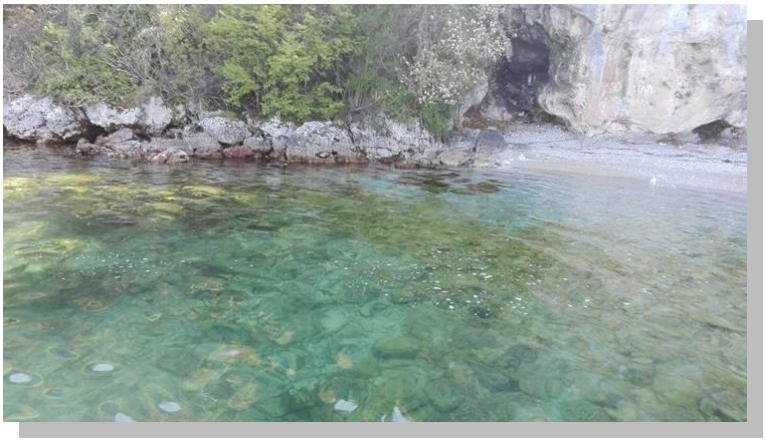

VELIDAB, LAKE OHRID MACEDONIA

TESSA - Toolkit for Ecosystem Service Site – based Assessment

Association for ecology EKOMENLOG Ohrid

Project: Conservation of Velidab - Biodiversity Heaven in Lake Ohrid (COVEL-BIOHEVLO)

EKOMENLOG OHRID
Association for ecology

COVEL-BIOHEVLO

The Rufford Foundation
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The Project Conservation of Velidab – Biodiversity Heaven in Lake Ohrid (COVEL-BIOHEVLO) has been implemented in the period 24.02.2017 to 24.02.2018. The Project has been financed by the Rufford Foundation from the United Kingdom. The team of the Project expresses great thankfulness and appreciation to the founder of the action.

Association for ecology EKOMENLOG (2018). ***Conservation of Velidab - Biodiversity Heaven in Lake Ohrid (COVEL-BIOHEVLO)*****. [online] Ohrid: Association for ecology EKOMENLOG. Available at: http://ekomenlog.mk/activities/**

Introduction

In the past few decades there has been an overall international recognition that generally, most of all in the underdeveloped countries, the contribution of the nature to the human well-being is often undervalued or not adequately valued and/or integrated and taken into consideration in the decision-making processes. Therefore, the ecosystem services due to this notion are often eroded, hence generating substantial cost to the society as a whole, instead of financial or non-market benefit whatsoever.

On the other side, governments all around the Globe are being asked to enact and implement great number of policies and laws, which would integrate the environment and development, including environmental mainstreaming, which would eventually result in achieving the Sustainable Development Goals and delivering a Green Economy. In addition, the international cooperation and the commitment that countries have accepted by signing international treaties result in ensuring assessment of the contribution of the ecosystem services to the overall human well-being (Peh et.al., 2013).

The Lake Ohrid as an ancient aquatic ecosystem has been researched from biological, geological and physicochemical perspective intensively in the past. With the establishment of the Hydrobiological Institute in Ohrid in 1935, the lake and its surroundings received a safeguard of the flora and fauna as well as monitoring point which has been responsible for different types of hydrobiological investigations. However, until recent times there have been no researches of the ecosystem services conducted in the Lake Ohrid and its surroundings. As it is the case with most of the developing countries, the ecosystem services have not been fully and correctly evaluated in terms of their contribution to the overall wellbeing of the humanity. Some of the first attempts for ecosystem services valuations in this region has been conducted in the period after 2014, regarding the evaluation of the biodiversity as a whole of the Lake Ohrid as well as valuation of the possibility of protection of certain endemic species in the lake (Zdraveski et.al., 2015, 2016). However, no evaluation of sites has been undertaken following some of the widely accepted methods for evaluation. One of the most appealing and interesting

localities in the shores of the lake is the locality Velidab, which has been considered as the most important hotspot of biodiversity in the same time harboring many endemics such as *Gocea ohridana*, an endemic snail whose areal of distribution is strictly limited to this locality. The locality of Velidab has not been evaluated, so that is why within the Project Conservation of Velidab – Biodiversity Heaven in Lake Ohrid (COVEL-BIOHEVLO), among other actions, the team members completed evaluation by implementation of the TESSA, the Toolkit for Ecosystem Service Site – based Assessment.

Background on the TESSA Toolkit

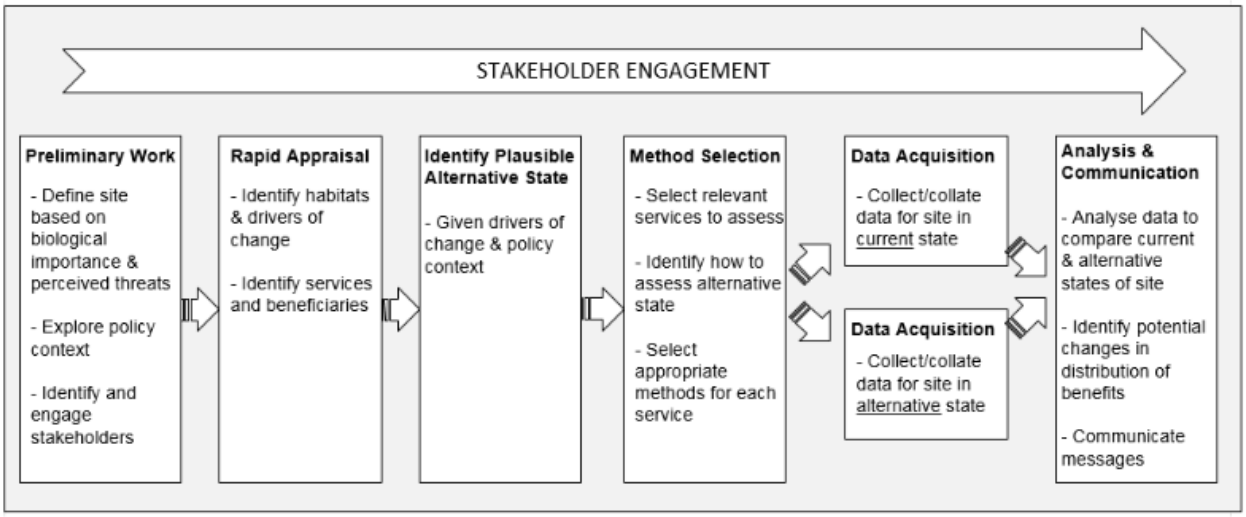
In order to undertake and implement an assessment of ecosystem services in a methodological way, for the purposes of this project, there has been used a methodological framework. In fact, TESSA, the Toolkit for Ecosystem Service Site – based Assessment, which has been developed in the United Kingdom and thereafter has been widely used in other countries has been used while undergoing with the site evaluation. The toolkit has been designed to take advantage of the local knowledge and stakeholder engagement and is relatively accessible to those who do not possess the adequate technical knowledge. The Toolkit aims to help "non-experts" evaluate several ecosystem services "quickly, cheaply, but robustly....and estimate the difference between current state and plausible alternatives" (Peh et al. 2013). The framework used while applying the TESSA evaluation comprises six consecutive steps:

- preliminary work
- rapid appraisal
- identification of plausible alternative state
- method selection
- data acquisition
- analysis and communication

As it can be seen from Figure 1 bellow, the stakeholder engagement is important throughout the entire process in terms of acquiring information, knowledge and communicating the findings with the appropriate stakeholders, thus ensuring valuable results which would be gained through the implementation of the TESSA

valuation of the specific site, in this case the hotspot of biodiversity Velidab on the shores of Lake Ohrid in Macedonia.

Figure 1 The methodological framework of TESSA



Source: (Peh et.al., 2013)

In the process of preliminary work, the site is defined based on the significance from biological point of view and perceived risks, the local policy condition is also explored and elaborated and the stakeholders are identified as precise as possible. It should be stressed that the early engagement of the stakeholders and decision-makers in the process of the evaluation would provide a more correct and precise information on the economic, ecological, social and cultural importance of the site in question.

Following the preliminary activities, a rapid appraisal is carried out for the site that is evaluated. During this phase, the most important habitats are being identified, the drivers of change (such as land use etc.), the services delivered by the site and the beneficiaries of these services, which in some cases does not have to be located in the approximate surroundings but may be further away from the site in question.

The next (third) step comprises the identification of the plausible alternative states, certainly based on the information gathered during the previous steps in combination with the already obtained information and knowledge in the local context. This alternative state can be a plausible state in the future, for instance the site after 10-20 years, or how the previous state of the site evolved into the

current one. In fact, possible alternative states are the conversion, the intensive use and the restoration of a degraded site. In order for the assessment to be useful in this step there have to be taken into consideration the services that the site is providing in its current state, as well as the services that the site may provide in the alternative state. If possible, the data for the alternative state should be collected and compared to similar sites which are in the surroundings of the locality which is being evaluated.

The fourth step is the method selection. The most relevant ecosystem services are being selected before continuation with the process of evaluation with finding the appropriate assessments methods for each service with the use of a separate decision tree. The selected method includes collecting primary data through field surveys, key expert interviews, household questionnaires, using existing databases and studies and employing numerical models if possible. The method, or combined methods that are going to be selected depend greatly on the availability of data, time, resources and expertise. The identification of how to assess the alternative state is assessed in this step as well.

The fifth step is data collection, where data is being collected for the current and for the alternative state of the site in question.

The final step is the analysis and the communication. In the process of analysis and communication, the most important issue that the analysts should do is to correctly compare the data for the current state and the alternative state. In most cases the data regarding the ecosystem services will defer between the two and this difference should be properly elaborated and communicated with decision-makers and stakeholders.

Preliminary work

Velidab is a slope in the shore of Lake Ohrid in Macedonia (refer to Figure 2), which is nearby Koder and Gradishte (famous summer destination for tourists). This area comprises approximately 3 km2 of strictly rocky underwater habitats in the south-eastern shoreline of the lake and its characterized by numerous sub lacustric springs. According to Albrecht and Wilke (2008) Velidab (N 40°59′188″; E 20°47′904″) is rather famous for its high degree of biodiversity for different species and families, as well as for its high degree of endemism, especially for the

macrozoobenthos. The place Velidab used to be known as one of the least affected by any anthropogenic impact in the past, but recent investigations show that this place is not as unpolluted as expected. The surrounding of the locality of Velidab is characterized by the National Park Galicica which is covering the mountainous slopes and continuation of the mountain on the East, the Lake of Ohrid on the West, on South there is the village of Trpejca on 4.2 km, while on the North there is the Bay of the Bones Museum and the Recreational Beach Complex of Gradishte on 650 meters and 1 km respectively. The borderline between the aquatic part and the terrestrial part of the area is a cliff with limited/no terrestrial riparian vegetation, which ends by the motorway Ohrid-Pogradec. The area belongs to the National Park Galicica, according to the spatial planning of the Park and is comprised by the Lake Ohrid, which is proclaimed Monument of Nature in Macedonia and is protected by UNESCO as World`s Natural Heritage. The area is fully comprised by public land, no private ownership is registered.

Figure 2 Geographical Location of Velidab

Rapid Appraisal

The rapid appraisal stage of the process of evaluation of Velidab comprises the identification of the relevant ecosystem services provided by the locality in its current state, but also the ecosystem services which it would provide in the alternative state – Strict Nature Reserve. The recognized stakeholders included representatives from the local community, local and central government, CSOs,

research institutions and the touristic sector in the region. The Velidab locality is only one part of the greater Lake Ohrid, but it is famous place for the picky tourists, since it is isolated and is characterized by pure, transparent waters. Moreover, the locality is famous as one of the hot-spots in terms of biodiversity in the Lake. There are numerous endemic species which are characteristic for the entire lake, yet within the ecosystem, they only survive at the locality of Velidab.

The ecosystem services provided by the locality are climate regulation, research opportunity, monitoring opportunities, presenting database for numerous species which may be preserved. Due to the close already developed touristic recreational places, this site does not provide any revenues for the local government in terms of tourism generated services. In addition, due to the specific terrain it is not suitable for crop production, building activities etc. The only ecosystem service which is related to the tourism may be the tour guides which are organized by big touristic boats to the surroundings, whereby Velidab is only a mid-station.

Regarding the habitats at the locality Velidab, it should be noted that the area is divided into the terrestrial and aquatic component. The terrestrial component is far less diverse in terms of flora and fauna, since it is characterized as cliff with rather rigid living circumstances for the terrestrial living world. Therefore, the terrestrial habitats at the locality are suitable for mosses, limited riparian vegetation, bushy vegetation, *Corylus fagus* etc. On the other hand, the aquatic component of the area is providing suitable habitats for immense number of representatives of the macrozoobenthos (benthic invertebrates), macrophytic vegetation, benthic diatoms, fish etc. Besides the rocky part of the area, some parts are also covered by sand and mud.

Identifying plausible alternative state

Despite the fact that is characterized by an impressive degree of biodiversity and excellent aesthetic attributes, the locality of Velidab is not being protected and/or managed in any way until present time. Very close to this locality is the newly established Museum Bey of the Bones and the very famous recreational place Gradishta (see Figure 3). On the other side, the closest village is on 4.6 km from the locality. The site is comprised within the National Park Galicica, but it is not managed by this institution in any way. Once again, due to its high degree of

biodiversity the locality has not only local importance, but it could be concluded that it has world`s importance in terms of conservation of numerous species, which have been assessed as critically endangered by the IUCN.

Figure 3 Velidab

That is why, the plausible alternative state to which this site is going to be compared is the proclamation of the site into Strict Nature Reserve. This type of protection is usually intended for areas that are created and managed mainly for the purposes of research. Their primary intention is the preservation of biodiversity and as essential reference areas for scientific work and environmental monitoring.

Figure 4 Velidab Closeup

Currently, as mentioned above, the local government and the local population do not have any financial benefit due to the existence of the site. The proclamation into Strict Nature Reserve, would enable the Local Government and the scientific

institution in Ohrid to be able to formally start management of the area, hence take the first steps towards the protection of the extreme high biodiversity. Moreover, this proclamation would enable the managing body of the site to be able to generate revenues in the future from the Central Government, scientific institutions which would use the place for research and monitoring, environmental foundations, visitors of the exhibitions which may be developed out of the locality and other types of founders.

Methods selection

In the previous stage of the analysis there has been determined that currently Velidab does not provide any additional financial inflows from touristic activities to the local self-government of the Municipality of Ohrid. Moreover, it has been mentioned that due to its size and the characteristic terrain the locality is not suitable for crop production, building activities etc., which results in no financial inflows from those ecosystem services, neither for the public, nor for individuals. Likewise, it can be concluded that the locality would generate only little from possible organized tour guides, since the site is on the road to the famous recreational place Gradishta, the newly established Museum Bey of the Bones and the Monastery Complex St. Naum – near the Albanian border. On the other hand, it has also been elaborated that this place, based on the already available information from numerous researches and investigations bears high degree of biodiversity of all species, especially the macrozoobenthos and benthic diatoms, thus it could be concluded that it has world`s importance in terms of prevention of numerous species, which have been assessed as critically endangered by the IUCN.

The ecosystem services which were assessed include the opportunities provided for scientific research and monitoring and the biodiversity degree as one important feature which if under proper management would eventually ensure generating some financial inflows for the management body of the site. However, in order to attain that stage when one could speak about monetary benefits from the site, the local government in cooperation with the central government and the non-governmental organizations should do their best to ensure protection of the area, hence protection of the rare endemics that are living there and which would be worth for the scientists to analyze and monitor.

That is why, the ES were analyzed in three points in time for three different groups of organisms. In other words, there have been collected the last available information regarding the species composition and biodiversity levels for the groups of macrozoobethos, benthic diatoms and macrophytes in the period 2010-11 (obtained from the findings of the Project Developing of Ecological Tools for Monitoring of Lake Ohrid according to the European Water frame Directive (2009-2013, financed by the Royal Ministry of Foreign Affairs of Norway and implemented by the Hydrobiological Institute Ohrid, Macedonia and the Agricultural University of Tirana, Albania under the leadership of the Norwegian Institute of Water Research (NIVA)). New research has been conducted by the team of the Project Conservation of Velidab - Biodiversity Heaven in Lake Ohrid (COVEL-BIOHEVLO), financed by the Rufford Foundation from the United Kingdom and it comprised inventorization of the species from those groups in May and July 2017. The two sets of data were compared and that is how the biodiversity levels as ES were assessed. Moreover, based on the expert opinion and on the already available knowledge on the trends of the species in the region, there has been provided forecasts on the state of the species, under the assumption that the site would be proclaimed as Strict Nature Reserve.

Analysis and communication

The analysis of the data includes the species which have been identified in the samplings conducted in the period 2010-11, 2017 and the qualitative discussions on the possible changes under the assumption that the place is going to be proclaimed Strict Nature Reserve (alternative state). In order to ensure understandability of the material there are not going to be listed Latin names of the species which have been recorded in the mentioned periods, instead there is going to be used numeric representation of the number of species which have been recorded in the different periods.

Benthic Diatoms

Based on the obtained information, the state of the benthic diatoms is rather different in 2010-11 and 2017. Having in mind that in this period the area has not been managed and/or protected in any way, it should be noted that none of the species which have been recorded in 2010-11 have been registered in 2017. Yet,

due to their size, short period of generation and ecological adaptability, it is easy to understand the changes and successions in the composition of the communities of the benthic diatoms. The insulation, water level, water currents and waves, temperature and food availability are the major factors influencing change in the species composition of the benthic diatoms. The water currents and the waves as well as the water level are of primarily importance in their distribution and factors that could easily move the substrates the benthic diatom algae are attached to. However, the difference in the number of registered species and the species composition may also imply to changed conditions which resulted into disappearance of the species during that time, which may have been avoided if the site has been properly managed and protected by a responsible and professional management body.

Proclamation of the site as Strict Nature Reserve, would ensure that the site is used for scientific research only, which would reduce to a minimum the anthropogenic negative impact on the species that is possible under the current state. In terms of benthic diatoms, the science cannot provide clear forecast on the number of species which would exist on the same site under the alternative state. However, it should be noted that the reduced negative impact from the humans, the proper management and physical protection of the site during stormy periods would ensure stabilization of the number of species and the species composition in the site. This stabilization would eventually result in transforming the site to its natural characteristics, which may also attract the species which used to inhabit the locality to come back again. All of these actions would enhance the biodiversity degree of the area for the benthic diatoms and will ensure that scientists may undertake their monitoring ensuring clean and unimpacted area, which besides the clear scientific results it may also generate positive financial figures for the management body of the locality.

Macrophytic vegetation

The analysis undertaken for the macrophytic vegetation in the period 2010-11 and 2017 indicated absolute no difference in the number of species registered in the two periods in question. The same number of species and the same species composition has been registered in the two periods of analysis. Regarding the “no difference” status in the diversity in two different periods, it has been expected if

one has in mind that macrophytes are wide group of vascular plants that are sessile i.e. rooted in the bottom of the Lake. Relatively stable water conditions without any perturbances caused by any anthropogenic activities, have enabled normal phenological change in the composition of the macrophytes in this locality.

However, if one analyses the alternative state, where the area is proclaimed as Strict Nature Reserve, the number of species would definitely not change in terms of the "normal" representatives for the site in question. Nevertheless, there are the so-called invasive alien species (Elodea canadensis being one of them), that are non-native to an ecosystem, and which may cause economic or environmental harm or adversely affect human health. The protection and proper management of the site would definitely result in enhancing the situation in regards to infestation of the area with invasive species and since at the locality the invasive plant species is already registered, the protection and management of the area would ensure control of its spreading and negative effect on the other types of species. The control would mean elimination of certain quantities of the invasive species at given point in time in order to avoid domination by the invasive species over the rest of the species. However, the eliminated biomass is not going to be disposed in the lake or in landfills, on the contrary the biomass which is generated by these plants could be used as a raw material for the production of biodiesel and/or bricks for heating, for whose production there are companies in the region and in the country. What is more, portion of the other species also detach from the ground naturally and they could also be used for the same purpose. Selling the "green waste" would definitely bring financial benefit for the management of the site, which, on the other hand, will assist in the financial sustainability of the Reserve.

Macrozoobenthos

As expected the community of macroinvertebrate has been assessed with highest biodiversity and endemism in comparison with the macrophyte vegetation and flora of diatom algae. In total, 33 species have been registered whereby 26 were identified during the spring period and 33 during the summer of 2017. The general endemism (all groups) of locality Velidab is impressive and reaches 73%. Doubtless, as expected, the most diverse is the group of Gastropoda. By comparing the last existing inventory list with the one from our research, we see decrease in the diversity level for 33 % i.e. we have registered 9 species less. Regarding the level of

endemism among the Gastropoda fauna, it is still extremely high: 17 species have been identified as endemic vs one cosmopolite (95%). 16 species, all of them endemic is the same as during the inventory in 2010-2011. Two species have not been registered in the earlier period.

Decreasing in the diversity and fluctuations in the density are natural phenomena in the structure of the benthic fauna and they are affected by the periodicity of the environmental factors and species ecological adaptivity capacity. Direct anthropogenic influence as a factor of changes in the structure and dynamics of the biotic components in Velidab is excluded. Naturally, due to its geographical position (very sloppy karstic area) access from the ground to this locality is impossible. Also, the mountainous configuration of the terrain excludes agricultural activities in its surroundings. But, Velidab is around 650 m far from the very famous historical hotspot Bay of the Bones which in the recent years has become a place of highest interest for the tourists that come there by commercial cruising boats especially during the summer. Dozens of boat lines per day certainly impact the Velidab locality and its underwater treasure due to the fact that the cruising line is only 300 m far from the shore where Velidab is located. Noise, water perturbances caused from the waves generated by the boats and fuel exhausting gases can be considered as factors that could or have contributed to the changes of the distribution and abundances of the freshwater inhabitants of Velidab.

As it can be seen from the analysis the state of the macroinvertebrates, a group for whose biodiversity the place has been famous and recognized is changing. In other words, there are some deviations in the number of species and the species composition, which could have been avoided if the place has been properly managed and protected. In the case under the alternative state, the living conditions for the species of macrozoobenthos would be enhanced by decreasing the noise and pollution from tourists, and the monitoring of the species would be ensured. In other words, the proclamation of the site as Strict Nature Reserve would result in stabilization of the state of the macrozoobenthos and eventually attracting the representatives which does not inhabit the place any longer. In addition, the management body of the Reserve would be able to undertake contemporary methods of conservation through DNA barcoding and meso-cosmos establishment, if they would have the free access to the protected site. Likewise, the creation of the meso-cosmos and potentially aquarium displaying the species living

at the site, would ensure financial benefits for the management body (tickets sold), which would assist in the sustainability of the Reserve.

The proclamation of the Velidab locality as Strict Nature Reserve would enable scientists from all around the world to be able to conduct researches and monitoring of the very unique flora and fauna which can be registered at this site. Currently, as it has been mentioned above, the locality does not generate any financial benefit neither for the Municipality, nor for any individual person (the land is public). This means that the valuation of the ecosystem services at the current state is impossible, since there is no actual market value which can be evaluated. However, based on the non-market values of the ecosystem services in the alternative state, one may conclude that the proclamation of the site as Strict Nature Reserve, besides protection of the environment will generate financial benefits for the potential management body of the locality and the economy. The financial inflows would be generated from visits for education, research and wildlife viewing.

- As it is the case with the Ezerani Nature Park in Lake Prespa where each year in early June students from the Institute of Biology (School of Natural Sciences in Skopje) visit ENP as part of their academic requirements, this may be also organized for the visiting of the Velidab locality. Therefore, a group of 30 students would stay in a hotel in the surrounding villages for a total of 14 nights spending 1,500 MKD per day for full board. This means that the local economy (or potentially the management body of the Reserve) would receive 630.000 MKD (10.244 EUR) per year only by this visit of students.
- Currently, there are numerous researches from all around the world who are visiting Lake Ohrid for research purposes on an annual level. An estimated 15 scientists come to the area for an average stay of 2 to 3 days for different scientific purposes. If one assumes that these scientists would definitely be interested to visit the most famous hotspot of biodiversity in the country, it would mean that there would be 30 overnight stays for that purpose. The average price of the hotel room in the city is 35 EUR, meaning that the visit of the locality by scientists for scientific purposes would generate 1.050 EUR per year.

- Based on the information on the annual visits of museums and different exhibitions in Ohrid, it has been found out that the Museum Bey of the Bones (near Velidab) has been visited by total 35.440 visitors last year, while the House of Robevci and Gallery of Icons were visited by 5000 visitors. If half of the visitors of the Bey of the Bones would express an interest of visiting an expedition of the living world at the hotspot of Velidab, it would mean that such exhibition/museum would be visited by at least 17.720 people per year. The entrance ticket at the Bey of the Bones is estimated at 2 EUR. If the entrance ticket of the Velidab Museum/Exhibition is estimated at 1 EUR, then based on the calculations it would generate 17.720 EUR per year, for the management body and/or the local economy.

The results obtained through this assessment were disseminated to the stakeholders via an organized Workshop at the end of the Project, via one scientific paper published in an international journal, the media and through brochures and Project`s website. The target public included the local community, country government representatives, national government representatives, CSOs representatives, and member of staff from private companies and public and private scientific and research institutions. In addition, since the results indicate that there are needed changes in the form of protection of the site, we have developed an Initiative (a legal document based on the findings, scientific and economic), which is intended for the Central Government of the country and the local government comprising a Request for Proclamation of Velidab as Strict Nature Reserve. Advocacy messages were also developed to include Velidab in local development planning and budget allocation. We have also contacted and informed potentially interested and eligible institutions who may be interested in foregoing in management of a Strict Nature Reserve, including the oldest scientific institution in the country – the Hydrobiological Institute Ohrid.

Bibliography

Albrecht, C. & Wilke, T. 2008. Ancient Lake Ohrid: biodiversity and evolution. *Hydrobiologia*, 615:103-140.

Peh, K., Balmford, A., Bradbury, R., Brown, C., Butchart, S., Hughes, F., Stattersfield, A., Thomas, D., Walpole, M., Bayliss, J., Gowing, D., Jones, J., Lewis, S., Mulligan, M., Pandeya, B., Stratford, C., Thompson, J., Turner, K., Vira, B., Willcock, S. and Birch, J. (2013). TESSA: A toolkit for rapid assessment of ecosystem services at sites of biodiversity conservation importance. *Ecosystem Services*, 5, pp.51-57.

Zdraveski, K., Petri, L., Trajanovski, S., Beqiraj, S. and Loshkoska, T. (2016). FIRST CONTINGENT VALUATION OF LAKE OHRID BIODIVERSITY. *International Scientific Journal: Micro Macro & Mezzo Geo Information*, (6), pp.62-74.

Zdraveski, K., Trajanovski, S., Budzakoska-Gjoreska, B. and Trajanovska, S. (2015). THE NATURE OF ECOSYSTEM SERVICES VALUATION: LAKE OHRID - THEORY VS. REALITY. Review, 43(1), pp.147-157.

Ministry of Environment and Physical Planning Republic of Macedonia (2013). Breaking new grounds in conservation in the Republic of Macedonia: The economic case for long-term protection of the Ezerani Nature Park. [online] Skopje: Ministry of Environment and Physical Planning Republic of Macedonia. Available at: http://www.mk.undp.org/content/dam/the_former_yugoslav_republic_of_macedonia/docs/Ezerani.pdf