 million (per annum) for the improvement of the state of the Lake Harku from bad to poor level. For a total of 2016–2020 for the survey period, this amount would be Euro 28 million. In order to improve the condition of Harku lake from poor to good state, the willingness to pay of the Tallinn and 11 municipalities of Harju County totalled 6.6 million euros a year, and for the period 2016–2020, a total is nearly 33 million euros.

Table 5. The willingness to pay of people, based on contingent valuation method

Scenarios	Willingness to pay Euro/person per year				Study area WTP Euro/year
	Average	Median	SD	95% CI	
(i) From bad to poor	13.12	10	13.62	[11.48-14.45]	5 681 143
(ii) from bad to good	15.09	10	15.19	[13.60-16.58]	6 534 181
Inhabitants (Tallinn and Harju county 11 municipalities)					433 014

In addition, the respondents were asked whether it is important for them for what type of improvement measures their payments would be used for. For 55% of the respondents, it was not important for what specific environmental improvements the money would be used for. The remaining 45% of respondents had a clear preference for how the funding should be used for. Of the 153 respondents, 86% of the respondents were in favour of cleaning the lake through comprehensive methods, such as removal and / or treatment of sludge, etc. The least important measures to use funds for were the reduction of the noise from water sports and supporting the introduction of predatory fish species into the lake.

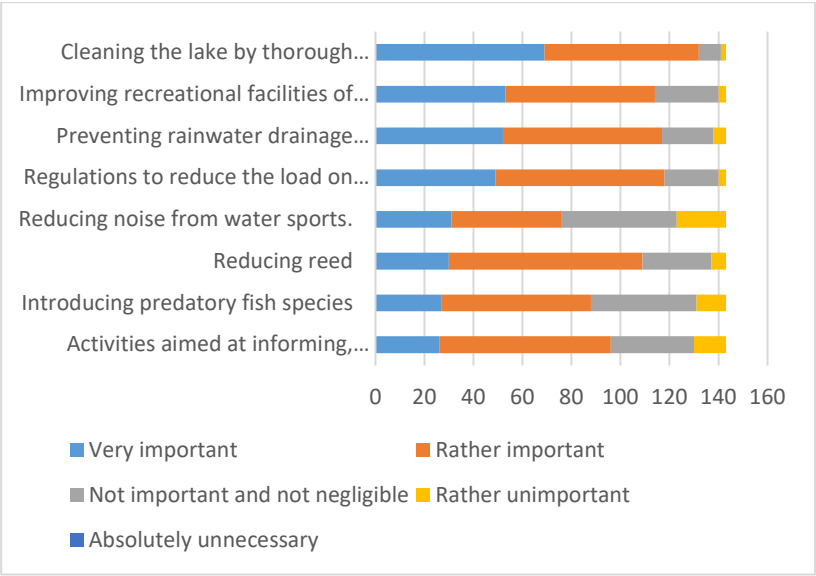

Figure 3. Respondent preferences for what the collected funds should be used for.

3.3. Relationships between variables

In the case of WTP, the possible relationships with the characteristics of the respondents were also examined. The variables that characterize the respondents were gender, income, education, distance from Lake Harku and whether the respondent had been to the lake or not. Of these variables, only the respondent's income was related to the willingness to pay, and whether he or she had been to Lake Harku.

Table 6. Relationships between variables in case of contingent valuation

Variable	Correlation coefficient (from bad to poor status)	Correlation coefficient (from bad to good status)
WTP and income	0.203 (p=0.0001)	0.189 (p=0.0001)
WTP and whether been /not been at Lake Harku	-0.086 (p=0.0852)	-0.117 (p=0.0196)

There is a positive correlation between income and the willingness to pay: people with higher incomes are willing to pay more for the improvement of the status of Lake Harku. At the same time, the link is not strong, the correlation coefficient value is approximately 0.2 for both improving to poor state and improving to good state. The relation between

the increase in the willingness of payment of people and their income is shown in Table 7).

Table 7. Average WTP of improvement of the lake from bad to good status by different income groups

Household monthly net income	Average WTP	95% Confidence Interval
Euro 499 or less	9.19	[6.74 ; 11.63]
Euro 500 – 899	15.23	[12.44 ; 18.02]
Euro 900 – 1599	17.32	[14.56 ; 20.08]
Euro 1600 or more	17.10	[13.55 ; 20.65]

It is also more likely that a person's WTP is higher if he or she has been to Lake Harku. In this case, the value of the correlation coefficient is negative (see Table 6), since Lake Harku survey questions are asked so that the first categories are those who have been to the lake (see Table 8). For example, those who have visited Lake Harku in the past year would be willing to pay an average of 16.98 euros for the improvement of the lake to the good status, but those who have never been to Lake Harku, have a WTP of 12.61 euros (see Table 8).

Table 8. The average WTP for improvement of the lake from bad to good status and visiting frequency

Have you been to Lake Harku?	Average WTP	95% Confidence Interval
Yes, over the past year (1)	16.98	[13.87; 20.09]
Yes, over the past three years (2)	16.67	[12.97; 20.36]
Yes, more than three years ago (3)	15.81	[12.66; 18.96]
I do not visit the lake, but often drive by the lake (4)	11.85	[8.29; 15.42]
No, because I usually go by other water bodies (5)	12.58	[7.82; 17.34]
No, never (6)	12.61	[8.66; 16.55]

3.4. Willingness to pay based on Choice Experiments

The data obtained through the choice experiment questions was analyzed by modelling using NLOGIT software. Both fixed and random parameter models were tested. The random parameter model assumes the nonmonetary attributes are normally distributed. The modelling results are shown in Table 9. Based on the results, it is advisable to use a normally distributed model because the log likelihood (LL) is closer to zero, additionally both values of the correlation coefficients (R^2) are higher and the Aikaike Information Criterion (AIC / n) value is lower.

Table 9. Features of the Fixed Parameter and the Random Parameter (normal distribution) models

Model Features	Fixed-Parameter Model	Normal distribution model
LL (log-likelihood)	-2364.2	-1692.56
McFadden R^2	0.063967	0.329883
Ben-Akiva R^2	0.393061	0.520796
AIC/n (Aikaike Information Criterion)	1.970255	1.429657
n (observations)	2,406	2,406
k (parameters)	6	27

The choice experiment method allows for a separate assessment of the WTP of people for different indicators. The results of the ecosystem services of Lake Harku based on both valuation methods are presented in Table 10. It can be seen that people are willing to pay (almost twice) as much for water quality than for the better fish species composition in the lake. This is in line with the results of the importance of ecosystem services in Figure 2, where fishing opportunities were considered by respondents to be relatively less important than swimming and bathing opportunities.

Table 10. The willingness to pay based on choice experiments

Improvement of…	Fixed parameter model		Normal distribution model	
	WTP €/year	Standard deviation	WTP €/year	Standard deviation
Water quality to poor	30.73	4.17	22.26	2.33
Water quality to good	39.96	4.52	34.42	3.45
Fish species composition to poor	15.79	2.14	14.60	1.69
Fish species composition to good	17.89	2.48	20.31	2.68

The results of the survey could also be interpreted in such a way that people are more likely to pay for specific benefits (for ecosystem services) than to improve the general state of the environment. In conducting similar tasks in future, involving the community or stakeholders should continue to be considered.

The results of people's willingness to pay are shown in Table 11. The analysis showed that the recreational and sporting opportunities influenced by the water quality at Lake Harku were the most important for people. For achieving the poor level, respondents

were willing to pay an average of Euro 22.26 per year and for achieving the good level an average of Euro 34.42 per year. Respondents were willing to pay on average Euro 14.60 per year for a poor level of fish species and on average Euro 20.31 per year for a good level of fish species. At the same time, the results showed that people were willing to pay relatively more to improve the quality of recreational and sports facilities from poor to good levels as compared to the fishing opportunities

Table 11. Estimated WTP per person for the selected method and extended to 11 local governments surveyed in Tallinn and Harju County.

Improvement of…	WTP Euro per person per year	95% Confidence interval	Tallinn and Harju County (11 municipalities) WTP, million €/ year
Water quality to poor	22.26	[17.69 ; 26.84]	9.64
Water quality to good	34.42	[27.66 ; 41.19]	14.90
Fish species composition to poor	14.60	[11.28 ; 17.91]	6.32
Fish species composition to good	20.31	[15.06 ; 25.57]	8.79
Inhabitants (Tallinn and Harju county 11 municipalities)		433 014	

The results of the willingness to pay for the 11 local governments of Tallinn and Harju County show that the payment of the inhabitants to the good level of recreational and sports facilities of the Harku Lake ecosystem services is on average about Euro 15 million per year. For the 2016–2020 period (5 years) the benefits are estimated to nearly Euro 75 million. For improving the level of fish composition, the payment of the population is close to Euro 9 million (for the period from 2016 to 2012 around Euro 44 million).

The analysis also examined which factors influenced the respondents' WTP, which in the setting of the choice experiment is interpreted as the decision to pay (see Figure 4.). The results suggest that bathing water quality, the possibility of swimming and bathing, the clarity of water were those most affected by recreational opportunities. The least affected were fishing-related factors. The amount of remuneration was the center of influence.

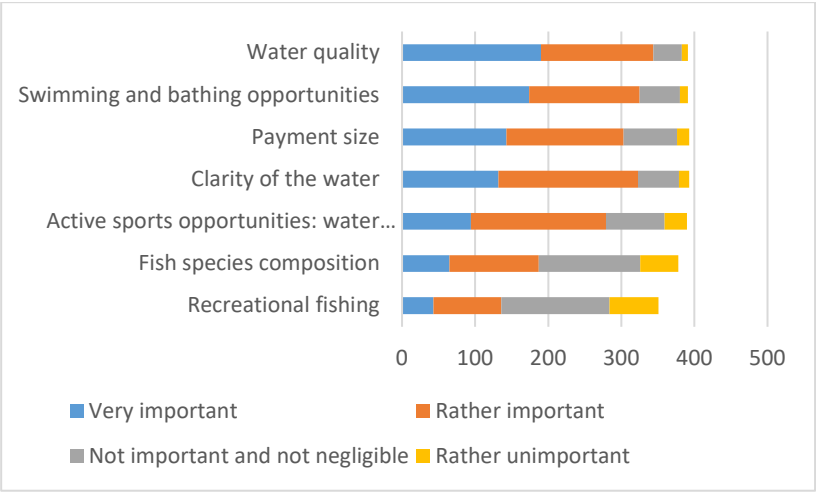

Figure 4. Factors influencing the decision to make a payment.

4. Summary and conclusions

The present study tested two stated preference methods for assessing the monetary value of ecosystem services i.e. the benefits offered by ecosystems – the contingent valuation method (CV) and discrete choice experiments (CE). It was possible to assess the total package value of ecosystem services by means of the contingent valuation method. The choice experiment method made it possible to assess the value of the individual ecosystem services separately. There were similarities and differences in the results of the willingness to pay. The justification for valuing ecosystem services in monetary terms is to provide information to decision-makers as basis for policy choices.

The study concluded that recreational fishing and improvement of conditions for fishing are not as important for people as improving other recreational opportunities at the lake. This result was based both on ranking of the importance of ecosystem services, and using contingent valuation method, as well as a result of the choice experiment.

The authors' first hypothesis about the existence of demand for improving the condition of Lake Harku was confirmed by significant willingness to pay identified using both contingent valuation and choice experiment methods.

The study showed that the willingness to pay based on the contingent valuation method yielded a lower result than the estimated payment option of the choice experiment. Thus, it can be said that the study results do not confirm of the authors' second hypothesis that both methods give similar results. Previous comparisons of these two stated preference methods are in line with this, but the evidence is mixed. Although care was taken to use

the same set of attributes of the environmental status in the CV and the CE questions, the methods differed by the number of questions and the econometric models. However, due to the fact that the results of the validation through the choice experiment showed that people agreed to pay twice as much for improving the quality of water and recreation as to improve the level of species composition, it could be assumed that the insignificance of improving the level of species composition of the fish could have been influenced by the willingness to pay of the contingent valuation question.

The results obtained must be used with caution, since the sample of 401 respondents is relatively small to ensure reliability of the specific numbers. Our task was, above all, to demonstrate the potential of the methodology. If the goal is to evaluate the value of particular ecosystem services for policy decisions, then the recommended sample size is usually between 800-1,000 respondents.

Decision-makers (national government, local governments, etc.) can use the methodologies for assessing the willingness of the population in future as additional opportunities to finance improvements of the state of the environment of Estonian water bodies (lakes, rivers, sea lanes, etc.). The methodologies for assessing the willingness to pay helps assessing how the cost of different measures relates to the benefits of the improvement of ecosystem services (part of the cost-benefit analysis). The amount of the willingness to pay assessed in this study cannot be regarded as the full monetary value of the benefits provided by Lake Harku, as only a small selection of ecosystem services and benefits were valued. Indirectly, the monetary value of the payment is indicative of the benefits to the general public of the quality of the selected ecosystem services.

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