

EVALUATION OF THE PROBLEMS OF LAKE PAMVOTIDA ASSOCIATED WITH THE RESIDENTS OF THE CITY OF IOANNINA (GREECE)

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Abstract

Lake Pamvotida offers an array of significant advantages to the inhabitants of the city of Ioannina that are related both to the enhancement and recreation of the landscape, and the traditional usages of water. However, the ongoing intensification of water use, in combination with the pollution and faulty interventions that were undertaken in the past, have created problems in the lake as well as in the wider area. According to the inhabitants who live within the extent of the lake, the overuse of agricultural pesticides, lack of cleansing, increase of waste, as well as the inappropriate use of biological cleaning material are among the most serious problems that the surrounding lakeside region encounters. Lack of signposting and a museum of natural history also constitute part of the problem in the area. More particularly, inhabitants consider that the causes of their inability to solve these problems are to be found in the insufficient environmental education, scarcity of financial resources and lack of coordinated actions on the part of public stakeholders, such as the local administration, the prefecture administration and the central power, as well as private individuals and groups in the area, the union of hotel owners and/or freelance etc, environmental organizations and the local press, for instance. Based on the inhabitants' evaluations with respect to the significance of the problems facing the lake display little satisfaction concerning the actions that they have undertaken with regard to the protection of the lake.

Key words: stakeholders activities, protection, management of the lake.

Introduction

Lakes and rivers that are within easy reach of cities offer a variety of significant advantages both to the urban centers and, more particularly, to the people who live close to the water and, thus, can improve their quality of life (Tampakis et al. 2013). These advantages are closely related both to traditional quantitative usages of water such

as domestic use, for agricultural purposes, fishing, hunting, as well as protection against natural disasters (Pacione 2003, Tsiadikoudis et al. 2012) and benefits that are associated with the enhancement and recreation of the landscape's aesthetics (Lansford and Jones 1995, Klessig 2001, Vesterinen et al. 2010).

Generally, the fundamental role of water for the human life is recognized by water

legislative frameworks in developed societies (Scott and Coustalin 1995, Cullet 2011, Grafton and Hussey 2011), which set rights and obligations on its use, as a result of demographic expansion, use-oriented conflicts and perceived problems of scarcity (Kuks 2004, Pettella et al. 2012). However, the ongoing intensification of water use of lakes and rivers threatens the balance of their sensitive ecosystems in a variety of areas of our planet and more evidently in underdeveloped countries (Eiswerth et al. 2011). Lake Pamvotida in the prefecture of Ioannina constitutes a case study in Greece. The harmonic coexistence of the city and the lake has been disturbed over the last years due to the growth of the city of Ioannina and its surrounding area (Albanis et al. 1986, Panou 2011). The industrial and especially the agricultural production have increased rapidly, improving the standards of living of the inhabitants in the area but at the same time they cause ecological problems both in the lake as and the wider region (Lambrou 1998, Vrigka 2003). Nowadays, the lake is confronting significant problems of eutrophication that are related to the elimination of water transparency, the characteristically unpleasant odor, death of fish, reduction of fishing, excessive increase of aquatic vegetation, etc. The increased figures of phosphorus, nitrogen and chlorophyll-a are indicative of the eutrophication in the lake (Albanis et al. 1986).

In the past, many interventions were undertaken and, although being resolved with initially good intentions, they have had a negative impact on the ecosystem of the lake on a long-term basis (Barba 2008, Panou 2011). Such interventions as the drainage of the Lapsista (a small lake that united with Lake Pamvotida), the construction of lakefront roads and low walls surrounding

the lake acted as dams that closed some water sources up and obstructed the incoming of clean water into the lake. The polders used for the configuration of places of public utility (squares, etc.) have contributed, in the long-term, to a change in the natural coast, a reduction of the lake surface and its total water volume, as well as the limitation of its cleansing potential. Most importantly they have changed the society's perception and image of the lake.

The aim of the present research was to study how inhabitants in Ioannina perceive the problems that have been caused due to the faulty interventions and improper management of the lake. The evaluation of these problems is very important for their resolution, as it is believed that only when problems have ultimately become a source of constant disturbance in the life of the greatest part of local population it is possible that unanimous decisions for their solution will be taken and the inhabitants themselves will be even more willing to aid both ethically and financially.

Materials and Methods

The research has been conducted with the use of individual interviews in the municipality of Ioannina and random sampling has been applied for the sake of their simplicity in procedure (Damianos 1999, Matis 2001, Kalamatianou 2000).

The population ratio that is also impartial evaluation of the real ratio of the population p and the assessment of the standard error of the population ratio of the S_p without correction of the finite population as the sampling fraction is small, has been calculated using formulae of simple random sampling.

To calculate the size of the sample we thought it would be necessary to conduct pre-sampling with a sample size of 50 individuals. The size of this sample was calculated based on the formulae of simple random sampling (where $t = 1.96$ and $e = 0.048$) (Kalamatianou 2000, Matis 2001). Even though simple random sampling without off reset was used, the correction of the finite population can be omitted, as the sample size n is small in relation to the population size N (Pagano and Gauvreau 2000). More specifically, the sample size was set to 417 individuals.

The data collection was carried out during July to December of 2009. The individuals of the sample were then located and personal interviews were conducted. In some cases, in which this was not possible to be done, we followed the same procedure in the selection of new units of sampling.

The total number of questions which were reported to be possible problems of the lake constitutes a multi-theme variable on which reliability analysis was applied. In particular, in order to find out the internal reliability of a questionnaire (Frangos 2004), i.e. if our data have the tendency to measure the same thing we used the alpha coefficient (or reliability coefficient α -Cronbach (Howitt and Cramer 2003). If the alpha coefficient is 0.70 or higher it is regarded satisfactory (Howitt and Cramer 2003), and if it is higher than 0.80 it is regarded very satisfactory. In real practice, it is frequent that lower reliability coefficients, that are with values no higher than 0.60, are also accepted (Siardos 1999).

However, the checking must not only be reliable, but credible as well and this is performed through the application of factor analysis (Siardos 1999). Factor analysis is a statistical method which aims

to discover the existence of factors, common within a group of variables (Sharma 1996). In particular, we used the method of principal components which is based on the spectral analysis of the variance table (correlation) (Djoufras and Karlis 2001). Regarding the significance of the principal components, the criterion which was used was the one suggested by Guttman and Kaiser (Cattell 1978, Frangos 2004), according to which, the limit for the collection of the appropriate number of the principal components is determined by the values of typical roots, equal or higher to one. Furthermore, we also used the matrix rotation of the main factors applying the Kaiser's method of maximum variance rotation (Harman 1976).

Area of Study

Lake Ioannina or the Pamvotida or the Pamvotis (the name Pamvotis first appears in the 12th century commentary on the Odyssey of Eustathius of Thessaloniki) is Europe's second-oldest lake and the largest lake of Epirus, located in the central part of the Ioannina regional unit in northern Greece. The city of Ioannina to the west and the town of Perama to the north are urban settlements fringing the lake, while the remaining of its periphery is comprised of farmland. The lake features small fishing ports and a boating port. There is a regular boat service to the Island of Ioannina, where Ali Pasha was hiding during the last days of his reign, and it is situated near the northern shore. The Greek National Road 6 surrounds the northern half of the lake. The magical scenery of Lake Pamvotida is a true gem for the city of Ioannina and a pole of attraction for the region of Epirus in northern Greece. Its calm waters constitute the

ideal setting for the hosting of the water ski tournament.

Lake Ioannina is home to the Tsimia, a species of fish endemic to the lake. Two bryozoan species have recently been reported from the lake (Massard and Geimer 2008).

Demographic characteristics

With regard to the information sought after concerning the demographic characteristics of the population of Ioannina, Table 1 shows that most of them are graduates of

secondary education, and their age ranges between 18–30 years old, private employees, married and with no children.

Results of the Study and Discussion

The problems of Lake Pamvotida

Since 1900 up to the present day, the ecosystem of Lake Pamvotida has undergone

Table 1. Citizens' Socio-demographic profile.

1. Gender					
Male		Female			
49.1 % (S _p =0.0179)		50.9 % (S _p =0.0179)			
2. Age					
18–30		31–40		41–50	
		>50		No answer	
20.4 % (S _p =0.0176)		50.4 % (S _p =0,0153)		23.3 % (S _p =0,0178)	
		5.4 % (S _p =0,0069)		0.5 % (S _p =0.0024)	
3. Marital Status					
unmarried		married		divorced or widowed	
		did not answer the question			
23.2% (S _p =0.0181)		64.4% (S _p =0.0208)		12.3% (S _p =0.0196)	
		0.2% (S _p =0.0015)			
4. Childhood					
Without children		one child		two children	
		three children		more than three children	
29.1 % (S _p =0.0213)		26 % (S _p =0.0171)		30 % (S _p =0.0171)	
		10.4 % (S _p =0.0098)		4.6% (S _p =0.0062)	
5. Educational level					
Primary School		Lower Secondary School		Technical School	
		Upper Secondary School		Technological education	
4.9 (S _p =0.0053)		5.4 % (S _p =0.0079)		16.1 % (S _p =0.0120)	
		22.8 % (S _p =0.0196)		20.5 % (S _p =0.0169)	
				28.9% (S _p =0.0231)	
6. Profession					
private employee		public servants		self-employed	
		students			
37 % (S _p =0.0144)		16.5 % (S _p =0.0168)		18.2 % (S _p =0.0197)	
		6.3 % (S _p =0.0114)			
unemployed		housewives		farmers or stock-breeders	
		pensioners		did not answer the question	
3 % (S _p =0.0059)		11,6 % (S _p =0.0083)		3 % (S _p =0.0059)	
		4 % (S _p =0.0068)		0.4 % (S _p =0.0021)	
7. Annual income					
<5,000 euro		5,000–10,000 euro		10,001–15,000 euro	
		15,001–20,000 euro		>20,000 euro	
No answer					
5.1 % (S _p =0.0101)		7.5 % (S _p =0.0058)		26.5 % (S _p =0.0218)	
		21.4 % (S _p =0.0189)		5.4 % (S _p =0.0074)	
				34 % (S _p =0.0199)	

significant changes, although the lake has been integrated within the European Ecological Network of Special Conservation Areas 'Natura 2000' (Environment DG – European Commission 2001).

The surface of the lake has been reduced by 25–30 % and its water volume has also been reduced by more than 32 % while the reduction of its average depth is measured around 57 % (Management Agency of Lake Pamvotida 2012). With respect to the drop of the water level in the lake, 41 % of the inhabitants in the area claimed that this problem is moderate, while 25.7 % stated that it is a big problem (Table 2).

The mound that was raised around the lake of Ioannina during the period of 1969–1974 as well as the respective concrete scaffolding delimited the lake arbitrarily and also detracted vital areas from the lake that are up to 10 % of its surface such as the temporarily flooded wet pastures in the north (Amfithea-Perama) and the currently

poldered plots in the south extending from Ioannina to the Katsika area. It can be stated that 50 years ago, the lake surface was a lot more expanded than it is nowadays. The arbitrary delimitation of the lake using the artificial scaffolding has led to polders and plotting, mainly upon the south section of the area (Management Agency of Lake Pamvotida 2012). Inhabitants' perception of the problems the area faces due to arbitrary constructions was reported to be as moderate in 27.8 % of the cases and big (Fig. 1), in 22.8 %.

Referring to the problem of lack of policing in the area of the lake, its surveillance seems to be relatively important to the inhabitants of the area, who claim that the lack of policing may have balanced the situation. In 31.4 % of the cases, inhabitants consider this problem to be moderate, another 23.5 % big and 17.7 % very big. However, the lack of surveillance in the lake is the main cause of a series of other problems that have appeared in the

Table 2. Evaluation of problems in the Pamvotida lake by the citizens.

Problem	Very little		little		Moderate		Big		Very big		No answer	
	%	S _p	%	S _p	%	S _p	%	S _p	%	S _p	%	S _p
Drop of the water level	7.4	0.0128	17.7	0.0187	41.0	0.0241	25.7	0.0214	7.7	0.0130	0.5	0.0034
Arbitrary Constructions	13.7	0.0168	20.9	0.0199	27.8	0.0219	22.8	0.0205	13.7	0.0168	1.2	0.0053
Lack of Surveillance/ Policing	9.8	0.0146	16.3	0.0181	31.4	0.0227	23.5	0.0208	17.7	0.0187	1.2	0.0053
Presence of Rubbish and lack of cleansing	4.3	0.0100	7.7	0.0130	22.1	0.0203	33.1	0.0230	32.6	0.0230	0.2	0.0024
Inappropriate use of biological cleansing	6.7	0.0123	9.4	0.0143	21.1	0.0200	32.6	0.0230	28.1	0.0220	2.2	0.0071
Use of agricultural pesticides	4.3	0.0100	6.5	0.0121	16.1	0.0180	31.4	0.0227	39.8	0.0240	1.9	0.0067
Lack of an Exhibition Venue – Natural History Museum	5.0	0.0107	11.3	0.0155	33.1	0.0230	29.7	0.0224	20.1	0.0196	0.7	0.0041
Lack of signposting	4.6	0.0102	12.2	0.0160	27.8	0.0219	35.3	0.0234	19.9	0.0196	0.2	0.0024
Illegal Hunting	8.2	0.0134	19.4	0.0194	28.3	0.0221	25.7	0.0214	17.7	0.0187	0.7	0.0041
Overfishing	7.2	0.0127	19.2	0.0193	36.7	0.0236	26.6	0.0216	10.3	0.0149		



Fig. 1. Polders in Lake Pamvotida (<http://www.lakepamvotis.gr/articles/drasis>).

lake in the last years and are related to the lack of cleansing and the increase in the quantity of waste in and around the area of the lake.

The creation of the mound and the scaffolding has led to a dramatic restriction of the potential of natural self-cleansing of the lake. The coast that once existed in front of the gangway or pier/dock, where the lake washed up waste and deposited organic material which was oxygenated by the waves, and was rising every time north winds were blowing, no more exists. Nowadays, the whole area has been poldered with concrete and a municipality park has been constructed in this site. The cleansing of Lake Pamvotida with the aid of mechanical means is scarce for the lack of organized cleansing planning. There are only two pieces of machinery that clean the water and this is done only in cases of water pollution reaching the highest level. As for the question concerning the lack of cleansing and presence of waste in the lake, 33.1 % of the participants in the study believes that it is a big problem, and 32.6 % of the inhabitants

answering that it is a very big problem. It was only in 1992 when biological cleansing started in Ioannina. However, all urban sewage from the island, as well as from other lakefront settlements pours out in the Pamvotida, since these areas have never been connected with the system of biological cleansing and most sewers are located below the surface of the lake. Moreover, inhabitants' allegations about concerning the sewage leakage from the residences

in the city, but the authorities state that they are unaware of the accurate source of the sewage. The municipality and the Municipality Agency of Water Supply and Sewage (MAWSS) insist that the problem is attributed to the illegal connections to the system of biological cleansing, while the prefecture claims that the central tube has waterproof problems that have never been dealt with (Management Agency of Lake Pamvotida 2012). In regard to the question of the inappropriate use of biological cleansing in the lake, results show that the existence of this problem is a big concern to the inhabitants. Therefore, 32.6 % of the participants answered that it is a big problem and 28.1 % said that the problem is very big (Fig. 2).

The lake is largely burdened with increased quantities of nitrogenous and phosphorus-based pesticides that are flushed from agricultural crops. The quantities of pesticides and insecticides are considered to have been quadrupled in the average use. For this reason, inhabitants consider pesticides to be the most

important problem of all. More specifically, 39.8 % of the participants notes that this problem is very big and 31.4 % ($S_p = 0.0227$) of the inhabitants thinks that this problem is big as it leads to the eutrophication of the lake that is directly related to the extinction of fauna and the reduction of water quality.

About a year ago, in April 2012, the information centre of Lake Pamvotida was founded. Its contribution is deemed to be important. However, the foundation of the Centre for the Protection of Natural Environment – Museum of Natural History dedicated to the study, conservation and protection of natural environment can establish a new line of educational policy for the preservation of natural environment and educate tens of visitors on a daily basis, mostly children of school age. The primary purpose of such a place should be the collection and preservation of every species of fauna, flora and mineral wealth. Their exposition offers an opportunity for study, research, education and recreation. Visitors have the possibility to come in contact with the kingdom of plants and animals, in order to observe the interaction of plant and animal world as well as the interdependence and balance of the ecosystems. The lack of an exhibition venue and of a Natural History Museum of the lake is considered to be a disadvantage for the area according to the inhabitants. Consequently, 33.1 % of the inhabitants classify this problem as moderate, 29.7 % of them stated that this problem is big and 20.1 % of the individuals asked, stated that this problem is very big. Similarly,



Fig. 2. Illegal sewage leakage
(<http://www.lakepamvotis.gr/limne-kai-antr>).

these percentages are relative to those who believe that lack of signposting for the flora and fauna of the area is a grave omission. According to their responses, 35.3 % of the inhabitants believe that lack of signposting is a big problem, 27.8 % of them report it as a moderate problem.

The Lake is also a place where many species of birds, such as ducks, geese, and coots spend their winter there, while ferruginous (*Aythya nyroca* Gldenstdt, 1770) has additionally been observed, which is a globally endangered species. Their populations are smaller compared to those of the past. Hunting is altogether prohibited in the lake. Nevertheless, according to many allegations, made on behalf of people who are inhabitants of the area, there are references to systematic hunting carried out every afternoon in the little island, in the Katsikas area and in the Perama-Amfithea area even with the use of a boat inside the lake. With respect to the question concerning illegal hunting, the responses we elicited reinforce their allegations making reference to a visible danger. More specifically, 28.3 % of the participants said that this problem is moderate while 25.7 % of the inhabitants stated that it is big.

Excessive exploitation of natural wealth and overfishing also cause problems to the ecosystem of the lake. Nevertheless, the responses concerning this specific problem showed that 36.7 % ($S_p = 0.0236$) considers overfishing a problem of moderate significance, 26.6 % of the inhabitants stated that it is big. In an open-ended question regarding other kinds of problems that they can spot, only 10 % of them provided an answer. These problems are related with the allocation of responsibilities for the management of the lake, inhabitants' indifference and lack of governmental willingness to take action. Furthermore, problems are found in regard to the lack of delimitation of the lake, the encroachment of coastal areas, the excessive number of nightclubs, that lead to degradation of the area, the lack of advertising of the lake, its consequent tourist decline and the concentration of sediment in the seabed. Problems were also reported, on the subject of the reduction of clean water from sources so that the lake water can be renewed and the lack of enriching of the lake with fish, the intense movement of boats within the lake, the traffic jams in the vicinity of the lake as well as the presence of noise pollution in the area, the lack of a cycle lane and of a sporting centre.

For this multi-form variable we applied a reliability analysis after we have done the necessary checks. Reliability coefficient α is 0.8510 and this result constitutes strong evidence that the grades of the scale are logically consistent, i.e. our data affirm this to measurement. Besides, this is also confirmed by the significantly high individual correlation coefficients α , after the deletion of any infrastructure, an increase in correlation coefficient can not be achieved.

Moreover, before we proceed on with the application of factor analysis, the necessary checks were done. The index Keiser-Meyer-Olkin (KMO) has a figure of 0.823. It is suggested that the index KMO should be bigger than 0.80, however figures bigger than 0.60 are also accepted (Sharma 1996). Furthermore, Bartlett's sphericity checking rejects the null hypothesis so that the correlation table is unitary and that the coefficients of partial correlation are low. Also the suitability measures taken for the sampling procedure (MSA) have range from high to very high figures, which supports the view that the paradigm of factor analysis is acceptable.

In Table 3 we can see that the factors that were extracted were three and they all have a characteristic root bigger than 1. Additionally, the second column shows the percentage of variation that is attributed to every factor while the third column shows the percentage of variation that is attributed to every factor succeeding rotation. The bigger the loading of a variable the more this factor is responsible for the total variation of the grades taking the variable into consideration. The variables that 'belong' to every factor, are those for which the loading (columns 1, 2, 3) is bigger (than the figure of 0.5) in this factor.

Factor 1 includes the variables 'arbitrary constructions', 'lack of surveillance – policing' 'presence of rubbish and lack of cleansing', 'inappropriate use of biological cleansing' and 'use of agricultural pesticides' and we can name it as 'Pollution problems that are related to the supervision and management of the lake'.

Factor 2 can be named as 'Problems related to the protection of fauna' and includes the variables 'illegal hunting' and

‘overfishing’. However, it would not be wrong if problems that are associated with ‘arbitrary constructions’ and the ‘reduction of water level’ could also be included in this factor even if their figure is below 0.5. The second variable with the same figure is also included in Factor 1. Therefore the two variables can be considered as act as bridges between Factor 1 and Factor 2.

Factor 3 includes the variables ‘lack of an Exhibition Venue – Natural History Museum’ and ‘lack of signposting’ and we can name it as ‘Advertising and Prominence Problems of the lake’.

Actions taken on the part of Local Stakeholders for the protection of the lake

It is known that one of the most fundamental elements in the formulation of environmental policy is the approach adopted and the level of participation exhibited by all interested parties – stakeholders and this is because they act differently and according to their values, knowledge and interest (Duerksen et al. 1997). The improvements that are required so that the quality of nature can be protected pertain to the political and local financial interests even for protected areas (Bachert 1991). As a con-

Table 3. Table of Factor Loadings, before and after rotation concerning the problems of the lake.

Variable	Factor loadings					
	Before rotation			After rotation		
	1	2	3	1	2	3
Reduction of the water level	0.533	–0.222	–0.133	0.421	0.417	0.016
Arbitrary Constructions	0.699	–0.346	–0.014	0.658	0.418	0.004
Lack of Surveillance/ Policing	0.664	–0.004	0.168	0.564	0.216	0.323
Presence of Rubbish and lack of cleansing	0.708	–0.347	0.349	0.850	0.118	0.077
Inappropriate use of biological cleansing	0.666	–0.235	0.332	0.759	0.100	0.153
Use of agricultural pesticides	0.758	–0.003	0.195	0.645	0.244	0.371
Lack of an Exhibition Venue – Natural History Museum	0.555	0.668	0.144	0.154	0.120	0.858
Lack of Signposting	0.565	0.677	0.117	0.144	0.146	0.865
Illegal Hunting	0.702	0.100	–0.581	0.160	0.856	0.286
Overfishing	0.671	–0.085	–0.574	0.229	0.850	0.112

sequence, one of the first priorities in the environmental policy should be the effective management and improvement of the already existing network of the protected area. Sufficient funding is basically the same thing as political support (Eidsvik 1977). In our case here, funding for this purpose is insufficient as it is shown by the dissatisfaction expressed by most of the inhabitants in Ioannina in their responses when asked to evaluate various stakeholders – groups that participate in actions for the protection of the lake (Table 4).

More specifically, in Table 4, it seems that citizens of Ioannina evaluate the actions taken on the part of local administration rather negatively as the 24 % of the cases are not satisfied at all and the 53.5 % of the cases seem to be very little

Table 4. Satisfaction degree for the stakeholders activities for the protection of the lake.

Stakeholders (Institution or group)	Absolutely		Very much		A Little Bit		Not at all		No answer	
	%	S_p	%	S_p	%	S_p	%	S_p	%	S_p
Local Administration	3.4	0.0080	18.9	0.0192	53.5	0.0244	24.0	0.0209	0.2	0.0024
Prefecture Administration	7.9	0.0132	24.9	0.0212	48.7	0.0245	18.2	0.0189	0.2	0.0024
Central Government (State)	2.4	0.0075	7.7	0.0130	49.2	0.0245	40.3	0.0240	0.5	0.0034
Groups of citizens (e.g. innkeepers' union, freelance union)	1.9	0.0067	13.7	0.0168	52.8	0.0244	30.5	0.0225	1.2	0.0053
Non-governmental ecological organizations	2.6	0.0078	17.7	0.0187	57.3	0.0242	20.9	0.0199	1.4	0.0053
Local Press	4.6	0.0102	24.2	0.0210	57.3	0.0242	13.2	0.0166	0.7	0.0041

satisfied. However, they evaluate the actions taken by administration of the prefecture a bit more positively as most of the inhabitants (48.7 %) state that they are a little bit satisfied and 24.9 % of them are very satisfied.

With respect to the actions taken on the part of central government concerning the protection of the lake the biggest percentage of the citizens (49.2 %) says that they are a little bit satisfied while 40.3 % states that they are totally dissatisfied. With respect to the actions taken on the part of different local stakeholders such as the innkeeper's union, freelance union, etc the inhabitants display some satisfaction in a percent of 52.8 % while the 30.5 % of the cases are not at all satisfied with them.

With respect to the actions taken on the part of ecological organizations concerning the protection of the lake, it seems that the inhabitants are not satisfied at all (20.9 %) and around 57.3 % seem to be a little bit satisfied. Oftentimes, the non-governmental organizations (NGO) try to get support in order to organize actions that are not directly related to the preservation

of the lake. Their rationale is that if they offer to the inhabitants programs that can fulfill their needs then they are even more willing to cooperate with NGOs and take part in actions adopted for the protection and upgrade of the lake. The inhabitants' in Ioannina hold a positive view with respect to the actions taken on the part of local press concerning issues of the lake. Their views with regard to these actions show that 57.3 % of the inhabitants are a little bit satisfied and 24.2 % of them are very satisfied.

Afterwards, the reliability analysis was applied for these questions after having done all necessary checks. The figure of correlation coefficient α is 0.796 and this constitutes strong evidence that the grades of the scale are logically consistent, i.e. the data have the tendency to measure the same thing. This is also supported by the significantly high individual reliability coefficients α when after the deletion of any variable, a reliability coefficient increase cannot be achieved.

Moreover, before we move to the application of factor analysis all necessary checks were done. The index Kaiser-

Meyer-Olkin has a figure of 0.768. Furthermore, Bartlett's sphericity checking rejects the null hypothesis in that the correlation table is unitary and that the coefficients of partial correlation are low. Also the suitability measures taken for the sampling procedure (MSA) vary from high to very high figures, which support the view that the paradigm of factor analysis is acceptable.

The factors that were extracted were two and they have a characteristic root bigger than 2. Table 5 shows the loadings which are the partial correlation coefficients of the six variables with each of the two variables that have come out of the analysis.

Factor 1 includes the variables 'local administration', 'prefecture administration' and 'central government (state)' and we can name it as 'stakeholders of state administration'. Factor 2 can be named as 'stakeholders that affect decisions taken by the administration' and includes the variables 'groups of citizens (e.g. inkeepers' union, freelance union, etc)', 'non-governmental ecological organizations' and 'local press'.

More specifically, citizens regard insufficient environmental education (50.6 %) as one of the most important obstacles for the solution of the problems in the lake (Fig. 3), followed by lack of financial funding (45.1 %) and lack of coordinated actions for the solution of the issues that accrue in relation to the area of the lake (41.7 %). On the other hand, citizens consider insufficient updating

(20.1 %) and non-participation of citizens in the making of decisions concerning the lake (25.2 %) to be obstacles of minor importance.

Conclusions

Over the last few decades, huge changes have been brought about in agricultural and intensive farming, which have had an impact on the environment and the quality of life of people who have been living near lakes (Seihas et al. 2012, Tampakis et al. 2013). An example of this is Lake Pamvotida which is an integral part of the city of Ioannina affecting its inhabitants' lives. The most important problems that inhabitants of the lake are facing are the excessive use of agricultural pesticides, lack of cleansing and the increase of waste in and around the lakefront area as well as the inappropriate use of biological cleansing. Moreover, lack of signposting and a Natural History Museum are also big problems for the inhabitants of this

Table 5. Table of factor loadings, before and after rotation related to the stakeholders' actions.

Variable	Factor loadings			
	Before rotation		After rotation	
	1	2	1	2
Local Administration	0.801	-0.400	0.878	0.176
Prefecture Administration	0.784	-0.327	0.819	0.224
Central Government (State)	0.730	-0.311	0.767	0.204
Groups of citizens (e.g. inkeepers' union, freelance union)	0.668	0.290	0.349	0.639
Non-governmental ecological organizations	0.540	0.650	0.027	0.844
Local Press	0.681	0.380	0.303	0.719

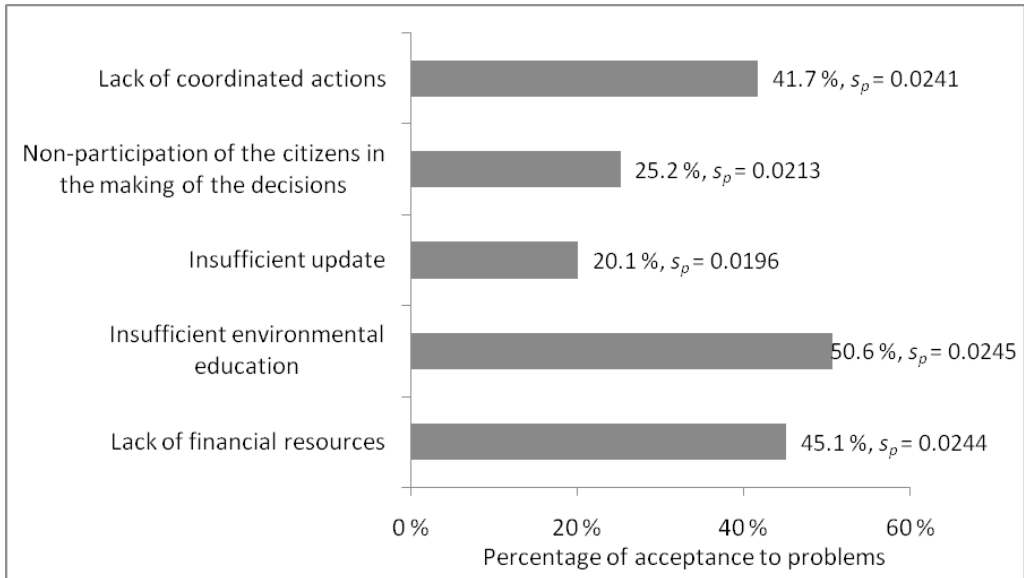


Fig. 3. Citizens' acceptance of the obstacles for the solution of problems in the lake.

area. The reduction of water level, over-fishing, illegal hunting and arbitrary constructions along the lake were evaluated as problems of moderate importance.

It is only until recently that necessary attention has been given to these problems and great efforts have been employed for their solution. Ignorance on the part of the inhabitants of Ioannina about the adverse consequences that these problems will have on their quality of life and their lust for more arable land have led to the drainage of Lapsista lake. The consequences of the ecological disaster are obvious up to the present day. The flora and fauna of the ecosystem have been greatly affected and the quality of the water in the lake has been downgraded.

What is more, the lake has been encroached by the local stakeholders as well as by individuals who have been dealing with a variety of activities in the surrounding area that result in profile distortions of

the area as the time goes by. The human factor is responsible for the increase of filth that inserts into the lake and, consequently causes a significant increase of the phenomenon eutrophication. The reduction of water level and water volume of the lake as well as the fact that its water is never renewed necessitate its enrichments with water from other areas. Nevertheless, no actions have ever been taken in order this problem to be solved. However, it is important that the actions that are to be assumed in the future will not only be related to the improvement of the environment and to the inhabitants' quality of life but they also have to be based on the implementation of financially viable activities and on the actual participation of the local population in the decision-making process (Seihas et al. 2012). Their participation in this process of making ecological decisions is mostly reported in these decisions whose results can affect in one way

or another local community in its entirety (Giannoulas et al. 2004). Citizens' involvement is essential in broadening the conceptualization of the lake values and the implementing management plans (Klessig 2001).

The citizens state that they are very little satisfied considering the actions adopted for the protection of the lake by state stakeholders such as the local administration, the prefecture administration, the central government and by other local stakeholders such as innkeepers' union, freelance union, etc, ecological organizations and the local press. What is more, among the most important obstacles for the solutions of these problems are the insufficient ecological education, the lack of financial resources and the lack of coordinated activities.

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