

First Contingent Valuation of the Endemic Species: *Salmo letnica* Karaman, 1924 (Actinopterygii: Salmonidae) and *Gocea ohridana* Hadžišce, 1956 (Gastropoda: Hydrobiidae) from Lake Ohrid

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Abstract: The study comprises the first contingent valuation of two endemic and endangered species, *Salmo letnica* and *Gocea ohridana*, from Lake Ohrid. During the investigations, a questionnaire with 18 questions, divided into five sections was circulated in the largest towns on the lake's shore, i.e. Ohrid in the Republic of Macedonia and Pogradec in the Republic of Albania, in order to determine the total economic value (TEV) of the two species and to clarify the willingness to pay (WTP) for the protection of the same animals among the residents of the area. The survey was completed in February 2016 and included respondents with diverse educational and professional backgrounds and different levels of the annual income. The findings of this valuation indicated that the majority of the respondents were willing to pay for the protection of the two species. Furthermore, it was found that the WTP was positively correlated with the income and educational level of the respondents and the best mode of payment was supposed to be an annual tax collectable by the local tax offices in the respective towns. Overall, the mean WTP for protection of *S. letnica* was estimated at 22.11 Euro a year per household, while this indicator for the protection of *G. ohridana* was 19.32 Euro. It was also found out that the WTP among the Macedonians was higher than that among the Albanians. The TEV of *S. letnica* and *G. ohridana* for the population living near Lake Ohrid for both the Republic of Macedonia and the Republic of Albania was estimated at 800,249.34 Euro and 699,268.08 Euro per year, respectively.

Key words: Ecosystem services, contingent valuation, total economic value, willingness to pay, *Salmo letnica*, *Gocea ohridana*, Lake Ohrid

Introduction

The ecosystem services (ESs) is a scientific field that provides a practical link between economy and ecology. The valuation of these services gives information that assist the decision-makers. In fact, based on the past experiences and data from different studies and analyses of ESs, some appropriate policies could be developed and implemented (SALLES 2011, AL-ASSAF

2015). The valuation of the ecosystem services is made by applying different methodologies. One of those is the contingent valuation method (CVM), which includes direct enquiring the public about their willingness to pay (WTP) for various ecosystem services.

Lake Ohrid is situated in the mountainous region between the Republic of Macedonia and the

Republic of Albania. It is one of the deepest and oldest lakes in Europe (WAGNER et al. 2014). Being the largest of the three natural lakes in the Republic of Macedonia, Lake Ohrid is used by the population for recreation, services of flood and pollution control and a source of food (ZDRAVESKI et al. 2015). The importance of the lake was also highlighted when it was declared a World Heritage Site by UNESCO in 1979. One of the most impressive features of the lake ecosystem is the high biological diversity and extremely high degree of endemism (ALBRECHT & WILKE 2008, HOFFMANN et al. 2010, KOSTOSKI et al. 2010, BUDZAKOSKA GJORESKA et al. 2014, TRAJANOVSKI et al. 2015).

Endemic species in aquatic ecosystems provide various ecosystem services, contributing to the overall quality of the ecosystem, its functionality and food webs. Therefore, the protection of endemic species, and of biodiversity as a whole, has a crucial importance for the overall well-being of the ecosystem, at the same time providing clear benefits for the economy and for the population that lives in the respective area.

The Ohrid trout (*Salmo letnica* Karaman, 1924) (Salmonidae) is one of the most famous examples of endemic species in the lake. According to CRIVELLI (2006), the taxonomic status of the species is disputable and it needs further confirmation with the application of molecular data. According to the same source, there is also limited data on the abundance, trends and threats of the species. However, *S. letnica* is believed to be genetically distinct and is generally regarded as a separate species, which requires urgent conservation measures and action plans. According to CRIVELLI (2006) and KOTTELAT & FREYHOF (2007), the range of *S. letnica* is limited to the Republic of Macedonia and the Republic of Albania. The species lives at depths of about 60–80 m in the lake, and the spawning season is in January and February. In the past, *S. letnica* made up the bulk of catches of salmonid in the lake, and the species was a specialty in the Macedonian and Albanian gastronomy. However, due to extensive and uncontrolled fishing this species has been driven to the verge of extinction. Other major threats, besides overfishing, are habitat destruction, water pollution, introduction of alien species and hybridisation (CRIVELLI 2006, KOTTELAT & FREYHOF 2007).

Gocea ohridana Hadžišće, 1956, is a gastropod species of the order Littorinimorpha, family Hydrobiidae. This snail is endemic to Lake Ohrid in the Republic of Macedonia. In fact, this species is known from only one locality, where it is registered in an extremely small area (of about 3 km²) (HAUFFE

et al. 2010). The occurrence of *G. ohridana* is restricted to the rocky south-eastern shoreline of the lake and is found in rather low abundance (BUDZAKOSKA GJORESKA et al. 2019). The species lives on underside of the stones in the surroundings of sublacustrine springs and for that reason is characterised as a sublacustrine interlithon species (HADŽIŠĆE 1956, HAUFFE et al. 2010). It is listed as critically endangered in the IUCN Red List, and the main threats to the species are water pollution, the increased frequency of fire occurrences in the region, resulting in an increased erosion, which changes the sediment composition and alters the natural habitats, introduction of alien species, etc. (HAUFFE et al. 2010, TRAJANOVSKI et al. 2015, 2019)

Our research aims to provide an economic valuation of the two endemic species *S. letnica* and *G. ohridana* in Lake Ohrid and their protection and conservation. The valuation is undertaken through the application of the contingent valuation method (CVM) and it is the first of its kind in this region and for this particular ecosystem service (ZDRAVESKI et al. 2015).

Materials and Methods

In order to determine the willingness to pay (WTP) for the protection of the two species, a questionnaire was developed and tested. So as to retrieve as accurate values as possible, the survey was conducted in person, i.e. people were approached and asked to fill in the questionnaire by an enumerator. The survey included a total of 18 questions, which were divided into five sections. The first section of the questionnaire provided background information on biodiversity and distribution of endemic species, the second portion provided information about the importance of biodiversity for different biological and socio-economic areas, including economy, tourism, overall health and well-being, the environment, as well as the ways in which a person can contribute to the protection of the environment. The third section contained questions about the familiarity of respondents with the two species, *S. letnica* and *G. ohridana*, and the fourth section was developed to obtain values through questions about WTP. The last portion of the survey asked for data about the respondents and their socio-economic status: gender, age, educational level and annual income. Regarding the annual income levels, there were three groups developed for this indicator: annual income level 1 comprises people with low income, annual income level 2 – with average income, and annual income level 3 – with high income.

Different valuation methods can be applied in valuation of different types of goods and services. The specificity of non-market values makes the respective goods and services much more difficult for assessment and evaluation (ZDRAVESKI 2015). In that context, the ecosystem services provided by endemic and endangered species comprise a large component of non-use or non-market value in its total economic value (TEV), therefore, the contingent valuation method (CVM) is one of the most useful and acceptable valuation techniques (PEARCE & TURNER 1990, CARSON et al. 1998, CARSON 2000). This valuation method involves direct surveying of people in an attempt to determine their WTP for a specific change in the supply and/or demand of certain ecosystem service. In this case, the changes in the population densities of the two species are subject of interest of the investigations and the WTP for these changes has been assessed.

The questionnaire used in the process of determination of the WTP in the region of Lake Ohrid was easy to follow and the questions defined the current condition regarding the biodiversity, its importance and the ways in which it can be protected on a global and local level.

The first WTP question could be answered either positively or negatively and asked respondents if they were willing to pay for protection of the biodiversity as a whole. If the reply to this question was positive, then the respondent was asked to continue answering the following WTP questions, while if it was negative, then those questions were not answered by the participant. After confirmation by the respondents of their interest and willingness to pay for the cause, the mode of payment was surveyed and determined. The next question asked respondents to choose their mode of payment out of the three options: A) additional monthly fee to the utility's bill; B) annual tax collected by the national public tax office; and C) annual local tax collected by the local tax office. Finally, there followed some questions that clarified the WTP of people for the protection of the two species. According to BATEMAN et al. (1995), the open-ended clarification mechanism is debatable since it usually draws more conservative WTP amounts than other techniques. That is why a modified open-ended clarification mechanism was used in this survey, which means that respondents were given the opportunity to choose an amount bracket first and then specify the exact amount that they would be willing to pay, thus eliminating the anchoring bias (KEALY & TURNER 1993, HALVORSEN & SOELENMINDE 1998, BALISTRERI et al. 2001). The possible options included three WTP brackets: less

than 50 Euro a year, 50–100 Euro a year, and more than 100 Euro a year (per household). In all three cases, the respondent was asked to specify a unique amount.

It is not possible to compare our findings with past surveys since this was the first conducted valuation of its kind in the concerned area. That is why the study represents a good basis for further similar investigations in this part of the world for the related ecosystem services. We believe that an adequate number of respondents was questioned because the survey was implemented in the two largest towns on the shore of Lake Ohrid: the town of Ohrid in the Republic of Macedonia and the town of Pogradec in the Republic of Albania. The survey was also conducted at different sites, such as public administration offices, bars and cafés, supermarkets, banks, private organisations, and schools, which ensure the participation of people with different socio-economic characteristics.

The survey was completed during February 2016. No incentives were given to the respondents. A total of 500 people were asked to participate in the survey, with 400 of them agreeing to fill in the questionnaire (75% response rate). Out of the filled-in 400 questionnaires, 350 were usable and by eliminating the protest zeros (50), there were totally 300 questionnaires analysed, 150 of which were from Ohrid and 150 from Pogradec.

Results and Discussion

Out of the 300 usable surveys, 127 (42.33%) were filled by male and 173 (57.67%) by female respondents. In the Republic of Albania, 77 (51.33%) and 73 (48.67%) of the respondents were male and female, respectively, while in the Republic of Macedonia, 50 (33.33%) male and 100 (66.67%) female respondents were questioned. The greater part of the respondents (90) was in the second age cluster, i.e. 26–35 years old. The remaining people were classified as follows: 52 respondents were 16–25 years old, 69 respondents were 36–45 years old, 50 respondents were 46–55 years old, and 30 were older than 56 years. In the Republic of Macedonia, 70 (46.67%) of the respondents, were with a high-school diploma as their highest education. Furthermore, 67 (44.67%) of the Macedonian respondents were with a bachelor degree (BSc), nine (6%) with a master degree (MSc), three (2%) with a PhD degree, and one (0.67%) with an elementary school diploma. In the Republic of Albania, the majority of the respondents (89 or 59.33%) were bachelors as their highest education degree, one (0.67%) was elementary

school graduate, and 54 (36%) were with a high school diploma. No information was completed for the educational degree in the case of six respondents from the Republic of Albania. The combined results indicated that the majority of the respondents in this survey (152 or 52%), from both countries, were with a bachelor degree as their highest education.

Before proceeding with the analysis of the WTP portion of the survey, it is important to specify the level of familiarity of the respondents with the presence of the two species in Lake Ohrid. The obtained results indicated that 287 of the respondents knew about the existence of *S. letnica* in the lake, while 13 respondents did not know. At the same time, 120 of the respondents knew about the existence of *G. ohridana* in Lake Ohrid, while 180 did not know this information. A total of 273 of the respondents replied that they had seen live Ohrid trout *S. letnica*, while 27 answered negatively; on the other hand, only 81 of the participants had seen live snails *G. ohridana*.

The results obtained through the WTP questions showed that people in the region were, in general, willing to pay for protection of the two species: out of the 300 respondents, 202 (67.33%) answered positively to that questions, while 98 (32.67%) answered negatively. Furthermore, the results demonstrated that the WTP for protection of the two species in the overall area of Lake Ohrid was estimated at 22.11 Euro a year per household for *S. letnica* and 19.32 Euro for *G. ohridana*. By splitting the results per country, some differences of the WTP in the Republic of Macedonia and the Republic of Albania, as indicated in Table 1, could be observed. The WTP for protection of both species in the Republic of Macedonia was slightly higher than those in the Republic of Albania. This finding may be linked to the fact that Lake Ohrid is the largest and most famous tourist place in the Republic of Macedonia, while in the Republic of Albania there are other tourist centers, which might have a greater value for the population.

The mode of payment and its connection with the WTP was also analysed in this study. Table 2 shows the results obtained from all respondents with regard to the three provided options for payment. The WTP for Payment B was the highest, but the standard deviation for Payment C was the lowest. It can be concluded that the results in the latter option were more reliable and, based on the number of people that had chosen this option, it appeared to be the most desirable payment mode for the respondents.

The gender also played a role in the determination of the WTP among the respondents: as

may be seen, the males had slightly higher WTP than that of the females. However, it should be noted that the standard deviation for the female respondents was lower. The results obtained for the WTP and the gender of the respondents are presented in Table 3.

Table 4 shows the results about the annual income level of respondents. There was a significant positive correlation between the WTP and the level of annual income, with respondents that had the highest annual income stating the highest WTP for the protection of both species.

The amount that an individual would pay for the protection of the two species may be linked to the highest educational degree of the person in question. Table 5 presents the mean WTP of individuals classified according to their educational level. As it may be seen from the table, these two indicators were positively correlated, which means that the WTP increases with the increase in the educational level of the individual, and vice versa.

Given the mean WTP for both species, their total economic value (TEV) can be calculated for the two countries and in general, for the people who live in the studied area. Considering that respondents in the survey were asked how much they were willing to pay a year per household for the protection of the two species in Lake Ohrid, the total economic value could be easily determined by simple multiplication of the total number of housing units and the obtained WTP. According to the Institute of Statistics of Albania (2016), there are a total of 8,869 housing units in the town of Pogradec, while according to the State Statistical Office of the Republic of Macedonia (2016), the housing units in Ohrid are 27,325. Table 6 presents the total economic values of the two species per year for the Republic of Macedonia and the Republic of Albania, as well as for the entire population that lives in the area concerned. The table shows that the TEV of *S. letnica* for the Republic of Macedonia, more precisely, for the municipality of Ohrid amounted to 604,702.25 Euro per year, while in the Republic of Albania (the town of Pogradec), the same sum was 195,827.52 Euro per year. The total economic value of the species *G. ohridana* for the Republic of Macedonia was estimated at 590,220 Euro per year, while this value for the Republic of Albania was 151,039.07 Euro. Accordingly, the TEV of both *S. letnica* and *G. ohridana* for the population living near Lake Ohrid in the Republic of Macedonia and the Republic of Albania amounted to 800,249.34 Euro and 699,268.08 Euro, respectively.

Lake Ohrid is one of the deepest lakes in Europe and the oldest in the continent (WAGNER et al. 2014, SADORI et al. 2016). As such it is of great importance

Table 1. The willingness to pay (WTP) (overall) for protection of *Salmo letnica* and *Gocea ohridana* in Lake Ohrid, in the Republic of Macedonia (MK) and the Republic of Albania (AL)

	Willingness to pay (WTP), Euro	
	<i>Salmo letnica</i>	<i>Gocea ohridana</i>
Mean (overall)	22.11	19.32
Standard Deviation (overall)	27.23	25.36
Mean (MK)	22.13	21.60
Standard Deviation (MK)	30.76	29.70
Mean (AL)	22.08	17.03
Standard Deviation (AL)	23.28	19.95

Table 2. The willingness to pay (WTP) for protection of *Salmo letnica* and *Gocea ohridana* in Lake Ohrid vs. mode of payment: Payment option A – an additional monthly fee to the utility’s bill; Payment option B – an annual tax collected by the national public tax office; and Payment option C – an annual local tax collected by the local tax office

	Willingness to pay (WTP), Euro	
	<i>Salmo letnica</i>	<i>Gocea ohridana</i>
Mean (Payment option A)	33.97	29.36
Standard Deviation (Payment option A)	28.81	27.58
Mean (Payment option B)	36.97	32.62
Standard Deviation (Payment option B)	28.86	29.31
Mean (Payment option C)	30.35	26.36
Standard Deviation (Payment option C)	26.71	24.53

Table 3. The willingness to pay (WTP) for protection of *Salmo letnica* and *Gocea ohridana* in Lake Ohrid vs. gender of respondents

	Willingness to pay (WTP), Euro	
	<i>Salmo letnica</i>	<i>Gocea ohridana</i>
Mean (Male)	24.00	20.87
Standard Deviation (Male)	28.64	27.11
Mean (Female)	20.74	18.20
Standard Deviation (Female)	26.16	24.04

Table 4. The willingness to pay (WTP) for protection of *Salmo letnica* and *Gocea ohridana* in Lake Ohrid vs. annual income level of respondents: Annual income level 1 – low income; Annual income level 2 – average income; and Annual income level 3 – high income

	Willingness to pay (WTP), Euro	
	<i>Salmo letnica</i>	<i>Gocea ohridana</i>
Mean (Annual income level 1)	15.66	12.59
Standard Deviation (Annual income level 1)	20.34	17.45
Mean (Annual income level 2)	18.63	15.86
Standard Deviation (Annual income level 2)	24.24	21.62
Mean (Annual income level 3)	36.67	34.41
Standard Deviation (Annual income level 3)	34.25	33.01

for the scientific community, as well as for the inhabitants of the surrounding areas, the region and at European and global level. Until present time, a lot of scientific investigations of the lake have been conducted in terms of its biodiversity, endemism, age, etc. Many of the investigations provided guidelines and action plans for protection of the lake and its surroundings from the increased processes of pollution and eutrophication (SCHNEIDER et al. 2014). However, before our study, there was no

environmental economic evaluation neither of the lake as a whole ecosystem, nor of any particular site surrounding the lake that is used for recreational purposes, production of agricultural and other products or the biodiversity and endemism, which are essential characteristics for this unique aquatic ecosystem.

Why should we worry about the economic valuation of Lake Ohrid? Partially because there will always be opposing needs for public funding and

Table 5. The willingness to pay (WTP) for protection of *Salmo letnica* and *Gocea ohridana* in Lake Ohrid vs. educational level of respondents

	Willingness to pay (WTP), Euro	
	<i>Salmo letnica</i>	<i>Gocea ohridana</i>
Mean (Elementary)	17.93	18.12
Standard Deviation (Elementary)	25.35	25.62
Mean (High school)	13.43	12.30
Standard Deviation (High school)	18.08	16.85
Mean (BSc)	28.50	24.46
Standard Deviation (BSc)	31.58	29.55
Mean (MSc)	23.33	24.44
Standard Deviation (MSc)	25.12	25.67
Mean (PhD)	36.67	30.00
Standard Deviation (PhD)	23.09	20.00

Table 6. The total economic values (TEV) per year for protection of *Salmo letnica* and *Gocea ohridana* per countries and overall

	Housing Units	WTP <i>S. letnica</i>	WTP <i>G. ohridana</i>	TEV <i>S. letnica</i> (Euro)	TEV <i>G. ohridana</i> (Euro)
R. Macedonia	27,325	22.13	21.60	604,702.25	590,220.00
R. Albania	8,869	22.08	17.03	195,827.52	151,039.07
Overall	36,194	22.11	19.32	800,249.34	699,268.08

there will often be competing demands for use of the water resources. Moreover, cost-benefit analysis has been a useful tool for the public decision making when having numerous opposing interests at a given time. Environmental organisations and other groups of stakeholders may find it rather useful to follow the findings of the cost-benefit analysis, including the analysis of non-market values to peruse a complete accounting of the impacts of water policies that are enacted and are about to be enacted and implemented. In addition, the monetary valuation of ecosystem services is also very important in order to monitor and ensure that public funding, which is available for protection of the environment is rightfully used. In other words, those that are concerned about fiscal responsibility of the public investments in water resources may benefit from such an evaluation and eventually make a wiser use of the public funds. Moreover, Lake Ohrid as an aquatic ecosystem provides numerous ecosystem services that are not traded on any market, hence these services can be best evaluated by application of non-market methods that are developed by environmental economists. Therefore, it is very important for the economists to develop good collaboration with biologists and hydrobiologists in order to be better informed about the nature and characteristics of the ecosystem services that are about to be evaluated. Likewise, environmental valuation is a procedure that is

becoming increasingly important from scientific point of view, as well as from the viewpoint of funders of numerous scientific projects and public institutions that are responsible for decision-making concerning ecosystem prevention and policy implementation. What is more, it is evident that these activities are unlikely to decelerate in the future. The environmental resources are increasingly recognised as valuable assets that provide services, which are no longer available. Thus, the demands for measuring of their values and their incorporation in the decision-making and policy development are to be expected as these services are becoming more scarce (SMITH 1993).

Conclusions

This investigation provided contingent valuation of the two endemic species *Salmo letnica* and *Gocea ohridana* in Lake Ohrid and it generated the total economic values (TEV) of their protection based on the contingent valuation method for both countries: the Republic of Macedonia and the Republic of Albania. Overall, the mean willingness to pay (WTP) for protection of *S. letnica* was estimated at 22.11 Euro a year per household, while this indicator for protection of *G. ohridana* was 19.32 Euro. Our results showed that the WTP among the Macedonians was higher than that among the Albanians. The TEV of *S.*

letnica and *G. ohridana* for the population living near Lake Ohrid for both the Republic of Macedonia and the Republic of Albania was estimated at 800,249.34 Euro and 699,268.08 Euro per year, respectively.

Our study clearly indicated that there was high interest for financial contribution by the local population to protection of the two endemic species in Lake Ohrid. On those grounds, it may be concluded that a local annual tax collectable by the municipal tax offices may be introduced by the authorities as part of the measures for conservation of both species.

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