Project "Landscape Scale Conservation in the Prespa Lake Basin – Transboundary Species and Habitat Conservation Action Plans"

Status Survey and Conservation Action Plan for the Caves and Cave Bats of Prespa

E. Papadatou, B.Gichevski and A. Stojanov

January 2012

Status Survey and Conservation Action Plan for Caves and Cave Bats of Prespa

The present Conservation Action Plan is the product of data analysis carried out into the framework of the project "Landscape Scale Conservation in the Prespa Lake Basin – Transboundary Species and Habitat Conservation Action Plans. The project was undertaken within the UNDP project "Integrated ecosystem management within the Prespa lake watershed".

Report prepared by:

Dr. E. Papadatou, Bat expert, Greece

M.Sc. B. Gichevski, Speleologist, Macedonian Ecological Society, Skopje, Macedonia

A.Stojanov, Junior expert for bats, Macedonian Ecological Society, Skopje, Macedonia

V. Avukatov, GIS specialist, Macedonian Ecological Society, Skopje, Macedonia

M.Sc. Brajanoska, Macedonian Ecological Society, Skopje, Macedonia

Dr Ljupcho Melovski, Macedonian Ecological Society, Skopje, Macedonia

Dr Slavcho Hristovski, Expert for cave invertebrate fauna and ground beetles, Macedonian Ecological Society, Skopje, Macedonia

Process facilitation and document editing by:

Gabriel Schwaderer

Lawrence Jones Walters

Cover photo: Biljana Gichevski

Abbreviations

ASPBM:	Albanian Society for the Protection of Birds and Mammals
CAP:	Conservation Action Plan
EUROBATS:	Agreement on the Conservation of Populations of Bats in Europe
EIA:	Environmental Impact Assessment
IUCN:	International Union for Nature Conservation
NGO:	Non-governmental organization
PA:	Protected Area
PPCC:	Prespa Park Coordination Committee
SAP:	Strategic Action Programme
SPP:	Society for the Protection of Prespa
TDA:	Transboundary Diagnostic Analysis
TMS:	Transboundary Monitoring System
TPP:	Transboundary Prespa Park
TTT:	Technical Task Team
UNDP:	United Nations Development Program
MCWG:	Monitoring and Conservation Working Group
WAMP:	Women Association of Micro Prespa

Contents

Summary

This document summarises the knowledge on important caves and cave-dwelling bat populations, as well as providing some information on cave invertebrate fauna in the area of Prespa, and defining a list of conservation and research priorities to ensure their favourable conservation status across national boundaries. Overall, 15 species of bat have been recorded in Prespa caves. These roost in caves along or near the shores of the Prespa lakes or in the surrounding mountains and include some of the most threatened European species. Despite the generally well preserved condition of the caves, a number of factors represent threats to the bats and their cave habitats, including roost disturbance through unauthorised public access and the public ignorance in relation to the ecological role and importance of caves and bats. The lack of enforcement of existing legislation is an additional problem. It is therefore crucial to preserve the caves and to improve the conditions at certain locations.

In the first part of this report (PART I), we provide background information including a brief description of the study area, the physical characteristics of selected underground sites (caves, rock shelters) and the bat fauna of caves that are important as bat roosting sites. We further present the conservation and legal protection status of caves and bats. We also provide an overview of the Transboundary Monitoring System elaborated within the framework of the SPP-UNDP project on the development of a transboundary monitoring system for the Transboundary Prespa Park. In the second part (PART II) we describe the threats and limiting factors to which caves and bats are exposed and we focus on the aims, objectives and recommended actions for their conservation in the area. We first recommend research and survey actions to increase our scientific knowledge and understanding of caves and bats in the area of Prespa linked to their conservation. We then recommend appropriate conservation management actions based on currently available knowledge and experience. We finally provide recommendations to increase public awareness and support towards the conservation of Prespa caves and bats. Because bats know no borders, actions should be designed and implemented on a transboundary level. The recommendations in the report will require financial support and political will for their successful and sustainable implementation.

Much of the text and particularly the parts referring to the bats of Prespa have been adapted from the “Status Survey and Conservation Action Plan for the Bats of Prespa” by Papadatou *et al.* (2011). The text has further been enriched with data and information acquired over the course of this project, as well as bibliographical resources.

PART I. BACKGROUND INFORMATION

1. Introduction

The aim of the GEF Prespa Regional Project is to mainstream ecosystem management objectives and priorities into productive sector practices and policies in the Prespa watershed. The project is designed to strengthen capacity for restoring ecosystem health and conserving biodiversity at the local, national and trans-boundary levels in the three countries sharing the Prespa region by piloting ecosystem-oriented approaches into spatial planning, water management, agriculture, forest, fisheries and protected areas management.

On the basis of: i) the Technical Assessment Report for the Prespa Park Coordination Committee in transboundary ecosystem management (2007); ii) the Technical Task Team (TTT) assessment and evaluation of national information in support of the Transboundary Diagnostic Analysis (TDA); iii) the development of a Strategic Action Programme (SAP) in the Prespa Lakes Basin - National Report; iv) the Assessment prepared in the frame of the Project - Consulting Services of training on Conservation and Action Planning for Priority Transboundary Habitats and Species in the Prespa Lakes basin-Preparatory Phase (2009); and v) proposed selection criteria (DEKONS-EMA 2009), three priority habitats and three priority species have been proposed for protection. Findings and proposals for protection of these priority habitats and species were presented during the session of the Monitoring Committee for Prespa Park, on 26 November 2009. The following species and habitats were adopted as priority and relevant status papers (DEKONS-EMA 2010) were prepared for them, namely:

- Species: Mountain tea (*Sideritis raeseri*)*;* Prespa barbel *(Barbus presepensis)* as key species enforcing the protection of other endemic fish species; and Brown bear *(Ursus arctos).*
- Habitats: Grecian Juniper woods; Reedbeds; and Caves not open to public*.*

This Conservation Action Plan (CAP) presents the overall conservation goal, institutional setup, threats and proposed conservation actions for selected caves and cave fauna in the watershed of Prespa.

1.1 Transboundary Prespa Park

The most prominent characteristic of the Prespa watershed is its transboundary nature, which is manifested in various ways; e.g. through the similarities and links between the three sides of Prespa related to its geography, geology, hydrology, climate, biological features and nature conservation aspects (see below); but also when studying contemporary and historical human-related issues. This important element of the Prespa watershed has been the basis for the commitment of the three states to support sustainable development in the area, officially expressed through the *"Declaration on the creation of the Prespa Park and the Environmental Protection and Sustainable Development of the Prespa Lakes and their surroundings"*, signed by the Prime Ministers of Albania, Greece and the FYR of Macedonia on 2 February 2000. With that declaration, the entire Prespa Lakes watershed was included in the Transboundary Prespa Park (TPP), the first transboundary protected area in the Balkans. Based on that declaration, the Prespa Park Coordination Committee (PPCC) and its Secretariat were established, and forwarded important actions to support transboundary cooperation in Prespa. The TPP includes: the two Prespa National Parks (in Greece and Albania), parts of the Galicica and Pelister National Parks, the Ezerani protected area and Leskodol landscape protected area (in FYR of Macedonia), both Prespa lakes (designated as Wetlands of International Importance under the Ramsar Convention), as well as the remaining territories in the Prespa watershed which are not protected by other conventions or national legislations.

Among other agreements between the three states concerning Prespa, it is important to note the two latest ones: a) the "Joint Statement of the Prime Ministers of the three States sharing the Prespa Lakes watershed" of 27 November 2009 (Pyli, Greece); and b) the recent "Agreement on

the Protection and Sustainable Development of the Prespa Park Area", signed by the Ministers of the Environment of three countries and the European Commissioner for the Environment (2 February 2010). The latter aims at further supporting transboundary conservation issues through developing specific principles and mechanisms of cooperation; these have included the establishment of the Prespa Park Management Committee (with its Secretariat) and the Working Group on Water Management.

Transboundary cooperation between the three countries in Prespa has been achieved at various political levels (e.g. PPCC, Municipalities), but also at the level of nature conservation mainly through small-scale projects involving protected area management authorities, local NGOs and scientists active in Prespa. Whilst a lot more needs to be done, it is important to be aware that an active basis for cooperation has already been created, and specific organizations and people have the will to further promote it. It is within this framework that the current Conservation Action Plan (CAP) for the conservation of caves and their bat fauna in Prespa lakes watershed has been developed.

1.2 The Prespa Lakes' Watershed

The Prespa lakes' watershed is located in the central-western part of the Balkan Peninsula and it is shared between Albania, Greece and the FYR of Macedonia (Fig. 1). Geographically, it is divided into two sub-watersheds: the Greater Prespa Lake (synonyms: Macro Prespa Lake, Liqeni i Prespes, Limni Megali Prespa, Golemo Prespansko Ezero) and the Lesser Prespa Lake (synonyms: Micro Prespa Lake, Liqeni i Prespes, Limni Mikri Prespa or Malo Prespansko Ezero). The largest part of the Greater Prespa Lake watershed is situated in the FYR of Macedonia, while Albania and Greece share a smaller part (Fig. 2). The Lesser Prespa Lake watershed is shared between Greece (approx. 80% of the watershed) and Albania (Fig. 2). The territory of the Prespa watershed belongs to three local administrative units, one in each of the three countries: the municipality of Resen - FYR of Macedonia, the municipality of Korçë (mostly community Liqenasi) - Albania and the municipality of Florina - Greece. About 30,000 inhabitants live in the Prespa region. The total surface area of the combined sub-watersheds and lakes is 1218.1 km^2 (Perennou *et al.* 2009), but according to Chavkalovski (1997) the total area of the hydrological basin is 1349.2 km^2, out of which 1095.3 km^2 belong to the Greater Prespa Lake and 254.0 km^2 to the Lesser Prespa Lake.

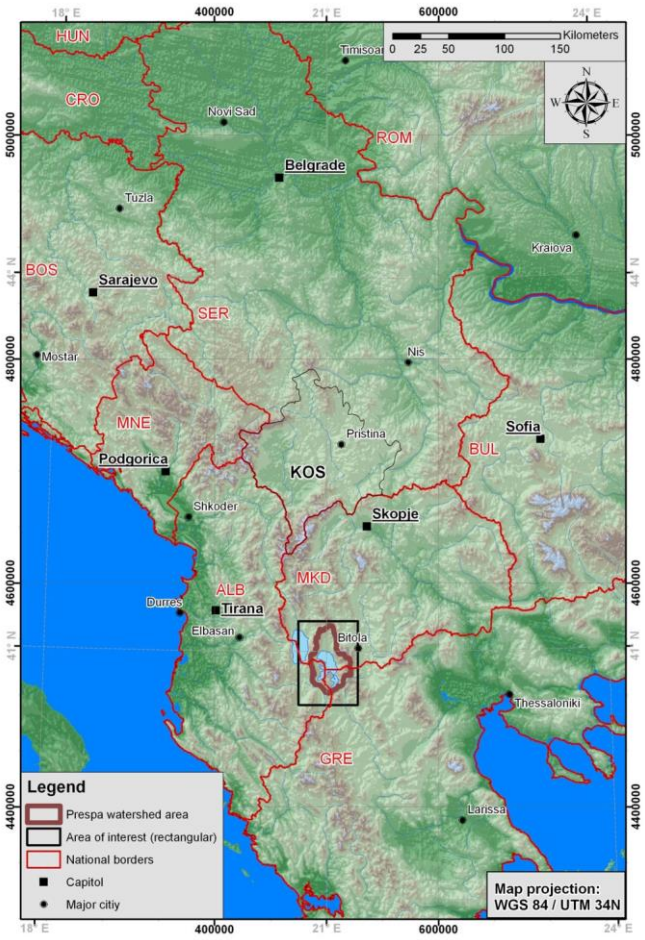


Fig. 1 Balkan Peninsula Map with Prespa lakes' watershed indicated

1.3 Area of interest

Although the Prespa lakes watershed is the area of interest for this conservation action plan, Samoska Dupka, a cave located on Galichica Mt. in the watershed of Lake Ohrid but very near the Prespa watershed, was also included in the area of interest (Fig. 3). This is because it is likely to be used in winter by bats whose summer quarters are in Prespa.

1.4 Physical features and hydrology

Both Prespa lakes are situated on a plain of an elevation of approximately 850-900 m a.s.l. surrounded by high mountain ranges that create the Prespa lakes' watershed. These are: the Baba Mountain Range (Pelister, 2601 m) and Mt. Varnous (2330 m) to the east of the lakes, Plakenska Planina (Stalev Kamen, 1998 m) and Bigla (1656 m) to the north, Galichica (Vir, 2287 m) and Mali Thate / Suva Gora (2284 m) to the west, Mt. Ivan (1770 m) and Triklario / Sfika (1750 m) to the south-southeast.

The Greater Prespa Lake has a surface area of 253.6 km^2 (Perennou *et al.* 2009) or 273.2 km^2 at water level of 851.83 m a.s.l. (Chavkalovski 1997). Its maximum depth is 54 m, its average depth 18.8 m and the length of its shoreline is 100.1 km[1]. Because water goes downward through the limestone into Ohrid Lake near the locality of Zavir (Vragodupka), the water level and the surface of the lake fluctuate annually and through the years. Annual fluctuations vary between 0.5 m and

[1] Due to regular fluctuations of the lake's level throughout time, the surface area of the lake, its depth and the length of its shoreline refer to the periods when they were measured. In addition, the three countries sharing the lake use different systems for elevation measurements also contributing to variation of figures in the existing literature.

1.75 m, while periodical fluctuations are up to 4.5 m (Chavkalovski 1997). However, over a nine year period (from 1987 to 1995) the Greater Prespa Lake level dropped by 6.05 m exceeding the natural variation by 1.55 m (Chavkalovski 1997). Based on hydrological analysis, Chavkalovski (1997, 2000) ascribes the decrease of the water level by 3.29 m to artificial outflow (water for irrigation purposes in the three countries). The water level is currently at approx. 843-845 m a.s.l. The Greater Prespa Lake watershed is characterized by a developed hydrographic network mainly in its eastern and northern parts, less developed in its western and southern parts.

The Lesser Prespa Lake has a surface area of 47.4 km^2 (Perennou *et al.* 2009). It has a maximum depth of 8.4 m, a maximum length of 13 km and in recent years the water level has been approx. at 853-854 m a.s.l. Since 1975, the water level of Lesser Prespa Lake has remained higher than that of Greater Prespa Lake (Hollis and Stevenson 1997). An alluvial isthmus 4 km long and 100-500 m wide separates the two lakes. The lakes are linked by a small channel located at the westernmost part of the isthmus. Water outflows from the former to the latter are controlled by a sluice gate – road bridge system originally built in 1969 on the channel connecting the two lakes (the first gate was positioned in 1987). This system was restored in 2004 to allow for control of the water level of the Lesser Prespa Lake (Kazoglou *et al.* 2010).

1.5 Geology

The rock masses belong to the West-Macedonian geotectonic unit (Klincarov 1997) which is separated into five segments. The Prespa lake watershed belongs to the Pelister - Shar Mountain segment (Arsovski 1997). Mountains to the east are composed of silicate rocks (schist, magmatic and volcanic rocks), while mountains to the north, south and west are mainly carbonaceous (limestone complex). The lowland part of the watershed is composed of a clastic complex of sediments (clay sediments, fluvioglacial residues, alluvial sediments, lake-swamp sediments and proluvial deposits). Due to the porous limestone rocks to the west there is an underground water flow from the Prespa Lakes to the lower Ohrid Lake, where water appears as numerous sub-lacustrine and vigorous surface springs, such as Drilon in Albania and St. Naum in the FYR of Macedonia.

The most important rocks for the formation of the karst forms are the massive limestone rocks of the Triassic period. They are from 500 to 550 m thick and are located over the clastic layers of the conglomerates and the sandstones (Dumurzanov and Ivanovski 1978). The limestone rocks are usually grey or light grey with distinguishable cracks. They form the west and south parts of the Prespa Lakes watershed. There are also other factors that influence the formation of the underwater karst forms (the caves) beside the lithological content of the rocks, such as the tectonics (fault lines and cracks) and changes in the climate (especially changes in humidity - rainfall).

1.6 Climatic features

The climate of the area is under Mediterranean and continental influences and could be characterized as Continental-Central European. The main climatic modifier is the water mass of the Greater Prespa Lake with its thermodynamic inertia which influences the entire Prespa watershed area. The average annual air temperature was 10.2°C in 1931 - 1960 and 9.6°C in 1961-1987. According to more recent data (1991-1995), the average air temperature in the north of the lower part of the watershed was 9.5°C (Resen meteorological station) and 10.8°C in the east (Pretor meteorological station) (Ristevski *et al.* 1997). The warmest month is July, with an average monthly temperature of 19.2°C and the coldest is January, with an average temperature of 0.2°C (Lazarevski 1993). The earliest freezing temperatures occur in October and the latest in May. The average freezing period is 167 days. Rainfall is under the influence of the Mediterranean pluviometric regime. Precipitation mainly occurs in late autumn and winter, while the least amount of rainfall is recorded in July and August. Average rainfall in 1961-1991 was 730 mm/m^2. In the lower parts of Prespa, precipitation ranges between 600 and 700 mm, in the mountain belt it increases up to 800-900 mm, and in the high-mountain belt it is up to 1000 mm (it can reach 1400 mm in the most humid years) (Ristevski 2000). Prespa is characterized by a unique regime of local winds conditioned mainly by the Greater Prespa Lake's water mass and by the unequal warming of the air over the lake surface and above the ground.

According to the thermal and pluviometric regime in the Prespa Lake region, the following climate zones exist in the area (Ristevski 2000):

- hot sub-mediterranean climate zone (600-900 m), which is more characteristic for the southern part of the Prespa watershed and especially the Lesser Prespa Lake and the Albanian part of the Greater Prespa Lake.
- cold sub-mediterranean climate zone (900-1100 m)
- submontane climate zone (1100-1300 m)
- mountain sub-mediterranean climate zone (1300-1650 m)
- subalpine climate zone (1650-2250 m)
- alpine climate zone (above 2250 m).

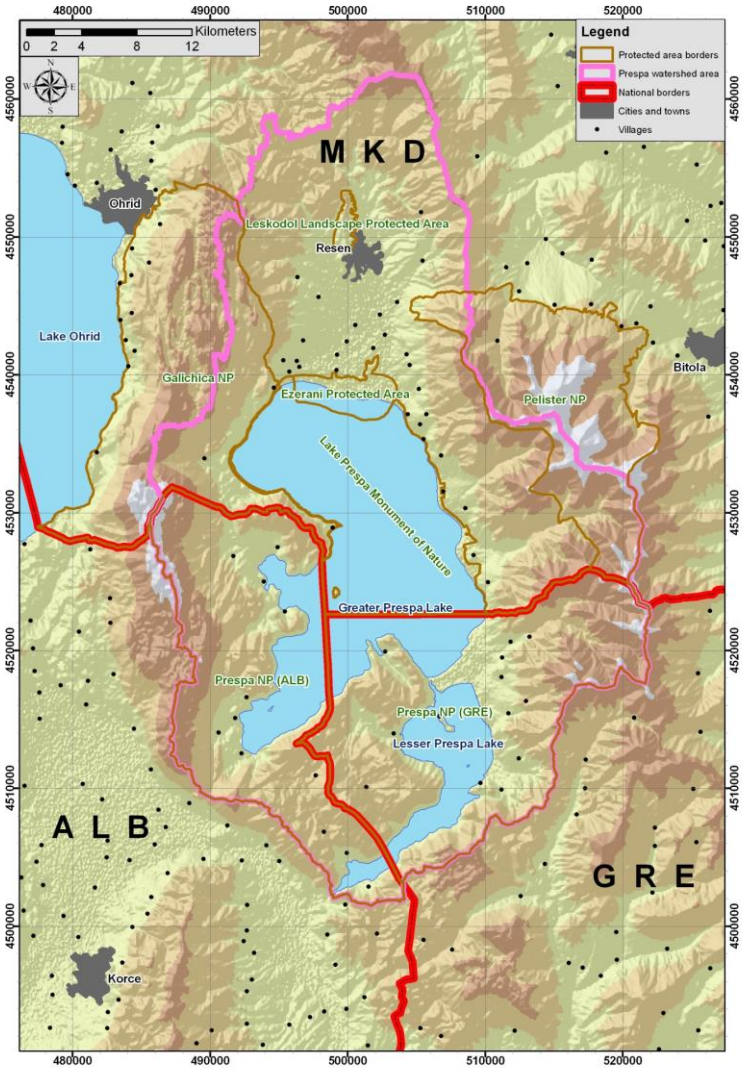


Fig. 2 The Prespa lakes' watershed and review of all protected areas

2. Underground sites in the Prespa Lakes watershed

2.1 Caves

Scientific information about caves in the Prespa lakes watershed is generally limited. Here we present data on selected caves based on their importance primarily with regards to their bat fauna. However, a number of other caves in the area (e.g. Petrochilou *et al.* 1977, Manakovic et al. 1993; Nedelko 2000) are important underground habitats and should also be subject to protection; these are not thoroughly elaborated in this document.

Most caves in Prespa are simple and relatively small, while they have few or no speleothems. To date, a number of key sites have been identified, hosting up to 10 species of bats depending on season. These caves are used by breeding colonies, as night roosts, for autumn swarming and mating, as stop-over (transitional) sites, possibly as satellite sites, as autumn shelters and for hibernation. Their distribution in Prespa is shown in Fig. 3 and their physical features and bat fauna are described by country below. The importance of Prespa caves as habitats is further stressed by providing data about invertebrate fauna. The description of the physical features of some caves is not given due to lack of data (Psarades Cave), but these are mentioned in the description of the bat fauna.

Fig. 3 The distribution of important caves for bats in Prespa

2.1.1 Caves in Albania

2.1.1.1 Physical features

Treni Cave – located on the southwest of the Lesser Prespa Lake (Fig. 3), near the village of Treni. It stretches southeast and has two entrances. The first entrance is larger and is 7 m wide and 3 m high. The second is 1 m wide and 1 m high. There is a large cave chamber (hall or gallery) 20 m long and 12 m wide which is located 9 m after the entrance. The floor is uneven because of the fallen blocks from the ceiling and the soil structure. Moving south-west, and then south-east, there is another cave expansion 43.2 m long, 5-16 m wide and 2-4 m high. Its floor is also covered with fallen blocks of rock. The highest inclination is at the south-east part of the hall because of the sedimented clay and guano. On the west part of the chamber there is another channel, 67 m long, which connects the first and the second cave chambers. Its width is between 2 -8 m, and its height 3-5 m. Twenty meters from the second chamber the channel is under water which is 0.6 m at its deepest point. At one point, in the northwest, the channel is dry due to fallen rocks and guano. The water inside the cave probably shares the same origin as the water from the Lesser Prespa Lake. In the cave, there is another channel stretching out of the first cave chamber southwards and then towards south-east. Its length is 65 m, width 1-8 m and height 1.5-2 m. Part of this channel (40 m long) is also flooded. The water depth here is approximately 0.2 m. The total length of the Treni Cave channels is 250 m. In the past, when the water level of the lake was higher, cave chambers and channels were flooded, allowing the formation of a few speleothems.

A drawing of the cave is shown in Annex I.

Water in Treni Cave (photo: B. Gichevski)

Zavir Cave – located between the villages of Gollomboç and Gorica (Fig. 3). Water runs from Greater Prespa Lake downwards into Ohrid Lake through this cave and under Galichica Mountain. The cave is 30 m long and 10 m wide and most of it is flooded with water. The floor is steep and slippery, as well as covered with unstable rocks. Fluctuations of the water level of the lake are reflected on the traces left on the cave walls. Local people say that there was a time when the lower water level of the lake was due to water flowing into the cave and therefore a small dam was constructed to prevent massive water flows. A drawing of the cave is shown in Annex I.

Petralia Cave – located near the cave chapel St. Blashtojna on the east coast of the Greater Prespa Lake (Fig. 3), it belongs to Gollomboç village. It has a chamber and two channels. The chamber is 21 m long, 8.6 m wide and has a maximum height of 10 m; it has a northwest direction. The floor is covered with rock blocks. The first channel is 10 m long and less than 1 m high. The second is oriented towards the northwest in the first 20 m, then its orientation changes towards the south for 36 m. This channel is narrow and its highest point is 2 m. There is a small crack at its end which goes through the rock with the opening a few metres away from the main cave entrance. Petralia Cave is a fossil cave, formed by tectonic abrasion (especially the first channel) and karst erosion. When the water level of the Greater Prespa Lake is higher, part of the longest channel

floods with water forming small lakes in its central part. There are almost no cave ornaments because it was under water in the past and because the roof has largely collapsed. These days, speleothems can only be seen in places where cracks are intersecting. Speleothems are represented by small stalactites and draperies.

The entrance of Petralia Cave (photo: B. Gichevski)

Cave Kosornik - located on the eastern shore of the Greater Prespa Lake, near Gollomboç village (Fig. 3). The entrance is opposite Golem Grad Island. The cave channel is simple and oriented towards the northwest. Its length is 40 m and its width ranges between 1 and 3 m. The highest point near its entrance is 5 m lowering down to 1.5 m at its end. The floor is covered with rocks, especially in the middle and at the end. At the end of the channel there is a chimney which is approx. 3-4 m high. Kosornik Cave is poor in speleothems, mainly because most of the roof has collapsed. Corrosion and the tectonic structure of the terrain have influenced the formation of the cave, while abrasion had important impacts at its entrance.

A drawing of the cave is presented in the Annex I.

The entrance of the Kosornik Cave (photo: B. Gichevski)

Cave of Doves *(Peshtera na gulabite)* – A small cave on Mali Grad Island (Fig. 3) about 5 m from the lake. The cave floor is covered with large rocks; therefore it is not possible to estimate its height. The lake waves had a lot of impact on its formation a process similar to the formation of rock shelters.

Golema Dupka (Bego 2011) - This cave is comparatively large, with an entrance that is approx. 10 m high and 25 m wide. “Golema dupka” is the name given to it by the locals and means “big or large cave”. The cave is located on the southern shore of Kallamas Peninsula, close to the border with the FYR of Macedonia, facing south towards Golem Grad Island (Fig. 3). The cave has two main galleries. The left-hand side gallery is deeper and more suitable for bats. It is some 50 m deep but after that it gets narrower and difficult to explore.

Zaroshka Cave (Bego 2011) – situated on the southwest coast of the Greater Prespa Lake (Fig. 3). This is the largest and deepest of about 5 shallow caves along this part of the lake shore and the only one that appears to host important bat colonies, at least for some time during the year. It has a narrow entrance and continues for approx. 10 m, after which it widens up in a gallery which is approx. 1-2.5 m wide, 10 m long and 1.7-2 m high. The cave continues further with a very narrow gallery.

2.1.1.2 Invertebrate fauna

The invertebrate fauna of Albanian caves in Prespa is almost completely unknown. The most important findings so far concern spiders (Deltshev *et al.* 2011). One of the most striking species is *Sulcia* pr. *cretica lindbergi* Dresco, 1962 – a troglobiontic (troglodyte) species described from a cave in Epirus. According to Deltshev et al. (2011) the *Sulcia* specimens from Shpella Uikut Cave near Treni village correspond well to *Sulcia cretica lindbergi*, with minor morphological differences. Also, one troglophillic species was recorded from Maligradska Cave - *Lepthyphantes leprosus* (Ohlert, 1865). The following trogloxene spiders were discovered in other caves on the Albanian side of Prespa: *Nesticus eremita* Simon, 1879 from Shpella Uikut Cave, Shpela Zebjes Cave also near Treni village and one Artificial gallery near Liqueni; *Holocnemus pluchei* (Scopoli, 1763) and *Meta menardi* (Latreille, 1804) from Gubilisteto Cave near Liqueni; *Metellina merianae* (Scopoli, 1763) from the Artificial gallery near Liqueni. There are indications of the presence (photographs of some cave insects) of some accidental trogloxenes in Treni cave such as the beetles *Cyphogenia lucifuga* and *Blaps sp.*

2.1.1.3 Bat fauna

Arguably, the most important cave on the Albanian side of Prespa is Treni Cave; it is used all year round by large summer colonies, swarming/mating bats, hibernating populations and bats simply using it as an autumn shelter (Table 1). It is among the most important known winter sites in the area. In summer, the cave hosts several thousand bats from breeding *Myotis capaccinii* and male *Miniopterus schreibersii.* Other species may breed in the cave, such as *Myotis myotis.* In autumn, several hundred mostly male *Miniopterus schreibersii* roost in the cave, whereas another eight species utilize the cave as a shelter and/or a swarming/mating site (Table 1). In winter, several hundred *Myotis capaccinii* hibernate in the cave, whereas only a few other bats have been found from three species (*Rhinolophus ferrumequinum, R. Hipposideros* and *Plecotus sp.*).

Zavir, Gollomboç, Petralia, Kosornik, Zaroshka and Golema Dupka Caves (Fig. 3) also appear to be important for bats, but their significance should be further investigated as they are not used all year-round. The quantities of bat droppings on the floor and urine stains on the walls and ceiling suggest their relatively heavy use by bats presumably in spring and summer. This has been confirmed for at least one of these sites, where *Myotis daubentonii, M. capaccinii, Eptesicus serotinus* and *Hypsugo savii* were found in 1995 (Uhrin *et al.* 1996). Only a few *Rhinolophus hipposideros* have been found in autumn and winter. From the quantity of bat droppings and urine stains, it has been estimated that Zaroshka Cave hosts colonies of more than 1000 bats in spring and summer (Bego 2011). Zavir Cave was used by more than 1000 bats in autumn 2011. Some of the other shallower caves along the lake shore have a few bat droppings on the floor suggesting their use by only a few bats as night or satellite roosts and therefore are not further described here. Finally, the Cave of Doves (Peshtera na gulabite) on Mali Grad Island has been found to be used by a few thousand *Miniopterus schreibersii* in autumn (W. Fremuth pers. com.) which suggests that the cave may be used only as an autumn shelter and perhaps in spring (Table 1). The quantities of bat droppings and urine stains on the ceiling suggest its long term use by the bats.

2.1.2 Caves in Greece

2.1.2.1 Physical features

General issues - In 1977, Petrochilou *et al.* identified and described 15 shallow or deeper caves along the rocky shore of Greater Prespa. In 1963, both lakes had approximately the same level, but the level of Greater Prespa has been generally decreasing since then (Hollis & Stevenson 1997). By the end of December 2010, the level of Greater Prespa was 844.70 m a.s.l. (SPP, unpublished data), being about 5 m lower compared to the lake level in 1977 when A. Petrochilou and colleagues published their report (Petrochilou *et al.* 1977). The situation for the caves must therefore have been very different at that time, with some lacustrine caves currently having dried out and other, new caves having been revealed. Indeed, the 1977 the description of some caves does not fit with the current situation; for example, the location and description of a cave called "Roti" in Petrochilou *et al.* (1977) fits that of the Psarades Cave (Fig. 3) which is now a dry cave approx. 4 m above the level of the lake. On the other hand, the lacustrine cave on the tip of Cape Roti (Fig. 3) was presumably covered by water at the time, as it is not reported by Petrochilou *et al.* (1977). Because of these differences and because not all of them are important to bats, we do not include their description by Petrochilou and colleagues here. We do not provide a description of Psarades Cave because it is infested with fleas and therefore difficult to explore.

Zachariadis *and* ***Kokkalis*** *caves* - These caves have great historical value related to the Greek civil war in the late 1940s and hence an effort for mild tourist development has been made by the local authorities. Kokkalis Cave is also known as the Civil War Hospital Cave. They are located in the northwest and the southwest of the Lesser Prespa Lake respectively (Fig. 3). Kokkalis Cave is approx. 1120 m a.s.l. and comprises a very large chamber. Zachariadis is a small cave approx. 1050 m a.s.l. They are both surrounded by oak forests.

Tcherna Cave – located on the south coast of the Greater Prespa Lake, near the village of Psarades (Fig. 3). It was semi-lacustrine in 1977 (Tcherna II, Petrochilou *et al.* 1977). There are two main channels (A and B) and one chamber. At approximately 10 m from the entrance of the cave, channels A and B are divided. Channel A is a crack 1.5-3 m wide and 3 m high. In its first 7 m it has western orientation, and in the next 10 m it gets a southern direction. Here it is divided in three smaller channels: one with western and two with southern directions. The bottom of the channel with a western direction goes out to the lake and is flooded with water. The middle channel has a larger inclination because of the fallen rocks, ending with a layer of rockslide that ends into the Prespa Lake. The total length of channel A is 44 m. Cave channel B is a narrow crack with a southeastern orientation. Its length is 27 m, width 1-3 m and height around 2 m. This channel is lowered towards an interior of a carbonate mass. The chamber is a special speleological object divided by a primary rock from channels A and B. The entrance of this chamber is 14 m wide and 5-6 m high. It is divided by a rock block that forms two entrances. The chamber orientation is eastward. The bottom is covered by wide rock blocks which have fallen from the ceiling. Because of these blocks, the slope is high and it is impossible to measure the exact height; however, it is approximately 5 m. The total length of the chamber is 37 m and it is 8 m wide. A drawing of the cave is shown in the Annex I.

Cape Roti Cave – located on the tip of Cape Roti (hence the name), near Psarades village (Fig. 3). The entrance and the first part of the cave are only accessible by boat. In the past the cave was entirely under water (Petrochilou *et al.* 1977), which is also suggested by the shells on the cave floor. It is a simple cave stretching along a rock crack and expanded through the process of karst erosion and abrasion. Its length is approx. 50 m and width 3-6 m. Its height is approx. 10 m near the entrance lowering down to 3 m towards the inside of the cave. The cave floor is slightly slanted towards the lake and in parts it is covered by rocky material fallen from the cave ceiling. Speleothems are represented by small stalactites, stalagmites and cave columns. A drawing of the cave is presented in the Annex I.

Mikrolimni Cave - situated east of Mikrolimni village at 860 m a.s.l. (Fig. 3). It was explored and mapped by K. Paragamian and G. Katsadorakis in 1991 (Paragamian 1992). The entrance is 4 m wide and 1 m high and ¾ of it are blocked by large stones and rocks. Behind the entrance there is a small chamber 3 m long and 6 m wide. After 6 m downwards, there is the main chamber of the cave which has a maximum length of 10 m, a maximum width of 17 m and a maximum height of 3

m. Its total length is 20 m and its deepest point is 9 m below the entrance level. In the northern part of the cave there is water with a maximum depth of 0.5 m. This water is at approximately the same level as the water table of the Lesser Prespa Lake and it appears that it follows its fluctuations: the water appears to flood half of the chamber for parts of the year, since its level rises by up to 1 m. A drawing of the cave is presented in Annex I.

2.1.2.2 Invertebrate fauna

Most of the known caves in the Greek part of Prespa have been formed by abrasion and therefore they do not provide conditions for survival of troglobiontic species. Because there is no information available for such species, research on water-dwelling troglobionts (stygobionts) would be needed in this type of caves in Prespa. There is some information about the presence of several accidental trogloxenes in Tcherna Cave such as the beetles *Blaps sp*. and *Tenebrio sp*. which are often associated with bat colonies. Tcherna Cave is also inhabited by other accidental species that were recorded during the field survey in September 2011: *Tegenaria domestica* and *Meta sp*. were common as well as one scorpion species (*Euscorpius* sp.).

2.1.2.3 Bat fauna

Tcherna Cave is perhaps the most important among caves on the Greek side of Prespa. It is used by bats for breeding in summer and for swarming, mating and generally as a shelter in autumn. In summer, the cave hosts important breeding mixed-species colonies of *Rhinolophus euryale, R. ferrumequinum, Myotis capaccinii, M. emarginatus* and a male colony of *Miniopterus schreibersii* (Table 1). Male *Hypsugo savii* have also been found in summer near the cave entrance, which probably roost in rock crevices. Summer colonies comprise several thousand individuals. The large piles of droppings on the cave floor and the large stains on the ceiling provide proof of its long term use by bats. Numbers of bats appear to have fluctuated over the years, suggesting that they may switch between a number of different underground sites that probably form a network; similar to the behaviour reported for *Myotis capaccinii* in Thrace, Greece (Papadatou *et al.* 2008, 2009). This is not surprising given the number of known underground sites suitable for roosting across the whole territory of Prespa (Fig. 3 and Table 1) and perhaps a number of other, potentially unknown sites. In the autumn several hundred male *Miniopterus schreibersii* can still be found in the cave, and other species may also roost in the cave in smaller numbers. The cave is further used by a large number of swarming/mating bats or bats using it simply as a night roost (*Rhinolophus ferrumequinum, R. euryale, R. blasii, Myotis capaccinii, M. daubentonii, Pipistrellus pipistrellus, P. nathusii*). It is therefore used by at least 10 species of bats (Table 1). In winter, the cave is used by only a few bats (*Rhinolophus ferrumequinum* and *R. hipposideros*).

The cave at Cape Roti is used by important breeding colonies of *Myotis capaccinii* and *M. daubentonii* (Table 1). *Myotis emarginatus* may also breed in the cave, but confirmation of this requires further investigation. It has not been possible to estimate the approximate size of the colonies because they roost in a dome high up in the ceiling, several meters away from the ground, half hidden by rocks and smaller groups roost inside deep crevices. Nevertheless, there are at least several hundred and up to a few thousand individuals in summer. In autumn, the large maternity colonies have dispersed and a few hundred individuals remain mostly inside rock crevices in the cave.

Psarades Cave (the “flea” cave in Papadatou *et al.* 2011) on the rocky shore near Cape Roti and opposite Psarades village (Fig. 3) has signs of past probably heavy use (stains on the walls and ceiling and quantities of bat droppings mixed with soil). However, it is not currently used by large numbers of bats: only a few *R. ferrumequinum* have been found in autumn. The lack of current use especially in summer may be related to the large numbers of fleas in the cave and/or to the decrease in the water level of the lake from the 1970s that may have altered the cave’s microclimate.

A significant proportion of the other, mostly shallow caves present along the shore of the Greek Greater Prespa Lake (Petrochilou *et al.* 1977) have been explored by X. Grémillet and colleagues up to the Albanian border. No large bat colonies were found other than small colonies or single roosting individuals.

Only a few *R. ferrumequinum* use Mikrolimni Cave in summer. However, in spring and autumn over 700 *Rhinolophus euryale* and *R. blasii* roost in the cave, probably using it as a transitional site between their summer and winter quarters (Table 1). The cave may not be a typical hibernation site, but in February 2011 the site was used by a small number of medium sized Rhinolophids that were not in deep torpor; (the winter of 2010-2011 was relatively mild and some bats may have not been in hibernation for at least some of the time).

Kokkalis' and Zachariadis' Caves are used by only a few *Rhinolophus hipposideros* or *R. ferrumequinum* individuals during day-time. At night, however, many bats utilise them: Kokkalis' Cave is an important swarming site; (i.e. it is used by bats with a typical swarming behaviour in autumn). Many bats also visit the site throughout the night presumably using it as a night roost in summer and probably autumn. Overall, 10 species have been recorded at this site (Table 1). Zachariadis' Cave is not suitable for swarming (small cave and entrance surrounded by densely structured vegetation) and is rather used as a night roost in summer and autumn by several species including *Rhinolophus euryale, R. blasii, Plecotus* species and possibly *Myotis emarginatus* (Table 1). However, it is possible that at least *R. ferrumequinum* use it as a mating site in the autumn, since reproductively active adult individuals have been observed in the cave. None of the two caves is used by hibernating bats.

2.1.3 Caves in FYR of Macedonia

2.1.3.1 Physical features

Samoska Dupka Cave – is located to the west of Mountain Hut "Asan Gjura", in the watershed of Lake Ohrid but very near Prespa watershed (Fig. 3). Preliminary data about the cave are found in Manakovic (1990) and Manakovic *et al.* (1993). It is a long channel with a general southwest-northeast direction. The channel is meander-like, frequently changing direction. Its average width is approx. 2 m and height approx. 10 m. In the middle there are three smaller side channels. The first is on the right side of the main channel and it is oriented towards the east. It is 8 m long, 0.5 m wide and 2 m high. The second is on the left side of the main channel and it is oriented to the northwest. It is 11 m long, 0.6 m wide and 1.5 m high. The last channel is on the right side of the main channel with a length of 2 m and a width of 2 m. The total length of the main chamber is 224 m. Cave Samoska Dupka is perhaps the richest in speleothems compared to the rest of the known caves in Prespa. These include stalactites, drainage watersheds, corals, cave pearls and travertine basins. Their colour is mostly white, yellow and red. Especially interesting are the cave pearls which are settled in travertine basins. During the wet period of the year, when water leaks through the cracks, the cave pearls are still active (speleothems are generally active when water drops through the cracks). During the dry period of the year, most of the speleothems lose their shine. A drawing of the cave is shown in the Annex I.

Speleothems in Samoska Dupka Cave (photo: B. Gichevski)

Leskoec Cave – Preliminary data about the cave are found in Tochkovski (1970) and Manakovic *et al.* (1993). The cave is located near Leskoec village (Fig. 3). The entrance is at the bottom of a rocky section at 1070 m a.s.l. and it is small (1.4 m wide and 1.3 m high). From the entrance, there is a narrow channel with a length of 14.5 m, 1-1.5 m width and 1.3-3 m height. Its orientation is towards the east, then north-east. This channel leads to the first cave chamber which has a length of 10 m, its widest point is 5.5 m and its highest point is approximately 3 m. Here there is an entrance through a small crack to a second cave hall with a length of 2.5 m and a width of 7.5 m. Beyond the second hall, there is another cave chamber in a southern direction which is 10 m long and 4 m wide and high. The bottom of the cave chamber is covered with soil and small rock blocks, while there is a high amount of guano (see bat fauna below). Speleothems are poorly represented. They occur only where there are large cracks and include basins and small stalactites. Cave Leskoec is a typical example of a cave in which an underground river flowed in the past. The underground river flow had a meandering character (Manakovic *et al.* 1993). A drawing of the cave is presented in the Annex I.

Zandana Cave - A small cave in the southwest of Greater Prespa Lake close to the border with Albania, at a locality called "Zandana" (Fig. 3). It is approx. 10 m long, relatively dry and has a few cave ornaments. The entrance is orientated to the southeast.

Bimbilova Cave – This cave is located on Golem Grad Island in the Greater Prespa Lake. The entrance is 3 m wide and 1.5 m high. First there is a channel, 10 m long and 1-2 m wide. There is then a cave chamber 30 m long, 15 m wide and 15 m high. There are rocky blocks on its floor, dividing the chamber in two parts. At the end of the southeast part of the chamber there is a small lake (10 m long, 5 m wide and 3 m deep). The origin of the water in the cave lake is from the Greater Prespa Lake since they are both connected via underground cracks. The total length of Bimbilova Cave is 50 m. This cave is poor in speleothems, represented only by few stalactites and cave basins. The formation of the cave was conditioned by the rain water and lake waters. Because the cave is formed from limestone plates, which are set vertically, rain water can easily breach through the inside of the carbonate mass and dissolve it. In addition, the mechanical and chemical erosion of the cave was facilitated through the fluctuations of the Greater Prespa Lake water level, expanding the cracks at the bottom of the cave. A drawing of the cave is presented in the Annex I.

2.1.3.2 Invertebrate fauna

The presence of large solutional caves with stable ecological conditions provided the basis for the evolution and survival of a number of troglobiontic and troglophilic species. However, caves on Galicica Mt. and the caves in the Albanian and Greek parts of Prespa have not been well investigated. There are almost no published data for the invertebrate fauna of these caves, with the exception of a few project reports (DEKONS-EMA 2010; Petkovski 2010).

Samoska Dupka is inhabited by several trogloxenic species; the most prominent being moths of the families *Geometridae* and *Noctuidae*, such as *Scoliopteryx libatrix*. Several spider species may be attributed to the group of trogloxens (*Tegenaria sp*., *Meta sp*.). Also, several accidental trogloxens were recorded during the field survey in September 2011: *Cychrus semigranosus albanicus, Helops sp. Enoplopus dentipes, Helix secernenda schlafli*, etc. Troglophilic species are represented by several species. One of the most important is the subendemic cricket *Troglophilus lazaropolensis* (Raphidiophoridae). This cricket mainly inhabits the cave entrances, but it may enter the subterranean habitats of the caves and also live in above-ground habitats (among large boulders in humid beech forests). The presence of a troglophilic centipede species was also recorded during the field survey, most probably *Brachydesmus sp*. (Polydesmidae). The most important species from a conservation perspective are the troglobiontic species (troglobites, troglodytes). Several pseudoscorpions have been described from caves in the foothills of Galicica Mt., next to lake Ohrid: *Chthonius lychnidis, Chthonius ohridanus, Roncus kikimora, Roncus lychnidis, Neobisium ohridanum*. One troglobiontic pseudoscorpion species (undetermined) also inhabits Samoska Dupka cave. *Ceutophyes karamani* (Coleoptera, Leiodidae) was described from Mechkina Dupka cave near Ohrid town. This troglobiont was also recorded in Samoska Dupka and Vojla cave.

Leskoec Cave is smaller and poorer in cave invertebrate species than Samoska Dupka. So far, the presence of two troglophilic species was confirmed: *Troglophilus lazaropolensis* and *Laemostenus terricola punctatus* (Carabidae). Abrasion caves on the shore of Greater Prespa Lake may be rich only in trogloxenic species [e.g. *Cyphogenia lucifuga* (Coleoptera, Tenebrionidae) was recorded in Bimbilova cave]. Troglobionts are absent from these caves, but troglophiles are expected (although not yet confirmed). Some other invertebrate species of Galicica limestone endogean habitats are also worth mentioning. *Duvalius vignai* (Coleoptera, Carabidae) is an exclusively endogean endemic described from the locality of Baba (approx. 1600 m a.s.l.). The same or a similar species was discovered in endogean and hypogean habitats of one cave on Galicica Mt. A blind *Centromerus* sp. was discovered from one of the caves on Galicica Mt. that represents an undescribed species (M. Komnenov, pers. comm.). *Ohridiola marinae* (Coleoptera, Leiodidae) is an endemic genus of Galicica Mt., known from endogean habitats (outside caves). Some *Gyralina* species (terrestrial snails) might also be expected from caves on Galicica Mt..

2.1.3.3 Bat fauna

To date, three important caves for bats on this side of the Prespa watershed have been identified: Bimbilova , Leskoec and Samoska Dupka.

Bimbilova Cave has only recently been discovered (June 2010). It is used by many thousands of bats in summer and autumn, whereas several thousand hibernate in the cave, making it one of the most important known hibernacula in the entire Prespa along with Samoska Dupka and Treni caves. Breeding has not been confirmed; nevertheless it hosts large bat colonies from at least two species (*Myotis capaccinii* and *Miniopterus schreibersii*) throughout the year (Table 1). Torpid *Rhinolophus ferrumequinum* have also been observed in winter.

Samoska Dupka is the longest known cave in Galicica NP. Although not in (but very near) the Prespa watershed, it has been included here because bats are highly mobile and it may be used in winter by bats whose summer quarters are in Prespa. The cave was used by over 80 hibernating bats from three species (*Rhinolophus hipposideros, Myotis blythii, M. myotis*) in winter 2011 (O. Avramoski, pers. comm.) and by almost 30 bats from four species (*R. hipposideros, R. ferrumequinum, M. blythii, M. myotis*) in October 2011 (unpublished data) (Table 1). It is the most important known hibernaculum for *R. hipposideros* in the entire Prespa area (almost 40 individuals counted in winter 2011; O. Avramoski, pers. comm.). The cave is cold and offers good conditions for hibernation. The relatively small amount of bat droppings and the lack of large urine stains on

the walls combined with the low temperature of the cave suggest that the site is not used by large numbers of bats at other times of the year; however, the annual use of the cave remains to be investigated. A grille-door at the cave's entrance (see photo) placed in 2005 to prohibit uncontrolled public access has not been designed according to standards that allow free access to bats such as those provided by EUROBATS (Mitchell-Jones *et al.* 2010). The gate should be replaced by a "bat-friendly" grille-door that may allow access to more bats species in the cave (see conservation recommendations 7.2.2 and recommended priority actions 7.3).

The grille-door at the entrance of Samoska Dupka Cave (photo: B. Gichevski)

Leskoec Cave is used by all four *Rhinolophus* species present in the Prespa area. *Myotis blythii* has also been found in the cave (Kryštufek *et al.* 1992), but it appears to be an important cave primarily for medium sized Rhinolophids (*R. euryale* and *R. blasii*) at least in the autumn months, since it is used by at least 500 bats for roosting and most probably mating; (comparable to Mikrolimni cave in Greece, see Table 1). In winter 2011, a few medium sized Rhinolophids and *R. hipposideros* were found torpid in the cave. A few *R. hipposideros* actually use the cave throughout the year and a few *R. ferrumequinum* have been found in summer.

Zandana Cave may be relatively important for bats. Three *Rhinolophus hipposideros* and a moderate amount of dry bat droppings have been found in the cave in autumn suggesting that the cave may be used at other times of year by more bats.

2.2 Rock shelters

Rock shelters can be found in limestone and other rock types where streams have undercut their banks at bends, or where there has been abrasion by blowing sand. They are small, and day light illuminates them to their end. Most of the rock shelters in Prespa are located along the coasts of the two lakes, while a few others can be found away from the coasts. Many rock shelters near or at the shorelines of Greater and Lesser Prespa Lakes have been used as hermitages and some have chapels constructed in them. Overall, 10 cave chapels have been recorded (Angelichin-Zhura 2006).

Table 1. Key natural underground sites in the Prespa lakes watershed, bat species, annual function and approximate colony size. Psarades Cave (Greece), and caves near Gollomboç and Zaroshka (Albania) and Zandana (FYR of Macedonia) are not included in the table (see text for details). Samoska Dupka Cave is located in Ohrid Lake watershed but very near Prespa (Fig. 3).

Country	Cave	Location and description	Species	Annual use	Colonies size
Greece	Tcherna	Partly lacustrine cave in the south of the Lake Greater Prespa, west of Psarades village	*Rhinolophus ferrumequinum, R. euryale, R. blasii, Miniopterus schreibersii, Myotis capaccinii, M. emarginatus, M. daubentonii, Hypsugo savii, Pipistrellus pipistrellus, P. nathusii*	Summer breeding; autumn shelter, mating & swarming; male only *M. schreibersii* colony	Several thousand in summer; several hundred in autumn; unknown number swarming
	Cape Roti	Lacustrine cave on the tip of Cape Roti, in the south of the Lake Greater Prespa, west of Psarades village	*M. capaccinii, M. daubentonii, M. emarginatus*	Summer breeding, autumn Shelter	Several hundred (autumn) up to a few thousand (summer)
	Mikrolimni	Warm cave on the east coast of the Lake Lesser Prespa, near Mikrolimni village	*R. euryale, R. blasii*	Spring and autumn shelter; winter use	> 700 individuals
	Kokkalis'	Cave with historical importance in the west of Lesser Prespa Lake, near the village of Vrondero surrounded by oak forest	*H. savii, P. pipistrellus, Myotis capaccinii, M. blythii, M. myotis, Miniopterus schreibersii, Plecotus austriacus, R. blasii, R. euryale, R. ferrumequinum, R. hipposideros*	Night roost; autumn swarming	Tens up to a few hundred bats
	Zachariadis'	Cave with historical importance in the southwest of Lake Lesser Prespa, near the village of Pyli surrounded by oak forest	*Rhinolophus hipposideros, R. ferrumequinum, R. blasii, R. euryale, M. emarginatus, M. myotis, Plecotus sp*	Summer roosting; night roost; autumn mating	Some tens of bats
Albania	Treni	Cave in the southern tip of the Lake Lesser Prespa, near reedbeds and the Treni village	*Miniopterus schreibersii, Myotis capaccinii, M. myotis, M. daubentonii, Plecotus species, R. blasii, R. euryale, R. hipposideros, R. ferrumequinum, Eptesicus serotinus*	Summer breeding; autumn shelter, mating & swarming; male only *M. schreibersii* colony; *M. capaccinii* hibernation	Several thousand in summer; several hundred in autumn and winter; unknown number swarming
	Mali Grad	Dry cave on the eastern shore of Mali Grad Island, Lake Lesser Prespa	*Miniopterus schreibersii*	Autumn and probably spring Shelter	> 2000 individuals
FYR of Macedonia	Bimbilova	Cave on Golem Grad Island, Lake Greater Prespa	*Miniopterus schreibersii, Myotis capaccinii, Rhinolophus ferrumequinum*	Summer breeding; autumn shelter, mating & swarming; male only *M. schreibersii* colony; hibernation	> 10 000 in summer; > 7000 in autumn; > 3000 in winter
	Samoska Dupka	Cave to the west of the Mountain Hut Asan Gura surrounded by beech forest	*R. hipposideros, R. ferrumequinum, Myotis blythii, M. myotis*	Hibernation; autumn use	Tens of individuals in autumn > 80 individuals in winter
	Leskoec	Dry and warm cave in the northwest of Lake Greater Prespa, near Leskoec village surrounded by oak forest	*Rhinolophus euryale, R. blasii, R. hipposideros, R. ferrumequinum, Myotis blythii*	Autumn and probably spring shelter	> 500 individuals

3. Review of previous research and conservation projects

3.1 Albania

Within the framework of the conservation action plan for the bats of Prespa developed by the Society for the Protection of Prespa (Papadatou *et al.* 2011), Bego (2011) investigated a number of caves along the shore of the Greater Prespa Lake in Albania. His results have aided in the description of some of these caves in this document (see section 2.1.1 above). A number of older studies included an examination of the Treni Cave and some caves along the shore of the Greater Prespa Lake. The first study on bats in the Albanian part of Prespa was conducted in 1991 by the Czech researchers (Chytil & Vlašin 1994). Their most important discovery was a large colony of approx. 10,000 *Myotis capaccinii* in Treni Cave, the largest known colony of the species in Europe at the time. In April 1995, a joint expedition of Slovak, Czech and Albanian researchers was organised in Albania including Prespa (Uhrin *et al.* 1996). Their survey resulted in new records on bat species in the Albanian part of Prespa, raising the number of known bat species to eight, including cave-dwelling bats. In 2008, the Treni Cave was surveyed in the framework of a project conducted by the Albanian Society for the Protection of Birds and Mammals (ASPBM), entitled "Biodiversity Protection of Treni Cave, Prespa National Park", funded by the GEF/SGP. During that time, the cave was fully explored by speleologists.

3.2 Greece

The founder of the Hellenic Speleological Society, A. Petrochilou visited Prespa with colleagues in 1977 and described 15 caves along the south coast of the Greater Prespa Lake (Petrochilou *et al.* 1977). In the early 1990's, K. Paragamian and G. Katsadorakis visited and described Mikrolimni Cave as well as a few other caves in the wider area of the Prespa watershed (Paragamian 1992). The cave bat fauna on the Greek part of Prespa was investigated by Grémillet and colleagues between 2004-2009 (Grémillet and Boireau 2004; Grémillet and Dubos 2008; Grémillet *et al.* 2010) leading to the "Status Survey and Conservation Action Plan for the Bats of Prespa" (Papadatou *et al.* 2011), a project implemented by the SPP. It must be noted that 54 caves not open to the public (habitat code 8310, Habitats Directive, Annex I) were erroneously reported in the past in the description of the habitat types in the Natura 2000 areas included in the National Park of Prespa. The habitat types have recently been revised and now comprise 4 caves not open to the public (Mikrolimni, Tcherna, Cape Roti and Psarades caves).

3.3 FYR of Macedonia

The first research on some caves in Prespa and Galichica Mt. as a whole was performed in the frame of the project "Pelister and Galichica – natural and socio geographic surveys", financed by the National Ministry of Science at that time (1986-1989) and performed by the team of geomorphologists (Manakovic, Andonovski and Kolchakovski) from the Institute of Geography, University of Cyril and Methodius, Skopje. More thorough investigation was performed in the scope of the project "Support for National Park Galichica" financed by the Government of the Federal Republic of Germany and KfW Bank (2008). Kolchakovski (2010) made a significant contribution to the knowledge about the caves on Galichica Mt. in the frame of the study for geomorphologic phenomena in the National Park Galichica for its management plan for the period 2010-2020. The recently discovered Bimbilova Cave was described by the Speleological Society Peoni (2010) - Report on Cave Bimbilova.

4. Conservation status, recent conservation measures and legal protection

4.1 Bats - conservation and protection status

4.1.1 Greece

Bats are protected by national and international laws, conventions and agreements. Table 2 shows the legal protection status of species associated with caves present in the Prespa watershed, according to the European and Greek legislation. The table further presents their conservation status according to the IUCN (2009) Red Data List and the Greek Red Data Book of Threatened Animals (Legakis and Maragkou 2009). Several species classified as Least Concern (LC) on a global scale are classified as Near Threatened (NT) or Vulnerable (VU) or Data Deficient (DD) in Greece, because of their limited distribution or very limited data available (see also below). Nine species (60%) are included in Annex II of the Habitats Directive and all are listed in Annex IV (Table 2).

Table 2. Cave-dwelling bat species, species roosting in rock crevices in caves near the entrance and species found occasionally in caves in the Prespa watershed, their conservation and legal protection status.

Scientific name	English name	Red Data Book IUCN 2009[2]	Red Data Book (GR) 2009	Habitats Directive[3]	Bern Convention[4]	Bonn Convention[5]	P.D. 67/1981[6]
Rhinolophus ferrumequinum	Greater horseshoe bat	LC	LC	II, IV	II	II	+
R. hipposideros	Lesser horseshoe bat	LC	LC	II, IV	II	II	+
R. euryale	Mediterranean horseshoe bat	NT	NT	II, IV	II	II	+
R. blasii	Blasius' horseshoe bat	LC	NT	II, IV	II	II	+
Myotis daubentonii	Daubenton's bat	LC	VU	IV	II	II	+
M. capaccinii	Long-fingered bat	VU	NT	II, IV	II	II	+
M. emarginatus	Geoffroy's bat	LC	NT	II, IV	II	II	+
M. myotis	Greater mouse-eared bat	LC	NT	II, IV	II	II	+
M. blythii	Lesser mouse-eared bat	LC	LC	II, IV	II	II	+
Pipistrellus pipistrellus	Common pipistrelle	LC	DD	IV	III	II	+
P. nathusii	Nathusius's pipistrelle	LC	DD	IV	II	II	+
Hypsugo savii	Savi's pipistrelle	LC	LC	IV	II	II	+
Eptesicus serotinus	Serotine bat	LC	LC	IV	II	II	+
Plecotus austriacus	Gray big-eared bat	LC	DD	IV	II	II	+

[2] IUCN threat status: VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient

[3] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)
Annex II: Animal and plant species of community interest whose conservation requires the designation of special areas of conservation;
Annex IV: Animal and plant species of community interest in need of strict protection

[4] Convention on the Conservation of European Wildlife and Natural Habitats, Bern 1979
Annex II: Strictly protected fauna species; Annex III: Protected fauna species

[5] Convention on the Conservation of Migratory Species of Wild Animals (CMS), Bonn 1979.
Appendix II: Migratory species conserved through Agreements

[6] Presidential Decree 67/1981 (Greek legislation)

Miniopterus schreibersii	Schreibers's long-fingered bat	NT	NT	II, IV	II	II	+

4.1.2 Albania

Bats and their roosts are protected according to the Albanian legislation. The Law on Protection of Biodiversity and the Law on Hunting and Wildlife Conservation both provide legal protection for bats and their roosting sites and, therefore, caves throughout the country. Albania is a Party of the Agreement on the Conservation of Populations of Bats in Europe (EUROBATS). However, the main problem remains law enforcement. This is partially due to low performance of the forest service and environmental inspectors that are responsible for the legal enforcement and implementation of the laws and regulations. The recent illegal removal of the gate at Treni Cave is indicative of the situation (see chapter 'Threats and limiting factors').

4.1.3 FYR of Macedonia

In the FYR of Macedonia, the protection of bats is regulated by international conventions and national legislation. According to the Law on Nature Protection, Article 35 (Official Gazette of RM No. 67/2004) the following cave-dwelling bat species found in Prespa are proclaimed as protected species: *Miniopterus schreibersii, Myotis capaccinii, Rhinolophus blasii* and *R. euryale* (Lists for designation of strictly protected and protected species, Official Gazette of RM No. 139/2011). In addition the country is a Party to the EUROBATS Agreement and Bern and Bonn conventions.

4.2 Caves – conservation and protection status

Caves not open to the public are included as important habitats according to Annex I of the Habitats Directive (code: 8310). Caves are also considered as important habitat according to the Bern Convention (Resolution No 4, 1996: 65. Caves). Underground sites in Prespa have generally a favourable conservation status and this is probably because they are located in protected areas such as national parks, the low size of the human population resulting in relatively low pressure to the environment, etc. Several national legal documents provide regulations for the protection of caves in each country in the Prespa Region.

4.2.1 Albania

Several laws and bylaws are related to conservation of caves in Albania:

- Decision no.451 dated 16. 09. 1993, concerning cave management;
- Law no. 8906, dated 6.6.2002, on protected areas, Article 8 (Caves as Natural Monument);
- Decision no.676, dated 20. 12. 2002, concerning declaration of nature's monuments in Albania as Protected Zones (Cave of Treni);
- Decision no.80 dated 18. 02. 1999 concerning designation of Prespa as "National Park" and of Pogradeci as "Protected Landscape and Water Scape";
- Decision no.146, dated 8. 5. 2007, approving the Albanian Red List of Flora and Fauna.

4.2.2 Greece

The Habitats Directive (92/43/EEC) is the most important legal document on caves protection used on a national level. Caves may also be protected by respective articles in laws 1650/86 and 3937/2011 through Common Ministerial Decisions and Presidential Decrees.

4.2.3 FYR of Macedonia

Protection of cave habitats (article 64) and speleological sites (articles 122-126) is regulated by the Law on Nature Protection (Official Gazette of RM 67/04).

In Prespa, all caves fall within the boundaries of National Parks (Galicica NP in the FYR of Macedonia and Prespa NPs in Greece and Albania). Thus, their protection is the responsibility of the National Parks' authorities. In addition, the protection of caves as Natural Monuments in Albania is generally the responsibility of the General Directorate of Forests and Pastures and the Directorate of Fishing, as well as the local governments in which they are located. However, because of the absence of specialized structures for their protection, this responsibility is entirely transferred to the authorities of the National Park. In Greece; here the management of caves is

generally the responsibility of the Department of Paleoanthropology and Speleology of the Ministry of Culture and Tourism.

4.3 General remarks

Knowledge on bats and their roosts, including caves, was until recently insufficiently known; therefore, in practice, management regulations in National Parks in most cases did not account specifically for caves and bats, for example with regards to the regulation or prohibition of public access to important caves. However, in recent years, monitoring, management and protection of caves and bat habitats in general in Prespa has been initiated (e.g. Papadatou, Grémillet & Kazoglou 2010 in http://www.spp.gr/monitoring_en; Papadatou *et al.* 2011). Until recently in Galicica NP, there had been no direct actions to protect cave-dwelling bat species or caves. However, a series of measures to protect all habitats have been undertaken by the park's authorities. In 2005, the entrance of Samoska Dupka Cave was closed by a gate in an effort to control public visits and protect it. Because the gate was not designed specifically for bats, and following more recent revelations of its importance as a bat roost, the park's authorities are considering replacing it by a new grille-door according to the EUROBATS standards (Mitchell-Jones *et al.* 2010). The park's authorities recently developed and are currently implementing systematic long-term monitoring of bats and their habitats including caves for the first time in the park and its vicinity, beginning in 2010 (see also Papadatou, Grémillet & Kazoglou). This document attempts to further improve the basis for the protection of caves and cave-dwelling bats in Prespa Region (see PART II).

5. Transboundary Monitoring System (TMS)

The Transboundary Prespa Park offers ample ground for cooperation on the conservation of bats. The basis for such cooperation is established through the document: 'The Conservation Action Plan for the Bats of Prespa (Papadatou *et al.* 2011) and the workshop organized at Stenje (Galicica NP, July 2010; Papadatou, Grémillet & Kazoglou 2010 in http://www.spp.gr/monitoring_en) within the framework of the SPP-UNDP project on the development of a Transboundary Monitoring System (TMS) for the Transboundary Prespa Park. In parallel to priorities set at national levels, the need to conduct transboundary work and cooperation was underlined during the workshop. Based on these initial steps for transboundary cooperation on the monitoring of bats, a series of monitoring activities for cave-dwelling bats were considered important for the future (Papadatou, Grémillet & Kazoglou 2010; Papadatou et al. 2011).

According to the study on the development of the TMS for the Transboundary Prespa Park (Perennou *et al.* 2009), the TMS at its first stage of application should be realistic, low-cost and applicable. One of the aims of the workshop on bats in July 2010 at Stenje was to identify and propose scientifically-based and practical methods to monitor bats in transboundary Prespa from a wide variety of methods and techniques. However, to date, resources necessary to implement such monitoring in the future have not been secured or defined; it is therefore very probable that its implementation in the near future may include collection of relatively simple data (i.e. not demanding highly skilled personnel or complex methods and equipment) based on common methodologies and field protocols for the three sides of Prespa, to be implemented by well-trained local people. In addition, bat monitoring should require resources comparable to those allocated for the other thematic areas and elements of the TMS, such as bird midwinter counts which do not require large funds. In brief, based on these preconditions and the existing experience on transboundary bat monitoring, a bat TMS should be initiated with a series of specific more simplified activities (Papadatou, Grémillet & Kazoglou 2010; Papadatou et al. 2011).

PART II. CONSERVATION ISSUES AND RECOMMENDATIONS

6. Threats and limiting factors

Based on expert knowledge and experience, the following threats on caves and cave fauna were identified:

1. **Disturbance and/or damage caused by uncontrolled and unauthorised public access**
   Some caves may be easily accessed by the public and have signs of uncontrolled visits which may damage them. Caves with archaeological interest may become a particular target. For example, in Treni Cave there are findings dated back to prehistoric times. Key underground roosting sites used by colonies of bats throughout or most the year, such as Treni, Tcherna and Bimbilova caves, should not be open to the public. Breeding and hibernation colonies are particularly sensitive to disturbance caused by uncontrolled visits: mothers may drop and abandon their young if disturbed and hibernating bats may be aroused from torpor and consume their expensive fat reserves, without being able to replenish, thus increasing their probability of death. Bimbilova Cave is currently not immediately threatened by uncontrolled visits especially because of the absolute protection status of Golem Grad Island. However, care should be taken and boats should not be allowed to take tourists to the cave or even show its exact location. Lescoec Cave is well known and easily accessible. For the moment, there are no apparent signs of disturbance in this cave but this cannot be ruled out. Signs of uncontrolled visits have been identified on several occasions in Tcherna (Greece), in Samoska Dupka (FYR of Macedonia) and in Albanian caves:
   - **Waste disposal problems**. Garbage items such as cans, plastic bags, clothes etc have been recorded in Treni and Kosornik caves in Albania and Samoska Dupka Cave in FYR Macedonia. The root cause for this problem is low awareness of local people about the importance and values of caves.
   - **Disturbance by hunters**. Shot cartridges in Tcherna Cave reveal that hunters shoot animals in or near the site (probably birds from inside the cave); if they shoot when bats are present, they certainly disturb them, not to mention that such shooting may provoke collapse of rocks and damages to the cave structure.
   - **Summer shelter for animals**. Treni Cave, the caves near Gollomboç, and Golema Dupka may be frequently used by shepherds during summer to shelter their animals (large herds of sheep and goats). Shepherds sometimes even light fires in the caves.
   - **Other uncontrolled activities**. Uncontrolled and unauthorised visits by people may even involve rituals: in February 2011 the grille gate recently placed at the entrance of the Treni Cave (Kazoglou *et al.* 2010, WAMP *et al.* 2011) was forced open and objects, such as a mirror and candles, were found in the cave. The gate has been repeatedly forced open in the past and it has recently been removed by people to be sold as scrap metal.
   - **Unsuitable gates at cave entrances**. Gates at cave entrances that are unsuitable for bats may prohibit their free access to these sites. The gate placed at the entrance of Samoska Dupka Cave in 2005 in an effort to control public visits is not designed particularly for bats and most possibly does not allow many bats and probably other bat species to roost in the cave (at least in winter).
   - **Degradation of speleothems in Samoska Dupka Cave**. This is the richest cave in speleothems in Prespa and the most threatened in this respect. The most vulnerable speleothems are travertine pools and the cave pearls that are found in them. They are formed on the floor of the main cave chamber and may be stepped on by visitors. A small part of the cave wall is damaged with graffiti.

   Importance: high

2. **Human pressure in caves' surroundings**

   a. **Changing the configuration of the immediate surroundings**

Changes in the landscape in the immediate surroundings of the caves may affect their utilisation by the bats, such as in Mikrolimni or Kokkalis caves where large trees protect their entrance. The non-modification of the entrance of Kokkalis' Cave (i.e. vegetation preserved) and the installation of non-continuous lighting (see threat 7 "Cave tourism" below) were made possible after the recommendations of Grémillet and SPP efforts; which included contacts with the Municipality of Prespa and the company that undertook the restoration works (Grémillet and Kazoglou 2006). Altering the vegetation may further affect the caves through changes in the hydrological regime.
Importance: medium

b. Deforestation

Negative effects of deforestation on the karst ecosystems have been well documented in forestry and karst hydrology literature (Urich 1996). Deforestation causes increase of surface run-off and intensifies erosion. Any change in the volume and chemical or physical state of flowing water or air may also have a profound effect upon cave decoration (Kiernan 1988). Any disturbance of the soil mantle can lead to dehydration and a change in the continuity of formation development. There have been cases where sealing roads and car parks at tourist cave locations had actually led to the degradation of the speleothems that attracted tourists in the first place (Skinner 1972 in Kiernan 1988). The removal of forest cover can raise soil temperatures and subsequently alter soil CO_2 levels, and ultimately lead to the development of more acidic and hence aggressive seepage water entering the cave environment, which could corrode decorations (Urich 2002). As a result of deforestation, water aquifers or cave ponds are easily filled with soil (clay) material. All of the changes in water hydrology may alter the ecological conditions for cave inhabitants.
Importance: not defined

c. The quarries near Treni Cave

Explosions in the area cause vibrations, which may result in the collapse of labile rocky material in the cave.
Importance: not defined

3. **Lack of scientific data on caves and cave-dwelling bats, as well as invertebrate fauna**
   Caves in Prespa have not been fully explored. Locals may know the geographical position of additional caves and pits. Further detailed speleological exploration is needed. Almost nothing is known on the invertebrate fauna of the currently known caves.
   Importance: medium

4. **Lack of enforcement of legislation**. Basic legal framework for conservation and/or protection of caves and cave fauna do exist in all three countries in Prespa Region (see chapter 4). Lack of enforcement of legislation is the main threat that needs to be addressed in this action plan.
   Importance: medium

5. **Lack of capacity in NPs in regards to cave research and conservation**
   Most of the National Park staff are not well informed about the importance of caves and cave fauna, as well as not having the necessary skills and knowledge for practical survey of caves and cave fauna.
   Importance: medium

6. **Law public awareness (prejudice against bats)**
   Public ignorance about the ecological role and importance of caves and bats may lead to lack of respect and interest for their protection.
   Importance: medium

7. **Cave tourism**
   There is currently a mild tourist exploitation of the two historic caves in Greece, i.e. Kokkalis' and Zachariadis', without major changes in the caves. However, heavier use

could affect the configuration and microclimate of the caves and hence their use by bats. Cave tourism is a real threat for some very important bat caves in the north of Greece (e.g. Paragamian *et al.* 2004). There were plans on the past for Samoska Dupka Cave to be visited by tourists. The lights that were placed at that time in the cave are not suitable and may destroy the cave if they come into use (they are currently out of use). If the cave is ever used to attract visitors in future, particular care should be taken with regards to the type and the use of lights, the time and season of visits as well as the number of visitors and other details (see conservation recommendations below). The cave is primarily used as a hibernaculum and, as mentioned earlier, accidental arousal of hibernating bats because of disturbance may increase their probability of death.
Importance: medium

7. Action plan

7.1 Overarching goal

The overarching goal of this action plan is **to ensure the sustainable, long-term conservation of the caves and cave-dwelling bats in Prespa watershed across national boundaries**. To fulfil this goal, aims, objectives and recommended actions are defined as a response to identified threats and limiting factors and are organized along three axes, all of which are essential in conservation and inter-connected:

1. Improving knowledge;
2. Protection;
3. Raising public awareness and capacity building.

More than one axis may be involved in the same objective. Recommendations concern all three countries that share the Prespa lakes watershed. Actions should ideally be designed and implemented on a transboundary level with cooperation among scientists, the local governments, the management bodies of the national parks (Galicica National Park, Prespa National Parks in Greece and in Albania), the Society for the Protection of Prespa (SPP) and other local NGOs, under the umbrella of the Transboundary Prespa Park.

Conservation projects should be community based and be implemented with the participation of local people at both the planning and execution stages, ensuring that the benefits are made available to local people where applicable. Raising public awareness plays a significant role in resolving any misunderstandings and in shedding light onto the importance of the ecological role of caves and bats and the need to protect and preserve them.

Some general recommendations applicable to all axes described in detail in the subsequent chapters are the following:

- Establish working groups on bats and appoint a coordinator in each country,
- Organize regular contacts, exchange of information/findings from bat surveys, and meetings,
- Plan and implement joint monitoring and research efforts based on commonly agreed protocols and methodologies,
- Use the already established collaboration of experts in the three countries as a model for transboundary conservation and monitoring work in the Transboundary Prespa Park,
- Train staff involved in caves and bats monitoring by experts already acquainted with the area so as to achieve the best possible results in terms of quality of data and compliance with code of ethics (minimal disturbance to the bats).

7.2 Detailed action plan

The caves and bats AP is prepared for a 5 year period of implementation. In order to reach the overarching goal of the caves and bats CAP, based on the known threats to caves in Prespa Region, 7 main aims were identified. To:

1. Increase knowledge of the specific threats;
2. Increase knowledge and understanding of caves, bats and invertebrate fauna;

3. Develop appropriate conservation measures in order to ensure the favorable conservation status and long-term survival of cave bat populations and their cave roosts in Prespa region;
4. Enforce legislation to ensure the favourable conservation status and long-term survival of cave bat populations;
5. Develop capacity in NPs with regards to cave research surveys and conservation;
6. Develop sustainable eco tourism considering the ecological needs of the cave fauna; and
7. Increase public awareness about the function and importance of caves as well the ecological role and significance of cave-dwelling bats and invertebrates.

To fulfill these aims, 21 objectives and 73 recommended actions were elaborated through a participative process involving caves and bats experts from all three countries and external consultants. With very few exceptions, all the objectives and the recommended actions concern all three countries that share the Prespa lakes watershed.

The main identified aims, objectives and actions are categorized according the already principle of three axes (explained above, see also chapter 8). Therefore, in the next sections of this chapter, the aims, objectives and proposed actions (or recommendations) of the caves and bats conservation action plan are classified into three groups: 1) research and survey recommendations; 2) conservation recommendations; and 3) public awareness recommendations

7.2.1 Research and survey recommendations

This section is primarily concerned with the first axis. Research and survey recommendations are linked to conservation, because they produce knowledge necessary for regionally adapted conservation management plans and for targeted use of resources.

Actions should be organised and implemented by the management bodies of the National Parks (NPs) involved in collaboration with local scientists from the NPs, local NGOs (e.g. SPP) and external collaborators including bat experts and speleologists.

Aim 1: To increase knowledge and understanding of cave habitats specific threats in the Prespa Region in order to design appropriate conservation measures and priorities.

Objective 1.1 *To closely survey impacts of specific threats (uncontrolled visits, change in configuration of surroundings) in order to better assess their importance for the caves and bat fauna; to identify potential new threats.* To fulfil this objective, the following actions were defined:

- Specify the exact needs and develop survey protocol with the help of experts in collaboration with the NP authorities
- Survey caves (avoiding disturbance to bats)
- Train NP wardens to survey caves in terms of threats
- Exchange information and reports among NPs
- Take action against threats where appropriate

Objective 1.2 *To identify the importance of the impact of the explosions at the quarries near Treni Cave.* To fulfil this objective, the following actions were defined:

- NP authority to collaborate with experienced speleologists and bat experts
- Develop cave survey protocol
- Survey the cave both in terms of the impacts on the cave itself and on the bat fauna

Objective 1.3 *To identify the importance of deforestation as a threat to caves.* To fulfil this objective, the following actions were defined:

- Estimate the degree of deforestation in the areas associated with the caves
- NP authorities to collaborate with experienced speleologists to survey the cave in terms of the potential impacts of deforestation on the caves
- Develop cave survey protocols for the specific threat
- Conduct additional surveys in terms of the potential impact of deforestation on caves
- Limit deforestation above the caves and in their surroundings where appropriate

Aim 2: To increase knowledge and understanding of cave roosting habitats and bats that utilise them in order to design appropriate conservation measures and priorities.

Objective 2.1 *To perform speleological research in the wider area of the Prespa lakes watershed.* To fulfil this objective, the following actions were defined:

- Identify new caves that may be important to bats
- Seasonally assess these caves to determine their annual function if used by the bats
- Carry out surveys provided that all precautions are met for minimal disturbance to bats

Objective 2.2 *To investigate known caves along the rocky cliffs of Greater Prespa Lake and in other parts of Prespa to assess their annual function and importance for bats.* To fulfil this objective, the following actions were defined:

- Investigate known caves on a seasonal basis in order to update and complete the current knowledge; these primarily include Samoska Dupka, Cave of Doves, Gollomboç, Petralia, Kosornik, Zaroshka and Golema Dupka caves
- Include other known caves if judged necessary by the experts (e.g. Treni)
- Assess the annual function of the caves (maternity, mating, satellite, transitional, night roost, hibernation, autumn shelter, male-only roosts) through these seasonal surveys. Timing and frequency of surveys is the key to the determination of roost function
- Measure microclimatic parameters (temperature, relative humidity).
- Carry out surveys provided that all precautions are met for minimal disturbance to bats

Objective 2.3 *To survey the annual use of key cave roosting sites and to assess the bat population status on a long-term basis.* To fulfil this objective, the following actions were defined:

- Prioritise caves used by large colonies such as Bimbilova, Tcherna and Treni, as well as others that may be identified as important
- Develop a common survey protocol across the 3 countries (see Papadatou, Grémillet & Kazoglou 2010 in http://www.spp.gr/monitoring_en). Survey protocol should be developed and applied by qualified personnel; initially by bat experts in collaboration with the NPs' management bodies and scientists, and later by trained scientists of the NPs (see training recommendations below)
- Survey sites seasonally (e.g. twice per season in the first year keeping disturbance to a minimum, then once in every season in the following 3 years, etc)
- Assess the natural fluctuations and population trends of colonies roosting in caves
- Provide baseline data against which ongoing presence of bat species can be monitored in subsequent assessments
- In the Greek part of Prespa, actions may be combined with the national survey and monitoring scheme
- Carry out surveys provided that all precautions are met for minimal disturbance to bats

Objective 2.4 *To generally promote and establish common systems of bat surveys and monitoring on a transboundary level.* To fulfil this objective, the following actions were defined:

- Develop common survey and monitoring schemes, methodologies and protocols across the three countries so that results are comparable
- Organise regular meetings among bat experts, local NGOs and scientists from the management bodies of the NPs. The first steps have been established through the Transboundary Monitoring System (Papadatou, Grémillet & Kazoglou 2010 in http://www.spp.gr/monitoring_en)
- Update protocols every few years (period to be decided based upon experience)

Objective 2.5 *To investigate the invertebrate fauna of caves.* To fulfil this objective, the following actions were defined:

- Select caves for investigation
- Assess caves on a seasonal basis

- Measure microclimatic parameters (temperature, relative humidity)

Objective 2.6 *To develop regional and transboundary data bases.* To fulfil this objective, the following actions were defined:

- Develop a centralised system of data management in each National Park (regional data base). Regional data bases should use common formats and software
- Develop a centralised system of data management in the Transboundary Prespa Park (transboundary data base)
- Feed regional data bases with all survey data
- Train NP scientists to manage regional data bases
- Feed the centralised TPP data base through the regional data bases. The centralised TPP data base should have the same format as the regional data bases.
- Define protocols of data usage on a regional basis (what and how it is allowed to be used)

7.2.2 Conservation recommendations

This section is concerned with the second axis: protecting cave-dwelling bats and their cave roosts, including the sensitive invertebrate fauna that may be present in those caves. We recommend conservation management actions based on currently available knowledge and experience. The results of these actions should be monitored and conservation recommendations should be adapted to the results of monitoring as well as to the results of the research and survey actions. Conservation management actions will help to stabilise or increase populations of vulnerable species and improve their conservation status on a local level. The protection of cave roosts is a key action in achieving favourable conservation status for cave-dwelling bats and invertebrates, especially given the fact that bats are very faithful to these roosts and that they use a network of roosting places and that cave invertebrates have highly specialized needs.

Actions should be organised and implemented by the management bodies of the NPs involved in collaboration with local scientists from the NPs, local NGOs (e.g. SPP) and external collaborators, including bat experts and speleologists.

Aim 3: To develop appropriate conservation management actions in order to ensure the favourable conservation status and long-term survival of cave bat populations and their cave roosts in Prespa Region

Objective 3.1 *To apply immediate measures at Samoska Dupka Cave.* To fulfil this objective, the following actions were defined:

- Remove the perpendicular rails of the currently placed gate and block the gap between the gate and the rock at the upper part of the gate that allows people to enter in a first effort
- Remove the currently installed and disused lights and other infrastructure in the cave
- Remove graffiti from the wall with a steel brush (Ford and Williams 2007)
- Monitor the cave for any beneficial or adverse effects to the bats roosting in the cave in order to make appropriate adjustments to the door if necessary with previous training of the scientists of Galichica NP on how to perform the monitoring (bat experts to train scientists)
- In a subsequent step, completely replace the gate by a grille-door built according to the EUROBATS standards (Mitcell-Jones *et al.* 2010)

Objective 3.2 *To replace the gate at Treni Cave.* To fulfil this objective, following actions were defined:

- Replace the recently (2011) cut-off gate at Treni by a grille-door of more long-lasting material according to the EUROBATS standards
- Monitor the cave following the placement of the gate for any beneficial or adverse effects to the bats roosting in the cave in order to make appropriate adjustments if necessary

- Train scientists of Prespa NP to perform the monitoring (bat experts to train scientists)

Objective 3.3 *To maintain the configuration of the immediate surroundings of cave entrances.* To fulfil this objective, the following actions were defined:

- Survey the surroundings of the caves during the monitoring by the wardens
- Avoid tree cutting near the entrance of any cave unless the entrance is blocked in which case parts of the vegetation should be removed

Objective 3.4 *To regularly monitor caves to prevent impacts from uncontrolled public access.* To fulfil this objective, the following actions were defined:

- Develop a monitoring protocol (bat and cave experts, and NP authorities)
- Train wardens in monitoring methods
- Monitor caves on a regular and long-term basis to check for signs of uncontrolled visits and disturbance
- Carry out surveys provided that all precautions are met for minimal disturbance to bats.

Aim 4: Enforce legislation to ensure the favourable conservation status and long-term survival of cave bat populations and their cave roosts in Prespa Region

Objective 4.1 *To promote the enforcement of national and international legislation for the protection of caves and cave-dwelling bat populations on a local level.* To fulfil this objective, the following actions were defined:

- Encourage actions to ensure that cave roosts and their bat populations receive the fullest possible legislative protection
- Promote and include caves in management plans and local conservation strategies of NPs drawn up under national and international policies and legislation (e.g. the Habitats Directive)
- Include the protection of caves (in Greece) in the future update of the Common Ministerial Decision and Presidential Decree of the Prespa National Park to ensure the statutory protection of these sites
- Promote the enforcement of the legislation in all three countries through the establishment of the TPP authority
- Prioritise sites where current protection is inadequate (e.g. Treni Cave)

Aim 5: Develop national parks' staff capacity with regards to cave research surveys and conservation

Objective 5.1 *To educate the National Park authorities and management bodies as well as the local governments with regards to the function, ecological role and importance of caves and bat populations in the Prespa region.* To fulfil this objective, the following actions were defined:

- Organize local and transboundary meetings, presentations and discussions with experts and local NGOs (e.g. SPP)

Objective 5.2 *To train scientists and wardens in the National Parks in census techniques to take over the survey and monitoring of caves and their bat populations.* To fulfil this objective, the following actions were defined:

- Permanently equip local scientists and wardens of the NPs with the appropriate skills for the monitoring of cave roosts
- Organise training sessions and courses in practical survey and monitoring in the field as well as data management
- Produce guidelines and specific protocols in collaboration with bat experts and speleologists

Objective 5.3 *To permanently equip the NPs with the tools for practical monitoring.* To fulfil this objective, the following actions were defined:

- Include appropriate equipment for cave and bat monitoring in the budget of National Parks following advice from cave and bat experts

Aim 6: Develop sustainable eco tourism considering the ecological needs of cave fauna

Among all the caves examined in this document, only Kokkalis, Zachariadis (Greece) and Samoska Dupka (FYR of Macedonia) may be allowed to be open to the public. All other caves host bat colonies throughout the year or most of the year and hence visits should be prohibited. In any case, most of the caves in Prespa do not present particularly important cave speleothems. Psarades Cave cannot be open to the public because of the presence of large amounts of fleas. In particular:

- *In Greece - t*he mild tourist development of the two historical caves, Zachariadis and Kokkalis' should remain as it is.
- *In FYR of Macedonia* - in general, tourist exploitation of the cave should be mild, as for Kokkalis and Zachariadis caves in the Greek part of Prespa, and should be done under a strict protocol that will be devised following an Environmental Impact Assessment (EIA) study that will include a study of the annual use of the cave by bats.

Details for the treatment of a potential tourist development of these three caves are elaborated in the following objectives and actions:

Objective 6.1 *To define the protocol of visits in Samoska Dupka Cave in case it opens for tourism.* To fulfil this objective, the following actions were defined:

- An EIA study is a prerequisite prior to any works and opening of the cave to the public. The EIA should include a survey of the annual use of the cave by bats, if this has not been implemented until that time; the annual use of the cave by bats should determine the season or seasons that visitors may be allowed in the cave. We already know that visitors should not be allowed from October until February, since the cave is one of the most important known hibernacula in Prespa and the bats start gathering in the cave at least from October onwards
- Special care should be taken with regards to the lights used in the cave, the timing and duration of visits, the number of visitors allowed per day and other practical details that will be defined by the EIA

Objective 6.2 *To maintain the mild tourist development of Kokkalis and Zachariadis caves.* To fulfil this objective, the following actions were defined:

- These caves are open to the public. Because of their historical importance and because they are not used by breeding or hibernating bat colonies, they may continue to be used as such
- However, they should remain mildly exploited to avoid the change in the cave's microclimate. This should be ensured by the NP authority in Greece and the local government

Important point: Any restoration or protection works (e.g. placement of gates at entrances, etc) should be implemented when the bats are absent from the sites and under the supervision and advice of bat experts. For example, works in Samoska Dupka Cave should not take place in late autumn and winter

7.2.3 Public awareness

This section is concerned with the third axis: raising public awareness and capacity building.

Aim 7: Increase public awareness on the function and importance of caves as well as the ecological role and significance of cave-dwelling bats and invertebrates. Increasing public support towards the conservation of Prespa caves and cave fauna through the dissemination of information to the public will decrease the threats to their survival.

Objective 7.1 *To produce and disseminate information to the public: local communities and visitors.* To fulfil this objective, the following actions were defined:

- Organize educational campaigns/programmes
- Produce and disseminate leaflets and other information material
- Place information panels in information centres of the NPs

- Place outdoor information panels at caves open to the public
- Create a webpage as part of the websites of the NPs

Objective 8.2 *To inform and establish agreements with municipalities and authorities responsible for the tourist development of caves on a local level.* To fulfil this objective, the following actions were defined:

- Encourage municipalities and relevant authorities to maintain a mild tourist development of caves open to the public in collaboration with the management bodies of the National Parks

A review of all actions together with responsible institutions/organizations and priority for implementation is presented in Table 3.

Table 3. Recommended action plan for caves and cave bats in Prespa lakes watershed

	Threats	Aims	Objectives	Actions	Implementation	Timeframe[7]	Prioritization[8]
Research and survey recommendations	Disturbance and/or damage caused by uncontrolled and unauthorized public access Human pressure in caves' surrounding	**1. Increase knowledge of the specific threats**	1.1 To closely survey impacts of specific threats; to identify new threats	1.1.1 Development of survey protocol (survey caves avoiding disturbance to bats) for surveying impacts of specific threats	Bat and invertebrate experts, speleologists	ST	2
				1.1.2 Training NP wardens to survey caves in terms of threats	Bat and invertebrate experts, speleologists	ST	2
				1.1.3 Exchanging information and reports among NPs	NPs	LT	3
				1.1.4 Taking action against threats where appropriate	NPs in cooperation with the relevant experts	LT	3
			1.2 To identify the importance of the impact of the explosions at the quarries at Treni Cave (AL)	1.2.1 Collaboration of NPs authority with experienced speleologists and bat experts	NPs authority	LT	2
				1.2.2 Development of cave survey protocol for the specific threat	Bat and invertebrate experts, speleologists	ST	2
				1.2.3 Surveying the cave both in terms of the impacts on the cave itself and on the bat fauna	Bat and invertebrate experts, speleologists in collaboration with NPs stuff	MT	2
			1.3 To identify the importance of deforestation as a threat to caves	1.3.1 Estimating the degree of deforestation in the areas associated with the caves	Relevant experts in collaboration with NPs	MT	3
				1.3.2 Collaboration of NPs authority with experienced speleologists and	NPs authority	LT	2

[7] ST=Short term action (up to 1 year); MT= Medium term action (1-3 years); LT=Long term action (3-5 years)
[8] 1=Immediate action; 2=Action in the frame of this Action Plan; 3=Action to start in the frame of this Action Plan

	Threats	Aims	Objectives	Actions	Implementation	Timeframe[7]	Prioritization[8]
				bat experts			
				1.3.3 Development of cave survey protocols for the specific threat	Bat and invertebrate experts, speleologists, forest experts	ST	2
				1.3.4 Survey the cave in terms of the potential impacts of deforestation on the caves	Relevant experts in collaboration with NPs stuff	MT	2
				1.3.5 Limiting the deforestation of forests, above caves and in their surroundings	NPs authority	LT	2
	Lack of scientific data on caves, cave-dwelling bats and cave invertebrate fauna	**2. Increase knowledge and understanding of caves, bats and invertebrate fauna**	2.1 To perform speleological research in the wider area of the Prespa watershed	2.1.1 Identify new caves that may be important to bats	Bat and invertebrate experts, speleologists in collaboration with NPs stuff and local NGOs	MT	2
				2.1.2 Assessment of the annual/seasonal function of the new caves if used by the bats	Bat experts	MT	3
				2.1.3 Carry out surveys provided that all precautions are met for minimal disturbance to bats	Bat and invertebrate experts, speleologists	MT	2
			2.2 To investigate known caves along the rocky cliffs of Greater Prespa Lake and in other parts of Prespa and assess their annual function and importance for bats	2.2.1 Investigation of known caves on a seasonal basis	Bat experts and trained NPs stuff; local NGOs	LT	3
				2.2.2 Updating and completing the current knowledge	Bat experts and trained NPs stuff; local NGOs	LT	2
				2.2.3 Assessment of the caves' annual function through these seasonal surveys.	Bat experts and trained NPs stuff; local NGOs	LT	3
				2.2.4 Measurement of microclimatic parameters (temperature, relative humidity)	Bat experts, speleologists	MT	2
				2.2.5 Carry out surveys provided	Bat experts,	LT	2

	Threats	Aims	Objectives	Actions	Implementation	Timeframe[7]	Prioritization[8]
				that all precautions are met for minimal disturbance to bats	speleologists		
			2.3 To survey the annual use of key cave roosting sites and to assess the bat population status on a long-term basis	2.3.1 Prioritise caves used by large colonies such as Bimbilova, Tcherna and Treni, as well as others that may be identified as important	Bat experts	ST	3
				2.3.2 Development of common survey protocol across the 3 countries	Bat experts in collaboration with NPs authorities and local NGOs	ST	2
				2.3.3 Seasonal survey of the sites	Bat experts and trained NPs stuff; local NGOs	LT	3
				2.3.4 Assessment of the natural fluctuations and population trends of colonies roosting in caves	Bat experts	LT	3
				2.3.5 Provide baseline data against which ongoing presence of bat species can be monitored in subsequent assessments	Bat experts	MT	3
				2.3.6 Combine actions with the national survey and monitoring scheme (GR)	NPs	LT	2
				2.3.7 Carry out surveys provided that all precautions are met for minimal disturbance to bats	Bat experts and trained NPs stuff	LT	2
			2.4 To generally promote and establish common systems of bat surveys and monitoring on a transboundary level	2.4.1 Development of common survey and monitoring schemes, methodologies and protocols across the three countries	TPP, NPs, local NGOs and relevant experts	ST	1
				2.4.2 Organize regular meetings among bat experts, local NGOs and scientists from the management bodies of the NPs	NPs	LT	1
				2.4.3 Update of the protocols every few years (period to be decided upon experience)	Bat experts, local NGOs and NPs	LT	3
			2.5 To investigate the	2.5.1 Select caves for investigation	Invertebrate	ST	1

	Threats	Aims	Objectives	Actions	Implementation	Timeframe[7]	Prioritization[8]
			invertebrate fauna of caves		experts		
				2.5.2 Assessment of the caves on a seasonal basis	Invertebrate experts and trained NPs stuff	LT	3
				2.5.3 Measurement of microclimatic parameters (temperature, relative humidity)	Invertebrate experts	MT	3
			2.6 To develop regional and transboundary data bases	2.6.1 Development of a centralised system of data management in each NP (regional data base)	NPs, local NGOs and relevant experts	MT	1
				2.6.2 Develop a centralised system of data management in the TPP (transboundary data base)	TPP	MT	2
				2.6.3 Feed regional data bases with survey data	Qualified NPs stuff and local NGOs	LT	1
				2.6.4 Training of NPs scientists to manage regional data bases	Experts/local NGOs/ Qualified NPs stuff	ST	1
				2.6.5 Feed the centralised TTP data base through the regional data bases	Qualified NPs stuff	LT	2
				2.6.6 Defining protocols of data usage on a regional basis	Experts/local NGOs/ Qualified NPs stuff	ST	1
Conservation recommendations	Disturbance and/or damage caused by uncontrolled and unauthorised public access	**3. Develop appropriate conservation to ensure the favourable conservation status and long-term survival of cave bat populations and their cave roosts in Prespa Region**	**3.1 To apply immediate measures at Samoska Dupka Cave**	3.1.1 Block the gap between the gate and the rock at the upper part of the gate that allows people to enter in a first effort	NP Galichica	ST	1
				3.1.2 Remove the currently installed and disused lights and other infrastructure in the cave; remove graffiti	NP Galichica	ST	1
				3.1.3 Monitor the cave for any beneficial or adverse effects to the bats from these interventions	Bat experts and trained NP stuff	LT	2
				3.1.4 Train scientists of Galicica NP to do the monitoring	Bat experts	ST	2
				3.1.5 Replace the current gate by a	NP Galichica	ST	1

	Threats	Aims	Objectives	Actions	Implementation	Timeframe[7]	Prioritization[8]
				grille-door built according to EUROBATS standards, if necessary			
			3.2 To replace the gate at Treni Cave	3.2.1 Replace of the recently cut-off gate at Treni by a grille-door of more long-lasting material according to the EUROBATS standards	Prespa Park AL	ST	1
				3.2.2 Monitor the cave following the placement of the gate for any beneficial or adverse effects to the bats roosting in the cave to make appropriate adjustments if necessary	Bat experts and trained NP stuff	MT	2
				3.2.3 Train scientists of Prespa NP to perform the monitoring	Bat experts	ST	2
			3.3 To maintain the configuration of the immediate surroundings of cave entrances	3.3.1 Survey the surroundings of the caves during the monitoring	Park wardens	LT	2
				3.3.2 Avoid tree cutting near the entrance of any cave unless the entrance is blocked	NPs	LT	2
			3.4 To regularly monitor caves to prevent impacts from uncontrolled public access	3.4.1 Develop monitoring protocol	Relevant experts/NPs	ST	2
				3.4.2 Train wardens in monitoring method	Relevant experts/ NPs	ST	2
				3.4.3 Monitor caves on a regular and long-term basis	Park wardens	LT	2
				3.4.4 Carry out surveys provided that all precautions are met for minimal disturbance to bats	Park wardens	LT	2
	Lack of enforcement of legislation	**4. Enforce legislation to ensure the favourable conservation status and long-term survival of cave bat populations and**	**4.1 To promote the enforcement of national and international legislation for the protection of caves and cave-dwelling bat populations on a local level**	4.1.1 Encourage actions to ensure that cave roosts and their bat populations receive the fullest possible legislative protection	NPs	LT	2
				4.1.2 Promote and include caves in management plans and local conservation strategies	NPs authority	MT	1
				4.1.3 Include the protection of caves in the future update of the	Prespa NP authority	ST	2

	Threats	Aims	Objectives	Actions	Implementation	Timeframe[7]	Prioritization[8]
		their cave roosts in Prespa Region		Common Ministerial Decision and Presidential Decree of the Prespa National Park (GR)			
				4.1.4 Promote the enforcement of the legislation in all three countries	TPP authority	MT	2
				4.1.5 Prioritise sites where current protection is inadequate	NPs in collaboration with relevant experts	MT	2
	Lack of capacity in NPs in regards to cave research and conservation	**5. Develop NPs staff capacity with regards to cave research surveys and conservation**	**5.1 To educate the National Park authorities and management bodies with regards to the function, role and importance of caves, cave invertebrates and bat populations in the Prespa region**	5.1.1 Organize local and transboundary meetings, presentations and discussions with experts and local NGOs	NPs authorities and local NGOs	LT	1
			5.2 To train scientists and wardens in the National Parks in census techniques	5.2.1 Permanently equip local scientists and wardens of the NPs with the appropriate skills for the monitoring of cave roosts	Experts/ NPs/ local NGOS	MT	2
				5.2.2 Organise training sessions and courses in practical survey and monitoring in the field as well as data management	Experts/ NPs/ local NGOS	MT	1
				5.2.3 Produce guidelines and specific protocols	Experts/ NPs/ local NGOS	ST	1
			5.3 To permanently equip the NPs with the tools for practical monitoring	5.3.1 Include provision of appropriate equipment in NPs budget	NPs authorities	LT	1
	Cave tourism	**6. Develop sustainable eco tourism considering the ecological needs of cave fauna**	**6.1 To define the protocol of visits in Samoska Dupka Cave in case it opens for tourism**	6.1.1 Conduct Environmental Impact Assessment (EIA) study as a prerequisite prior to any works and opening of the cave to the public	NP Galichica	MT	2
				6.1.2 Define protocols of the visits	Relevant experts	ST	2

	Threats	Aims	Objectives	Actions	Implementation	Timeframe[7]	Prioritization[8]
				by qualified personnel based on the EIA study	and NP trained stuff		
			6.2 To maintain the mild tourist development of Kokkalis' and Zachariadis' caves (only GR)	6.2.1 Promote and ensure mild tourist exploitation	NP and local relevant authorities	MT	1
				6.2.2 Develop protocols of public visits	NP and local relevant authorities	ST	1
Raising public awareness and capacity building recommendations	Low public awareness (prejudice against bats)	**7. Increase public awareness on the function and importance of caves as well the ecological role and significance of cave-dwelling bats and invertebrates**	**7.1 To produce and diffuse information to the public: local communities and visitors**	7.1.1 Produce and disseminate leaflets and other information material	Local NGOs and NPs	ST	1
				7.1.2 Organize educational campaigns/programmes	Local NGOs and NPs	MT	1
				7.1.3 Place information panels in information centres of the NPs	Local NGOs and NPs	ST	1
				7.1.4 Place outdoor information panels at caves open to the public	Local NGOs and NPs	ST	1
				7.1.5 Create webpage as part of the websites of the NPs	NPs	MT	1
			7.2 To inform and establish agreements with municipalities and authorities responsible for the tourist development of caves on a local level	7.2.1 Encourage municipalities and relevant authorities to maintain a mild tourist development of caves open to the public	NPs authorities/ Local NGOs	LT	2

7.3 Recommended priority actions

From the Caves Action Plan given in Table 3, two priority conservation actions, that need to be applied immediately by the responsible management authorities, were selected by the expert team. In the following text they are elaborated in more detail.

Action 4.1.5 Replacing the current gate at Samoska Dupka Cave by a grille-door built according to the EUROBATS standards.

The gate placed at the entrance of Samoska Dupka Cave in 2005 in an effort to control public visits is not designed particularly for bats and most possibly does not allow many bats to roost in the cave (at least in winter). The gate should be replaced by a "bat-friendly" grille-door according to EUROBATS standards that may allow access to more bats and probably species in the cave. According to the EUROBATS recommendations, the grill-door should have horizontal bars of appropriate design and construction for the site. One of the most important variables of the grills is the spacing between the bars. Recommended air spacing is 130-150 mm between the bars (or more depending on species) and 450-750 mm between the vertical supporters. The grill door should be well secured, but to permit safety access to authorized persons. It is recommended that the grill should be securely fitted into solid rock and must be fitted in a way that does not obstruct the air flow into the site. The grill-door must be inspected regularly and maintained when necessary.

Time scale: Short term
Prioritization: Immediate action
Approximate costs: 1.000 €

Priority action(s)	Short description	Budget	Stakeholders	Leader(s) /potential implementers	Monitoring	Indicators
Replacing the current gate in Samoska Dupka Cave entrance by a grille-door built according to the EUROBATS standards	The gate placed at the entrance of Samoska Dupka Cave is not designed particularly for bats and most possibly does not allow many bats to roost in the cave. The gate should be replaced by a "bat-friendly" grille-door according to EUROBATS standards.	1.000 €	Local authority, NGOs	NP Galichica	Bat experts with trained NP stuff	Replaced grille-door according to EUROBATS standards

Action 4.2.1 Replacement of the recently cut-off gate at Treni Cave by a grille-door of more long-lasting material according to the EUROBATS standards.

A grill-door installed at the entrance of the cave allowing bats to freely emerge from and enter in the cave without being disturbed by the human presence was recently damaged and cut-off. Thus, there is an urgent need to replace it with a new door of long-lasting material according to the EUROBATS standards. It is recommended to use toughened steel for the most vulnerable parts of the grill. The grill-door should be well secured, but should allow access to authorized persons. It is recommended that the door should be securely fitted into solid rock and must be fitted on a way that it does not obstruct the air flow into the site. It should be inspected regularly and maintained when necessary.

Time scale: Short term
Prioritization: Immediate action
Approximate costs: 1.000 €

Priority action(s)	Short description	Budget	Stakeholders	Leader(s) /potential implementers	Monitoring	Indicators
Replacement of the recently cut-off gate at Treni by a grille-door of more long-lasting material according to the EUROBATS standards	As the previously installed grill-door at the entrance of the cave was cut-off, there is urgent need to replace it with new one made of long-lasting material according to EUROBATS standards.	1.000 €	Local authority, NGOs	Prespa Park AL	Bat experts	Replaced grill-door according to the EUROBATS standards

8. Conclusion: caves and bats in the Transboundary Prespa Park

Knowledge about most caves and bats of Prespa is recent and incomplete. Surveys have mainly been implemented in summer. More recently, the first surveys at swarming sites and generally autumnal shelters were undertaken, as well as the first winter surveys (Papadatou *et al.* 2011). Nevertheless, we now know that a number of limestone caves in all three countries sharing the Prespa watershed host important summer, autumn and winter bat colonies (Table 1). Cave-dwelling bats in the south of Europe switch between different underground sites both within and between seasons (e.g. Papadatou *et al.* 2008, 2009, Némoz and Brisorgueil 2008). This may well be the case for bats at Prespa: because borders between countries are not physical barriers to bats, they may move among underground sites across Greece, Albania and the FYR of Macedonia, along the shore of the Greater Prespa Lake, the islands of Golem Grad and Mali Grad, and in inland areas such as Mikrolimni and Lescoec caves.

Potential examples of movements include *Miniopterus schreibersii* and *Myotis capaccinii* between Bimbilova, Tcherna, Treni, Gollomboç, Petralia, Kosornik and Mali Grad caves; *Rhinolophus euryale* and *R. blasii* between Naumova Peshtera (Ohrid Lake watershed) and Leskoec caves or between Tcherna and Mikrolimni caves. These sites probably form a network used by the bats throughout the year and may also include other locations that to date are unknown and may even be found away from the Prespa watershed. This hypothesis is supported by the fact that the size of colonies fluctuates among years, seasons and even months. Movements of bats among caves may be related to seasonal changes in roost microclimate, avoidance of ectoparasites, the bats' life cycle stage, social organization, mating systems, the proximity of the roost to foraging habitats, predator pressure and disturbance.

Caves well outside the Prespa watershed may be used by bats roosting within Prespa at other times of year. For example, Jaroec is a cave at an approximate straight distance of 50-70 km from caves in the Prespa watershed such as Tcherna and Treni. These are distances easily travelled by species such as *Miniopterus schreibersii;* therefore it is likely that the cave is part of the network of underground sites used by the bats in the Transboundary Prespa Park and its adjacent areas. The same may apply for other caves surrounding the TPP. Only Bimbilova, Samoska Dupka and Treni caves have to date been confirmed as important hibernacula for *Myotis capaccinii* (Bimbilova and Treni)*, M. blythii, M. myotis* and *Rhinolophus hipposideros* (Samoska Dupka) and *Miniopterus schreibersii* (Bimbilova)*.* We do not know where most other bats go in winter. Because bats tend to hide in deep inaccessible crevices in underground sites or in inaccessible sites in general (e.g. vertical shafts), we may get a limited answer to this question even after systematic studies in future.

To truly protect cave-dwelling bat populations in Prespa Region, all their roosting sites should be protected on a transboundary level, i.e. winter, summer, transitional, mating and autumn roosts, as well as feeding habitats, and commuting and migratory corridors. For effective conservation and protection, we ideally need good knowledge of all of these sites, as well as of the movement patterns of bats, their specific ecological requirements and the particular threats they face in the area. In this document we focus on the protection of the cave roosts. Our current knowledge allows us to recommend some specific actions for their conservation.

References

Andonovski, T., Kolchakovski, D. (1990). Project report for Pelister and Galichica - natural and socio geographic surveys, Skopje

Angelichin-Zura, G. (2006). Cave churches in the Area of Ohrid and Prespa (Republic of Macedonia, Republic of Albania, Republic of Greece). Nis and Vizantija IV, pp 385-402

Arsovski, M. (1997). Macedonian Tectonic. Faculty for mining and geological engineering, Stip, pp 27-79

Bego, F. (2011). Bat roosting sites in the territory of Prespa National Park, Albania. Mimeographed report, Society for the Protection of Prespa. Tirana, Albania

Chavkalovski, I. (1997). Hydrology of Prespa Lake. Proceedings of the International Symposium "Toward Integrated conservation and Sustainable Development of Transboundary Macro and Micro Prespa lakes", Korcha, Albania, pp. 9-14.

Chavkalovski, I. (2000). Anthropogenic influence on the denivelation of Macro and Micro Prespa Lake. Proceedings of the International Symposium "Sustainable Development of Prespa Region", Oteshevo, pp. 250-257.

Chytil, J. & M. Vlašin (1994). Contribution to the knowledge of bats (Mammalia: Chiroptera) in Albania. *Folia Zool*. 43: 465-467

Cvijic, J. (1906). Fundamentals of geography and geology of Macedonia and old Serbia, Sp. Ed. VIII-689, Belgrade

DEKONS-EMA (2009). Selection of priority species and habitats in Prespa region. Report. Consulting Services of training on Conservation and Action Planning for Priority Transboundary Habitats and Species in the Prespa Lakes basin-Preparatory Phase. UNDP, Skopje.

DEKONS-EMA (2010). Status Papers on Priority Species and Habitats including information on current management arrangements and institutional mandates/jurisdiction. Consulting Services of training on Conservation and Action Planning for Priority Transboundary Habitats and Species in the Prespa Lakes basin-Preparatory Phase. UNDP, Skopje.

Deltshev, C., Vrenosi, B., Blagoev, G. & S. Lazarov (2011). Spiders of Albania – Faunistic and zoogeographical Review (Arachnida: Araneae). Acta Zoologica Bulgarica 63(2): 125-144.

Dumurdzanov, N. & T. Ivanovski (1977). Basic geological map of Yugoslavia - Ohrid, 1:100000, K-34-102, Belgrade

Dumurdzanov, N. & T. Ivanovski (1978). Interpreter on Leaves Ohrid (K 34-102) and Podgradec (K 34-102). Geological Institute, Belgrade, pp 22-26.

Ford, D.C. & P.W. Williams (2007). Karst Hydrogeology and Geomorphology. Jon Wiley & Sons, Chichester pp 562

Grémillet, X. & J. Boireau (2004). Les chauves-souris du Parc National de Prespa. Macédoine occidentale-Grèce. Mimeographed report, Groupe Mammalogique Breton, Sizun, France, pp 35

Grémillet, X. & Y. Kazoglou (2006). Memo on the wintering bat populations at the cave of Vrondero village (old "rebels' hospital"). Unpublished report (*in Greek*)

Grémillet, X. & T. Dubos (2008). Bilan chiroptérologique des prospections estivales organisées par le Groupe Mammalogique Breton dans le Parc National de Prespa - Macédoine occidentale, Grèce. Mimeographed report, GMB, pp 48

Grémillet, X., Dubos, T. & T. Le Campion (2010). Bilan chiroptérologique des prospections estivales organisées jusqu'en 2007 par le Groupe Mammalogique Breton dans le Parc National de Prespa, Macédoine occidentale (Grèce). *Symbioses* 25: 1-6.

Hollis, G.E. & A.C. Stevenson (1997). The physical basis of the Lake Mikri Prespa systems: Geology, climate, hydrology and water quality. *Hydrobiologia* 351: 1-19

Kazoglou, Y., Xega, N. & F. Doleson (2010). Guidelines for wetland vegetation management in Lake Micro Prespa, Prespa National Park, Albania. Women Association of Micro Prespa, Prespa National Park (Forest Service Directorate, Korca), Society for the Protection of Prespa, UNDP Albania – Small Grants Programme, pp 44 + 6 Appendices

Kiernan, K. (1988). The management of soluble rock landscapes: an Australian perspective. Sydney, The Speleological Research Council Ltd. 61 p.

Klincarov, S. (1997). Geological-hydrological characteristics of Prespa Basin and their influence on the hydrological conditions of the lake. Proceedings of the International Symposium “Towards Integrated Conservation and Sustainable Development of Transboundary Macro and Micro Prespa Lakes”, 24-26 October, 1997, Korcha, Albania, pp 79-83

Kryštufek, B., Vohralik, V., Flousek, J. & S. Petkovski (1992). Bats (Mammalia: Chiroptera) of Macedonia, Yugoslavia. Pp. 93-111 in: Horaček I, Vorhalik V (eds.): Prague Studies in Mammology. Charles University Press, Praha

Lazarevski, A. (1993). Climate in Macedonia. Skopje, pp 236-240. (*In Macedonian*)

Legakis, A. & P. Maragkou (eds) (2009). The Greek Red Data Book of Threatened Animals. Hellenic Zoological Society, Athens, pp 528

Manakovic, D. (1990). Project report for Pelister and Galichica - natural and socio geographic surveys, Skopje

Manakovic, D., Andonovski, T. & D. Kolcakovski (1993). Underground karst in the National Park "Galcica". God. zb. Geografija, 31/39: 37-71. (*In Macedonian*)

Mitchell-Jones, A.J., Bihari, Z., Masing, M. & L. Rodrigues (2010). Protecting and managing underground sites for bats. EUROBATS Publication Series No. 2 (English version). UNEP / EUROBATS Secretariat, Bonn, Germany, pp 38

Nedelko, M. (2000). Caves in Prespa region as a resource for sustainable development. Proceedings "Sustainable Development of Prespa region", Oteshevo. Special issues of Macedonian Ecological Society, 122-125.

Némoz, M. & A. Brisorgueil (2008). Connaissance et conservation des gites et habitats de chasse de 3 Chiropteres cavernicoles : Rhinolophe euryale, Murin de Capaccini, Minoptere de Schreibers. SFEPM, Museum National d’Histoire Naturelle,Paris, pp 104

Papadatou, E., Butlin, R.K. & J.D. Altringham (2008). Seasonal roosting habits and population structure of the long-fingered bat *Myotis capaccinii* in Greece. *Journal of Mammalogy* 89: 503-512

Papadatou, E., Butlin, R.K., Pradel, R. & J.D. Altringham (2009). Sex-specific roost movements and population dynamics of the vulnerable long-fingered bat, *Myotis capaccinii*. *Biological Conservation* 142: 280-289

Papadatou, E., Grémillet, X. & Y. Kazoglou (2010). Pilot Application of the Transboundary Monitoring System for the Prespa Park: Workshop on the Monitoring of Bats, Final report. Society for the Protection of Prespa, Agios Germanos, pp 25

Papadatou, E., Gremillet, X., Bego, F., Petkovski, S., Stojkoska, E., Avramoski, O. & Y. Kazoglou. (2011) Status survey and conservation action plan for the bats of Prespa. Society for the Protection of Prespa, Agios Germanos, pp 191

Paragamian, K. (1992). The cave of Mikrolimni Municipality, Prespa, Florina. Hellenic Speleological Society Bulletin, Athens (*in Greek*)

Paragamian, K., Nikoloudakis, E., Papadatou, E. & E. Sfakianaki (2004). Biological-environmental study of Maronia Cave: analysis of current status—proposals. Greek Institute of Speleological Research, Irakleion, Greece (in Greek)

Perennou, C., Gletsos, M., Chauvelon, P., Crivelli, A., DeCoursey, M., Dokulil, M., Grillas, P., Grovel, R. & A. Sandoz. (2009). Development of a Transboundary Monitoring System for the Prespa Park Area. Agios Germanos, pp 381

Petkovski, S. (2010). Inventory and ecological valorisation of the invertebrates in Galichica NP. Management plan for Galichica National Park for the period 2010-2020 (proposal). Book II, part 1, 153-188.

Petrochilou, A., Theologou, A., Moschona, G. & T. Kitseli (1977). Speleological research at Lake Greater Prespa, Florina. Hellenic Speleological Society Bulletin, Athens, pp 100-140 (*in Greek*)

Ristevski, P., Monevska, S. & B. Popovski (1997). Characteristics of temperature, pluviometric and evaporation regime of Prespa lake basin. Proceedings of the International Symposium “Toward Integrated conservation and Sustainable Development of Transboundary Macro and Micro Prespa lakes”, Korcha, Albania.

Ristevski, P. (2000). Climatic and agroclimatic characteristics in the Prespa Lake Basin. Proceedings of the International Symposium “Sustainable Development of Prespa Region”, Oteshevo, pp 212-223

Tochkovski, V. (1970). Caves in Galichica. Fifth Yugoslovenian Speleological Congress, Skopje, pp 161-172

Urich, P.B. (1996). Deforestation and declining irrigation in Southeast Asia: A Philippine case. International Journal of Water Resources Development 12(1): 49–63.

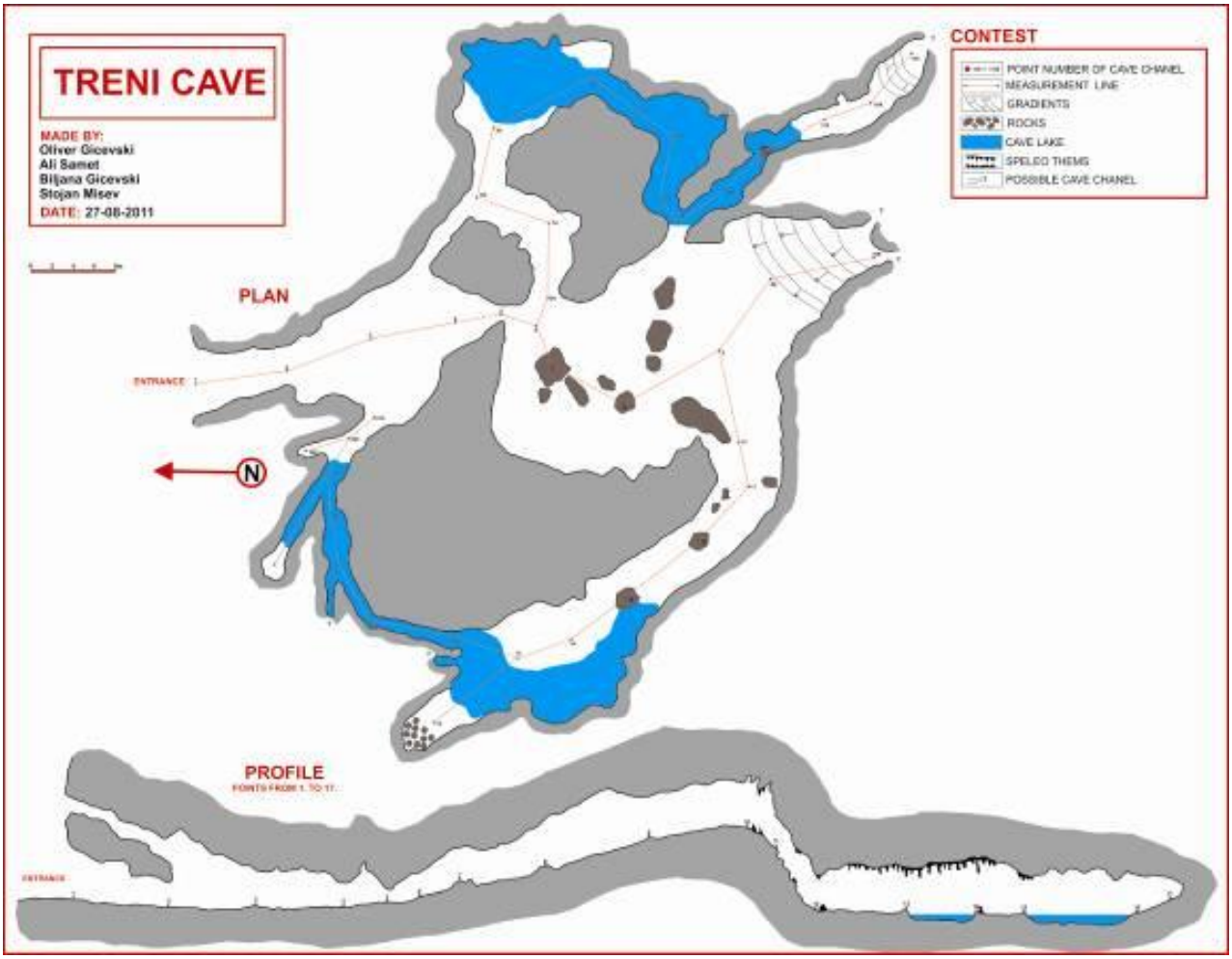
Urich, P.B. (2002). Land use in karst terrain: review of impacts of primary activities on temperate karst ecosystems. Science for Conservation 198. New Zealand Department of Conservation, 60pp.

Uhrin, M., Horacek, I., Šibl, J. & F. Bego (1996). On the bats (Mammalia: Chiroptera) of Albania: survey of the recent records. *Acta Soc. Zool. Bohem*. 60: 63-71

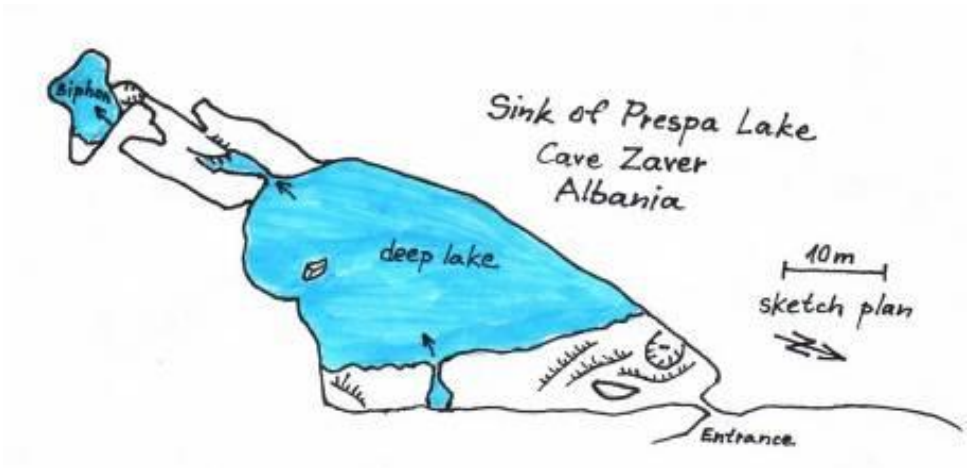
Women Association of Micro Prespa (WAMP), Prespa National Park (Forest Service Directorate, Korca) and Society for the Protection of Prespa (2011). Final report of the project “Implementation of pilot wetland management and public awareness activities in Lake Micro Prespa, Albania”. UNDP Albania, Global Environment Facility (GEF) – Small Grants Programme (SGP)

ANNEX I

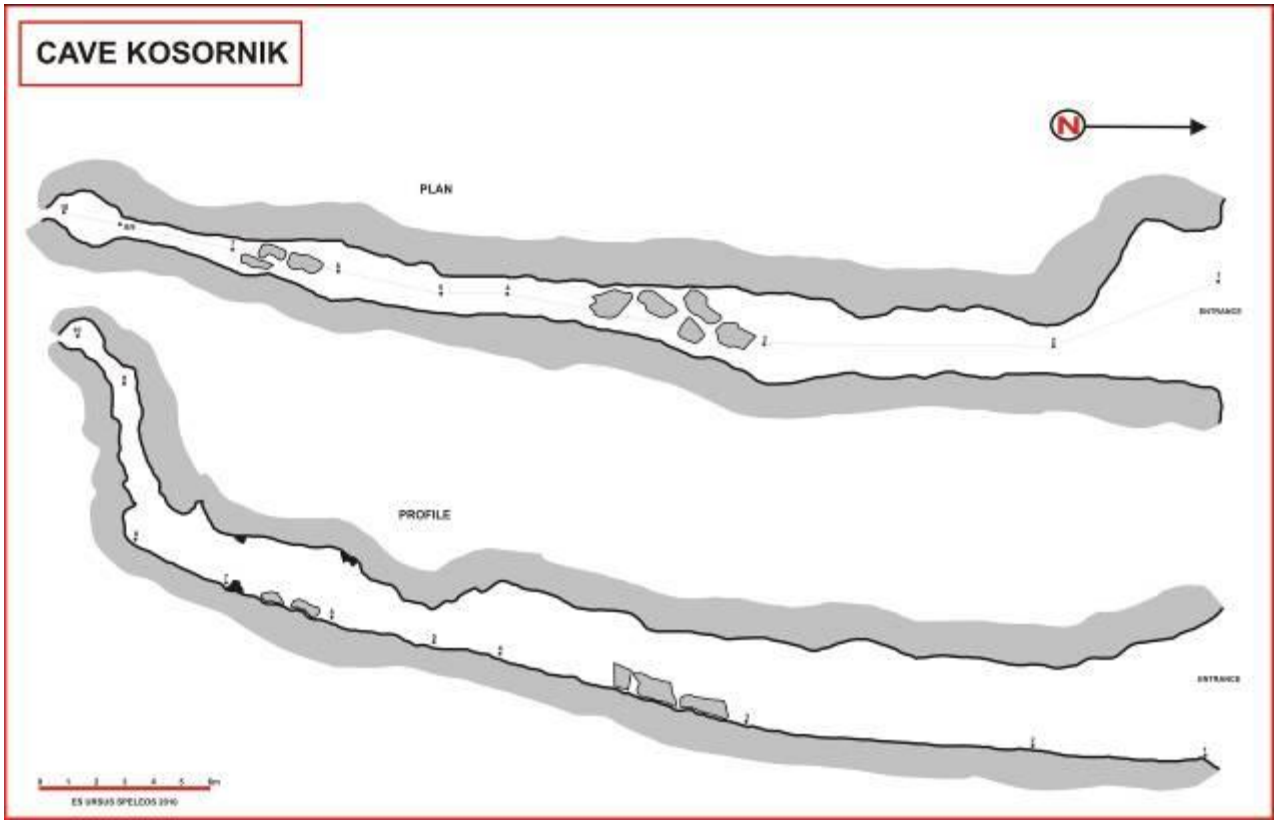
TRENI CAVE



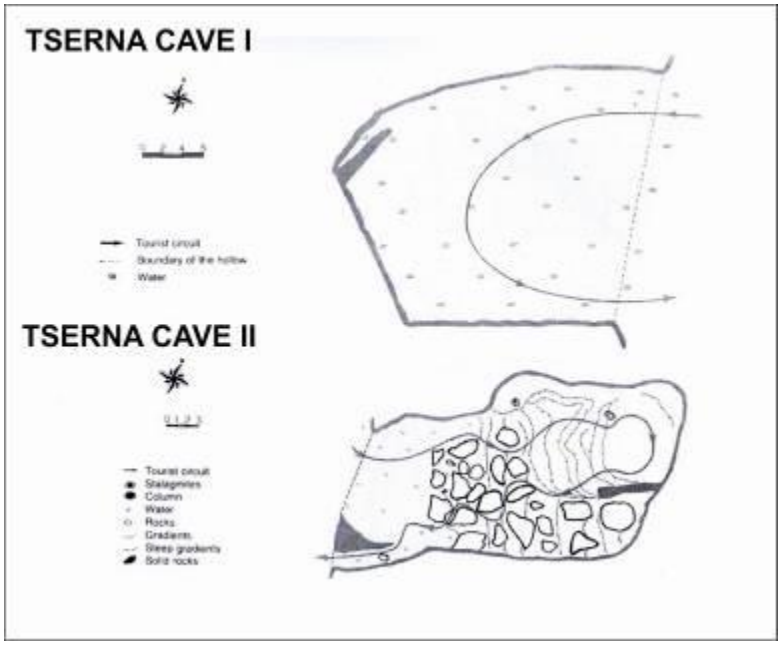
ZAVIR CAVE



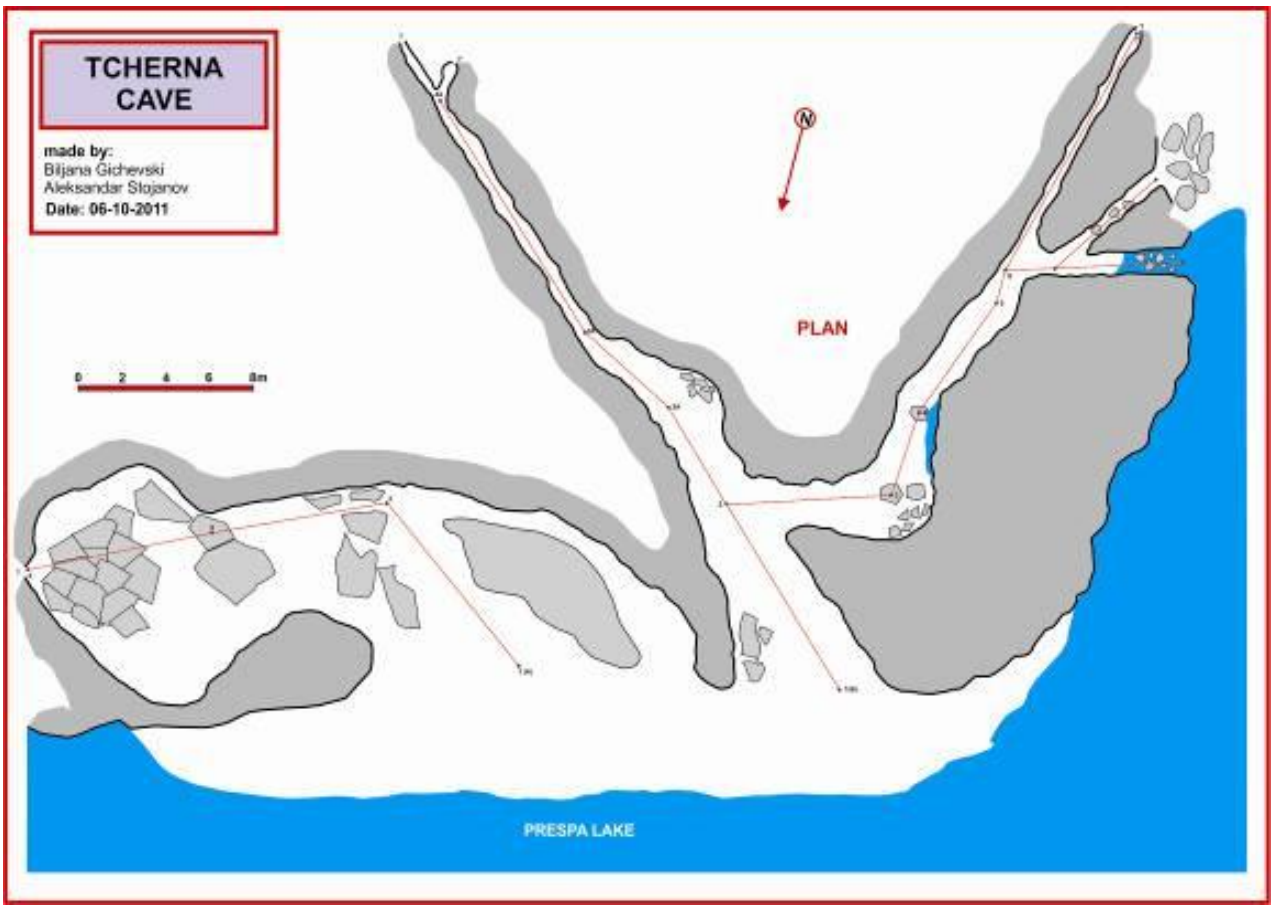
KOSORNIK CAVE



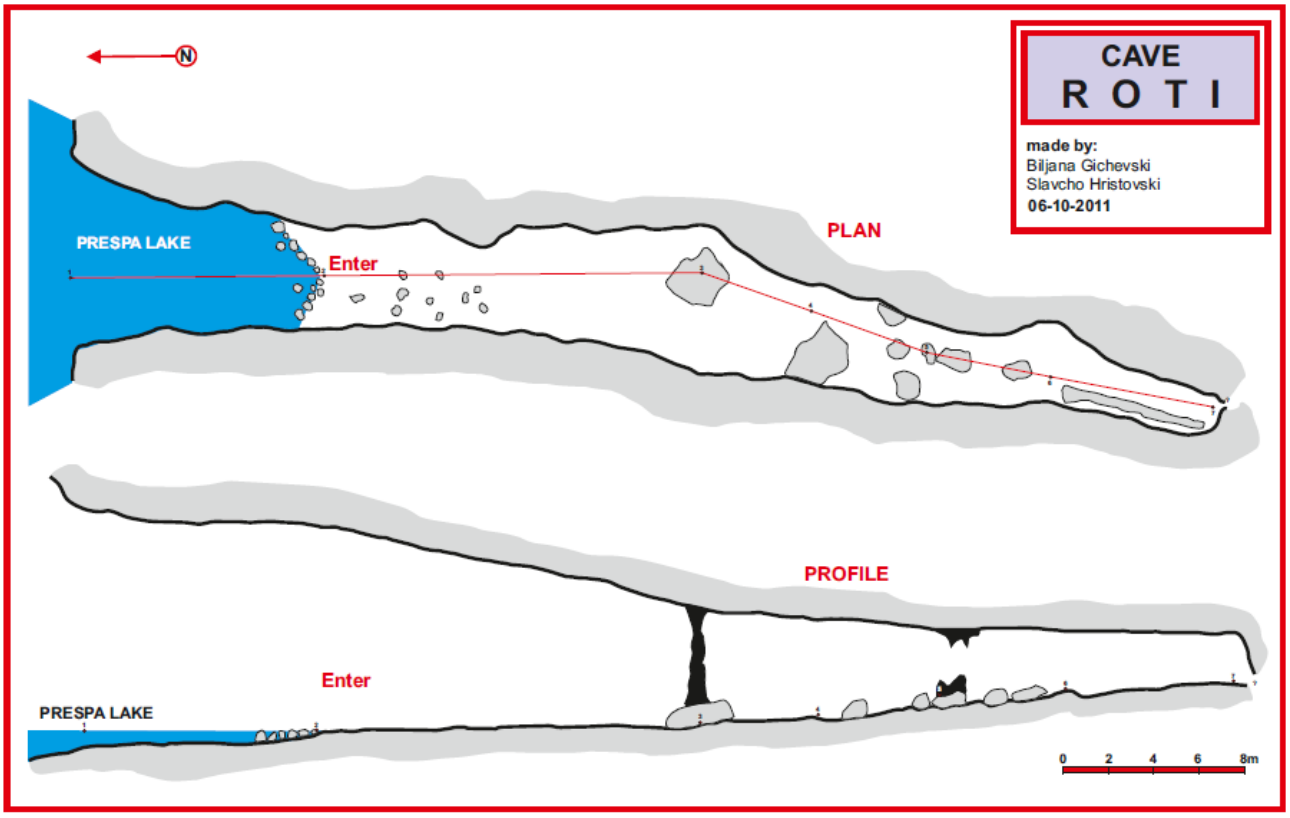
TCHERNA CAVE



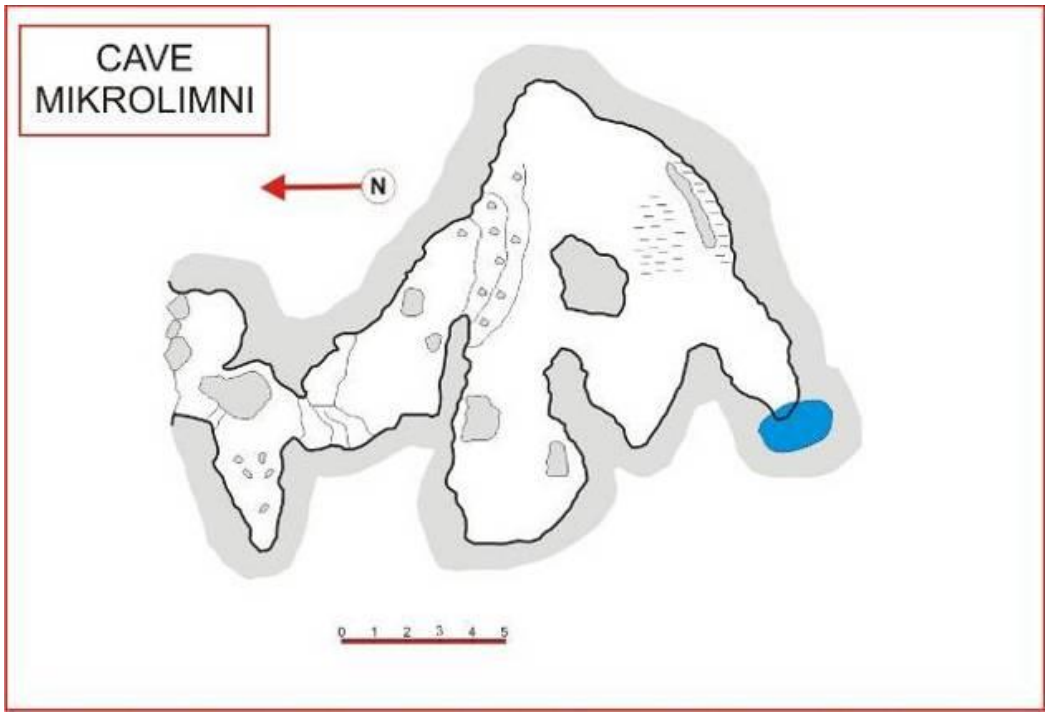
Tcherna Cave, according to Petrochilou *et al.* (1977)


TCHERNA CAVE
made by:
Biljana Gichevski
Aleksandar Stojanov
Date: 06-10-2011
PLAN
PRESPA LAKE

ROTI CAVE

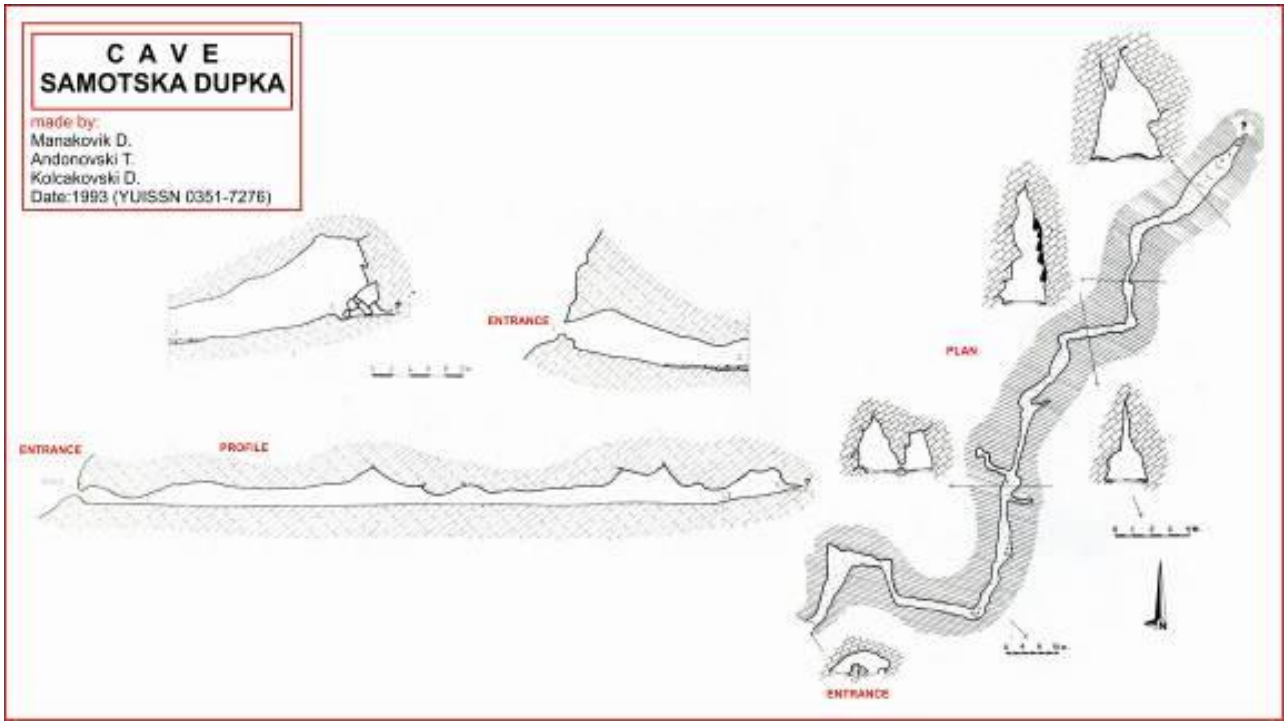

CAVE
R O T I
made by:
Biljana Gichevski
Slavcho Hristovski
06-10-2011
PRESPA LAKE
Enter
PLAN
PROFILE
Enter
PRESPA LAKE
0 2 4 6 8m

MIKROLIMNI CAVE



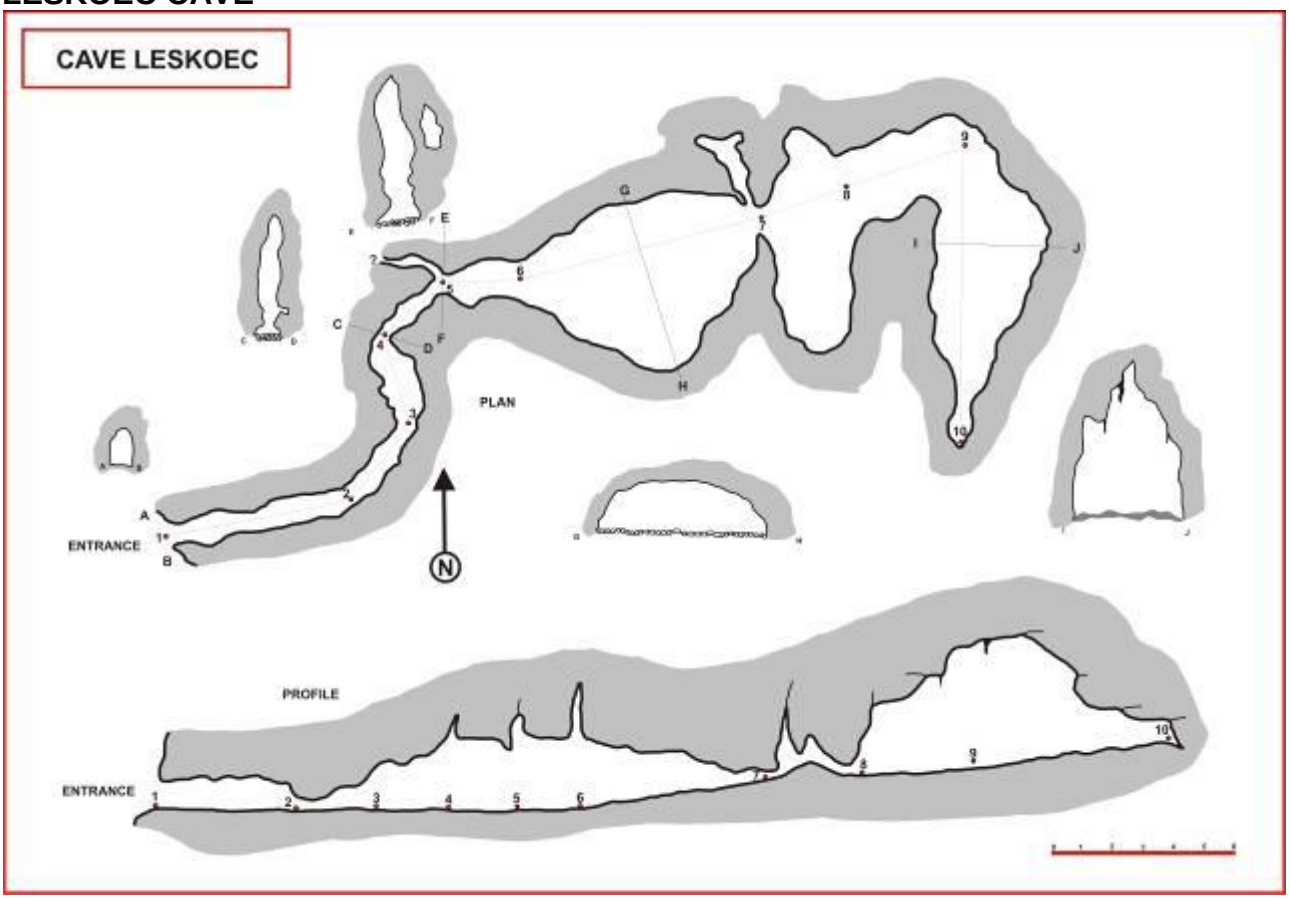
Mikrolimni Cave, according to Paragamian (1992)

SAMOSKA DUPKA CAVE



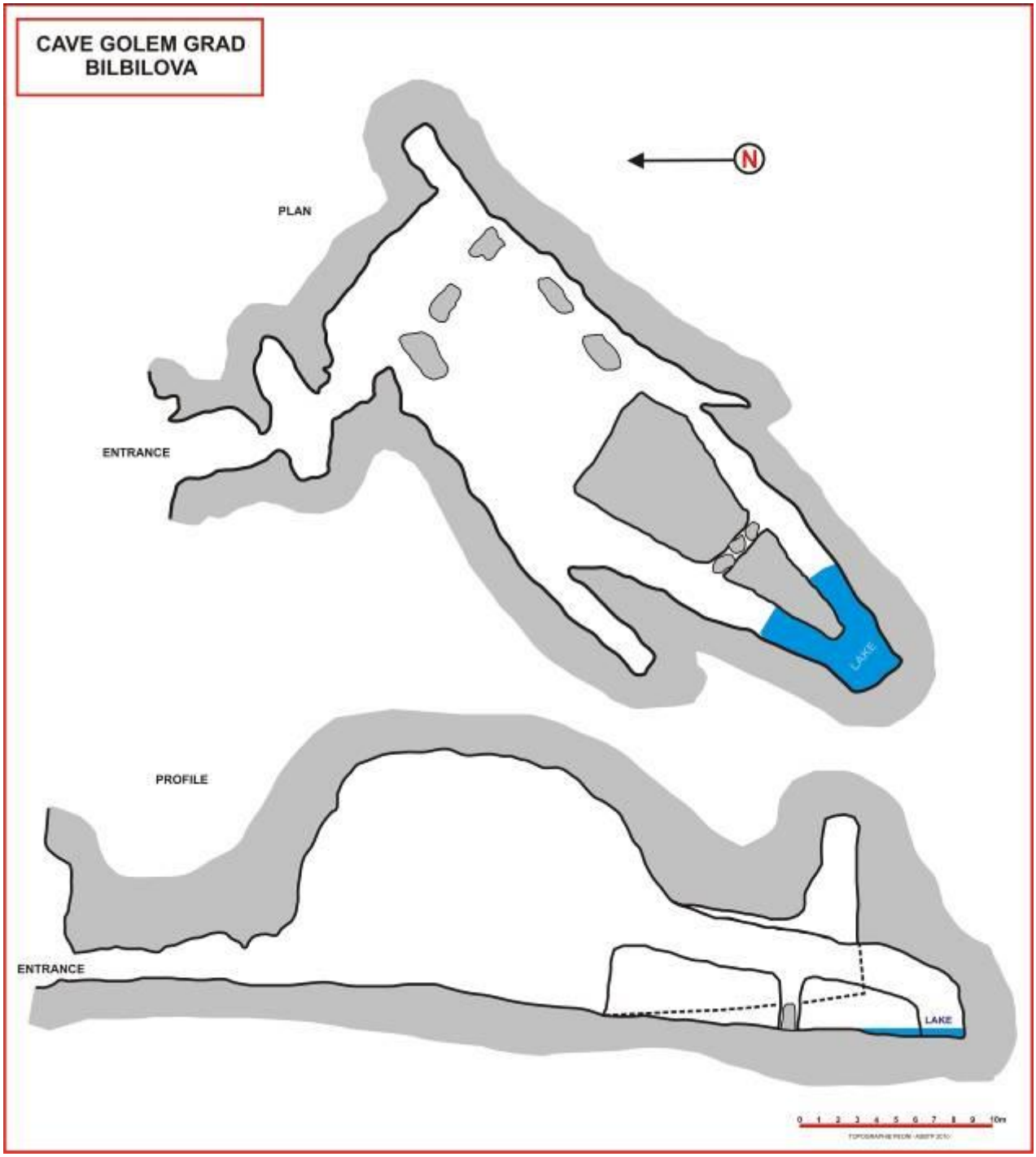
Samoska Dupka Cave, according to Manakovic, Andonovski and Kolcakovski (1993)

LESKOEC CAVE



Leskoec Cave, according to Andonovski and Kolcakovski (1990)

BIMBILOVA CAVE



Bimbilova Cave, according to the Speleological Society Peoni and ASBTP (2010)