A POSSIBLE RESTAURATION OF AN IMPORTANT HIBERNATING AND NURSERY BAT COLONY IN A TOURIST'S CAVE FROM ROMANIA

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Abstract. *Woman's Cave is situated approx. 2 km North from Baia de Fier village–Gorj Co. It was an important roost for hibernating and nursery bat colonies. Starting with the „improvements" for tourism (in the '60s) the colonies diminished drastically, continuously, almost to extinction. Today there are not more than some tens of individuals of Rhinolophus ferrumequinum, Rhinolophus hipposideros, Barbastella barbastellus, Myotis emarginatus, Myotis myotis, Myotis blythii, Myotis mystacinus, Nyctalus noctula, Plecotus austriacus/auritus, Miniopterus schreibersi. The restauration of former colonies might be possible only in previous microclimate conditions, before the „improvements" for tourism: demolishion of the wall from the eastern entrance; replacement of the existing gates with inadequate net of bars for free access of bats; using of cold light, directing them only to the karstic formations; building of a transparent tunnel for sectorial isolation of tourist's impact on bat colonies; an outside room with proper equipments for monitoring bat activities etc. All these measures will allow to continue tourism in the cave and to protect bat fauna, attracting and increasing former important hibernating and nursery colonies (10,000–14,000 individuals) in the above site.*

Keywords: *cave, tourism, bat colonies, hibernating, nursery, restoration.*

Résumé. *La caverne de la Femme est située à environ 2 km au nord du village de Baia de Fier - Gorj Déepartement. Il a été un important refuge de hibernation et de maternité pour les colonies des battes. À commencer par les "améliorations" pour le tourisme (dans les années 60) les colonies diminué de manière drastique, en permanence, a presque disparu. Aujourd'hui, il n'ya pas plus de quelques dizaines d'individus de Rhinolophus ferrumequinum, Rhinolophus hipposideros, Barbastella barbastellus, Myotis emarginatus, Myotis myotis, Myotis blythii, Myotis mystacinus, Nyctalus noctula, Plecotus austriacus/auritus, Miniopterus schreibersi. La restauration d'anciennes colonies pourrait être possible que dans les précédents conditions de microclimat, avant la «améliorations» pour le tourisme: démolition du mur de l'entrée orientale; remplacement des portes existantes à l'insuffisance nette de bars avec libre accès des chauves-souris, d'utiliser de froid lumière, pour diriger des battes uniquement aux formations karstiques; construction d'un tunnel transparent pour sectorielle isolement de l'impact du tourisme sur les colonies de chauves-souris, une salle extérieure avec les équipements pour le suivi des activités de chauves-souris etc. Toutes ces mesures permettront de continuer le tourisme dans la caverne et protéger la faune de chauves-souris, et attirer de plus en plus les colonies de hibernation et de maternité (10000-14000 exemplaires) dans le site ci-dessus.*

Rezumat. O posibilă refacere a unei importante colonii de lilieci, hibernare şi materintate într-o peşteră turistică din România. *Peştera Muierilor situată la aproximativ 2 km nord de localitatea Baia de Fier din judeţul Gorj a fost un important refugiu pentru lilieci. Odată cu amenajarea sitului pentru turism, coloniile de hibernare şi de maternitate (cu un total de 10,000-14,000 indivizi) s-au diminuat până la aproape totala dispariţie. Astăzi abia mai există câteva zeci de indivizi din speciile Rhinolophus ferrumequinum, Rhinolophus hipposideros, Barbastella barbastellus, Myotis emarginatus, Myotis myotis, Myotis blythii, Myotis mystacinus, Nyctalus noctula, Plecotus austriacus/auritus, Miniopterus schreibersi. Reabilitarea fostelor colonii de lilieci este posibilă prin refacerea condiţiilor microclimatice anterioare amenajării peşterii pentru turism: demolarea zidului din intrarea estică; înlocuirea uşilor actuale cu gratii improprii accesului liliecilor; utilizarea lămpilor cu lumină rece şi orientarea lor numai spre formaţiunile carstice; izolarea sectorială a impactului turiştilor asupra liliecilor, prin construirea unui tunel transparent, instalarea unor echipamente de monitorizare a lilieclor din afara peşterii etc., astfel ca activitatea turistică să continue în folosul comunităţii locale, iar fauna de chiroptere să fie ocrotită prin atragerea şi chiar creşterea importantelor colonii de altădată.*

Cuvinte cheie: *peşteră, turism, colonie de lilieci, hibernare, maternitate, refacere.*

INTRODUCTION

Natural caves, rock crevices and all man-made structures (mining galleries still in use or abandoned, tunnels, ice-houses, cellars etc.) with more or less similar environmental conditions from caves can be considered underground sites. Usually, these sites can be populated by bats. Why? Because these sites are protected from the external environment. Temperature and relative humidity in underground sites do not vary very much all over the year; usually the registered temperature in a cave is close to the mean annual temperature in the site. Most important changes of the temperature are close to the entrances in caves and depend on the amount and direction of air flow as well as on the configuration of the site. A ceiling like a bell will permit to the warm air to rise up (under the bell) while, at the floor level, fresh air, with lower temperatures.

In these conditions bats are attracted by the underground roosts. These type of roosts are mainly preferred by most rhinolophids and by some vespertilionids. Some of them are in large colonies for hibernating and in spring time they move to other roosts, with higher temperatures. Others use caves both for hibernating and for nursery periods.

In this papers it is mentioned the existence of important bat colonies in Women Cave/Pestera Muierilor-close by Baia de Fier village in Gorj County-Romania. Women Cave hosted large bat colonies (up to 14,000 specimens) before 1960 when it was opened for tourism. After 1962 the bat colonies abandoned the roosts because of tourist's disturbances and because of changes of airflow which diminished, closing one of three formerly entrances.

Knowing the importance of bats in physiology of ecosystems and their importance as bioindicators of the quality of the environment on one side and the existence of important national and international programes and regulations for bat conservation on the other side we see the possibility to restore the past bat colonies in Women Cave.

MATERIAL AND METHODS

For the documentation on the project of restoration of Women Cave they were made five field trips in the area and local authority was contacted (Mayor of Baia de Fier village) as well as The County Agency for the Environmental Protection and "Hades" NGO which is in charge with the management of the cave. They were measured temperature in different points (on the floor, on the walls, in vicinity of entrances) and the relative humidity in the same stations of work. The temperature was quite similar in different seasons: 8,4ºC on 22nd of December 2002 and 7,4ºC on 3rd of March 2003 while outside there were only negative temperatures. Observations on the bat species were also made on each occasion and 10 bat species were identified, some of them being reported here for the first time (Tab. 1).

RESULTS AND DISCUSSIONS

The Women Cave is situated on the right slope of the gorges of Galbenu/Yellow river at about 2 km North from Baia de Fier village. These gorges are placed in the South-East part of the Parang Mountains (Meridional Carpathians), in western end of Garba Hill with highest altitude of 751m. The cave is at about 40 m high from the river level (talveg).

First reports on the cave are since the first half of XIX-th century. Starting with 1929 the Speleological Institute from Cluj organized systematic studies, mentioning some bat species, too. Today the cave is managed by a local NGO named "Hades".

The length of the cave is more than 5000 m on four levels in tythonic limestone rocks and was dug by waters of Galbenu/Yellow's river in the same time when river's gorges appeared. From all the net of galleries, our project refers only to the highest level-the main gallery with a length of 573 m (Fig. 1).

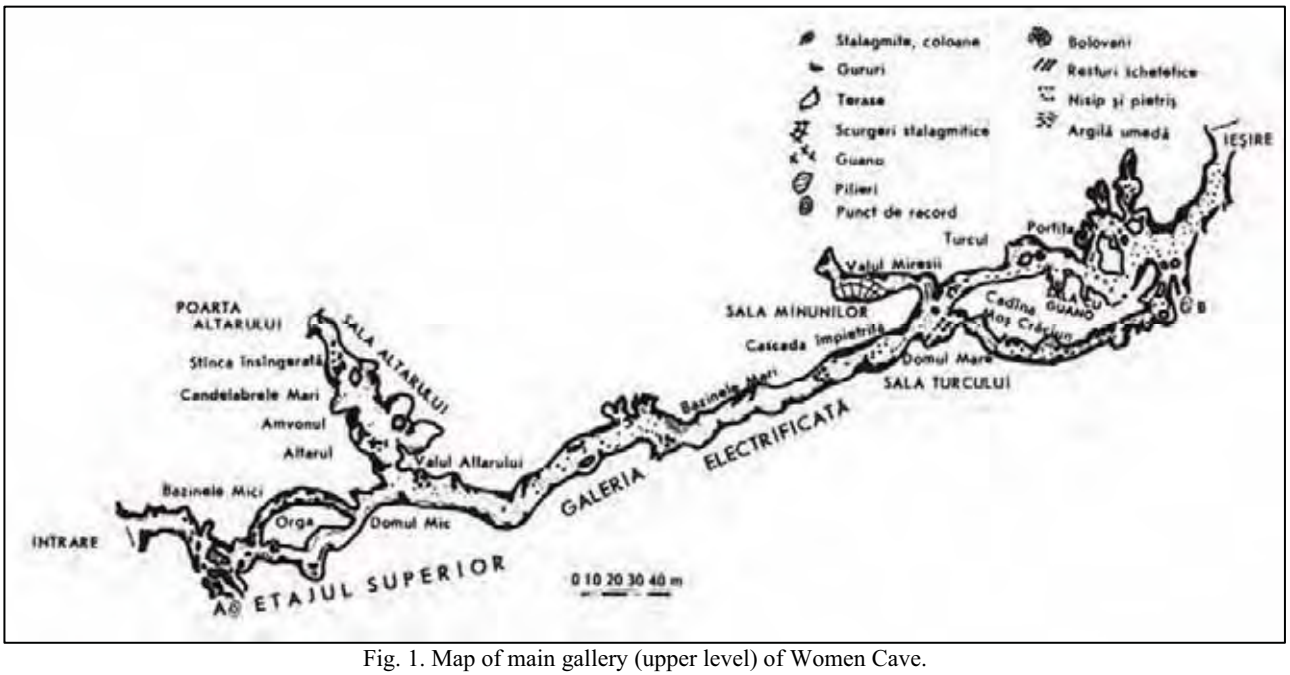

Fig. 1. Map of main gallery (upper level) of Women Cave.
Fig. 1. Harta galeriei principale (etajul superior) din Peştera Muierilor.

Only this gallery is electrified for tourist's purposes. In addition, it is added the length of some secondary galleries (diverticulums) and the total length of the highest level is 1228 m. The general orientation of the whole system of galleries is N-NW – S-SW along the fracture line in the right slope of the gorges. The cave is important because of its mineralogical and valuable karstic formations (domes, stalactites and stalagmites), fossils (e.g. *Ursus spelaeus*), archeological and anthropological remains (e.g. a skull of *Homo sapiens*), biological items (Fig. 2 A and B).

A B

Fig. 2. A-Fossil skull of *Homo sapiens sapiens* - approx. 29.000 years old; B-Skeleton of *Ursus spelaeus*-approx. 10.0000 years old.
Fig. 2. A-Craniu fosil de *Homo sapiens sapiens*-aprox. 29.000 ani vechime. B-Schelet de *Ursus spelaeus*-aprox. 10.000 de ani vechime.

Formerly there were three entrances in the cave: northern, eastern and southern (Fig. 1). Starting with 1952, the eastern one was closed with a wall on the occasion of its arrangements for tourist's purposes. The other two entrances (northern and southern) are for tourist's access and exit and have iron gates with inadequate bars mounted (Fig. 3 A and B).

A B

Fig. 3. A-Northern entrance for visitors in Women Cave. B-Southern exit from the same cave.
Fig. 3: A-Intrarea nordică pentru vizitatori în Peştera Muierilor. B-Ieşirea sudică din aceeaşi peşteră.

Walking in the main gallery, at only 30 m from the Northern entrance in the western wall there is a first diverticulum leading to the lower levels, discovered on the occasion of the electrification works; this is why the name of diverticulum is "Gallery of Electricians" (Fig. 4 A and B).

A B

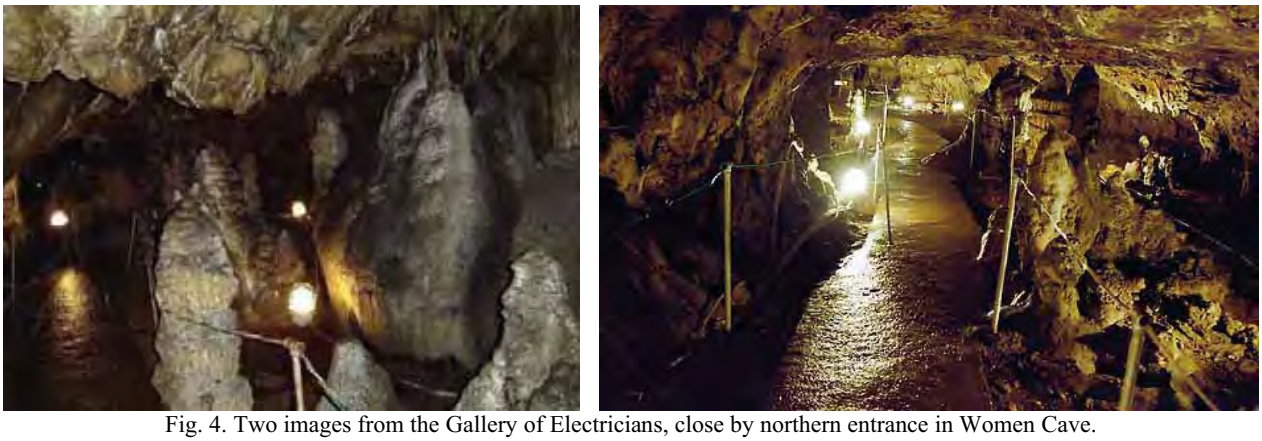

Fig. 4. Two images from the Gallery of Electricians, close by northern entrance in Women Cave.
Fig. 4. Două imagini din galeria Electricienilor, în apropierea intrării din nord în Peştera Muierilor.

Further up to the Altar Room (approx. 130 m from the northern entrance) the main gallery is 4-5 m wid and 2 m high. The Altar Room is a space with impressive concretions and a ceiling like a chimney with 17 m high (Fig. 5 A). This is the place leading to the eastern entrance and where it used to be large hibernating and nursery colonies of bats before tourist's arrangements and building the wall to close it. Marks of old guano are on the floor and on the walls still there are traces of bat species: *Myotis myotis*/*M. blythii* and *Miniopterus screibersii*.

Up to other important places for bat colonies there is a room (Turcului/Turkey's) with high concretions and Sala Minunilor/Room of Wonders with unexpected karstic formations: microgurs, stalactites, stalagmites like candles etc. Here the ceiling is here very low and tourists should band.

A B

Fig. 5. A-Altar Room from Women Cave. B-Guano Room-the most important roost for bat hibernating and nursery colony before the "improvements" for tourist's.

Fig. 5. A-Sala altarului din Peştera Muierilor. B-Sala cu guano-cel mai important adăpost din sit, pentru colonii de hibernare şi maternale, înainte de "îmbunătăţirile" pentru turism.

Another narrow path is leading to Sala cu Guano/Room (Fig. 5 B) with Guano where the largest hibernating and nursery colonies of *Rhinolophus ferrumequinum*, *R. hipposideros*, *Myotis myotis*/*M. blythii* and *Miniopterus schreibersii* used to roost before the tourist's arrangements. Total number of bats in those colonies was up to 14,000 individuals. This last room is situated at only 70 m before the Southern entrance/exit. On the occasion of building the paths for tourism from this room it was excavated several m^3 of guano – a proof of a large number of bats hibernating and nursery colonies in this site.

At about 40 m up to the Southern entrance, in the western wall, there is a descending gallery which leads to the Galeria Ursilor/Bears Gallery from the southern part of the cave.

In our survey along the whole main gallery there were observed very rare bat specimens of ten species. Three of them are dominant in hibernating colonies and five species are for the first time reported from the Women Cave. It is also important to highlight here the presence of small nursery colonies too (Tab. 1).

Table 1. Bat species identified in Women Cave in 2002 – 2008.

Species	Nursery colony	Hibernating colony
*Rhinolophus ferrumequinum***		X
Rhinolophus hipposideros		X
*Barbastella barbastellus**		X
*Myotis emarginatus**		X
*Myotis myotis***	X	X
*Myotis blythii**	X	X
*Myotis mystacinus**		X
*Nyctalus noctula**		X
Plecotus austriacus/auritus		X
*Miniopterus schreibersii***	X	X

* Bat species new reported from Women Cave.

** Dominant bat species in hibernating colonies in the same site.

WHY TOURISM IN THE WOMEN CAVE?

- There are already more than 50 years since the local community get a financial advantage-about 2 million lei/year.
- Easy access for tourists (stairs up to the northern platform and from the exit up to the road), a path built with concret and balustrade of cables, electrified gallery as a tunnel, starting the visit in northern part (upstream of Galbenu/Yellow river) and exit through the southern end, a well working system of pumping the infiltrated waters.
- Existing infrastructure and tourist's facilities: three hotels, large parking places, good roads and connection (only 4 km) with national road Ramnicu Valcea-Targu Jiu.

RISKS FOR SITE

- A too high number of tourists (especially in summer time) can pass the capacity of support of the cave; eliminated CO_2 through breathing facilitate the condens fenomena and can destroy some carstic formations.
- The path with concrete needs improvements in different sectors with very low ceiling and too narrow walls.
- Continuous development of the agrotouristic pensions will insrease the anthropic pressure on the cave.

THREATS FOR BATS

- Existing metal gates (at northern and southern entrances) with a net of bars 15 x 15 cm are not suitable for bat access in their free fly to enter or exit from the cave.
- Lights are not correct orientated and disturb bats.
- Noise of tourists and their walking very close or even under bat colonies.
- Close of the eastern entrance influenced internal micro-climate and air flow.
- Increasing anthropic pressure push the small bat colonies to abandon this roost both for nursery and hibernating.

SUGGESTED MEASURES

- Northern gate can be replaced with a compact one to diminish air flow and increase the temperature inside up to 12 - 14°C, necessary for nursery colonies; some free spaces for bat access can be left above the gate.
- Southern gate should be replaced with another one with horizontal metallic bars with spaces of 15 cm between them and at least 70 cm in horizontal plan; some free spaces for bat access can be left above the gate, similar with previous situation.
- Demolish of the wall which closed the Eastern entrance and set up a gate with metallic bars as mentioned above for Southern entrance; in this way will be reestablished the primary micro-climate conditions for bats.
- In order to mentain the existing temperature over the winter time we suggest to fix a pannel behind the gate of the eastern entrance; this pannel should be oppened starting with 15-th of April and closed on 15-th of October.
- In addition, the route of tourists will be modified between October and April, prohibiting thei access in the Altar Room and diminishing the intensity of light only to see speleothemes.
- In the Guano Room will be set up a transparent wall or a tunnel which will protect nursery bat colony by tourists noise and influence of their movements in the cave. In the same area on the floor will be set up a plastic/rubber carpet (40 m length) to absorb the vibrations of their steps.
- The guide will reccomand the visitors to keep silence and not strike the cave's walls.
- In front of the Northern entrance should be organized a biospeleological museum and information center with infrared videocamera to monitore and for visitors curiosity to see bat colonies from inside, their activities and behaviour.

CONCLUSIONS

1. On one side the national and international regulations to protect bat species do not allow touristic activities in the protected areas. On the other side the local community and their authorities are deeply interested to develop agro-tourism, to attract as many as possible tourists, to use the good existent infrastructure (hotels, parking places) and to realize an important income every year.
2. Our previous experiences in reabilitation of bat colonies in Bistrita and Cioclovina Uscata Caves, allow us to estimate the possibility to attract in Women Cave in 5-8 years about 4000 bat individuals for hibernation and more than 10,000 individuals in nursery colonies.
3. Except the above mentioned bat species (Tab. 1) and considering bat fauna from neighbour caves we expect to attract in new nursery and hibernating colonies *Myotis bechsteinii, Myotis daubentonii, Myotis capaccinii* and *Myotis nattererii*.

4. With measures to replace existent inadequate gates with others mainly with horizonthal bars, demolish of the wall built in eastern entrance, avoiding lighting the bat colonies and izolation of tourist's noise using a transparent tunnel will reduce considerably the anthrorpic impact in the cave and improve the conditions for nursery and hibernating bat colonies in Women Cave.

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