

THE CONCEPT OF ECOLOGICAL RE-ESTABLISHMENT OF SOME LARGE BAT POPULATIONS IN WOMEN CAVE FROM BAI A DE FIER (ROMANIA)

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All over the world, at least for some bat populations there is an alarming decreasing number of individuals. In most cases, this is a result of human pressure either using pesticides in forests and agriculture, disturbing their most preferred underground shelters and not in the least – because of wrong beliefs about bats, the man has a hostile attitude. In this article we are referring to a case of using a cave for touristic purposes and improvements there disturbed up to extinction some important bat colonies. It is about Women Cave, close to Iron Bath (Baia de Fier, Gorj County). After several years of observations and finding explanation for lack of bats there we offer several concrete solutions to restore this underground habitat and to rehabilitate the former bat colonies. The project should allow both habitat and bat conservation, and prosperity for local human community. Up to our knowledge, this project has a unique character.

Keywords: anthropic pressure, habitat restoration, bat conservation, interest of local community, Women Cave from Iron Bath (Baia de Fier) locality.

INTRODUCTION

Important climate changes all over the world, with mild winters are favoured conditions to agricultural pests (mainly insects) to develop up to invasion phenomena. A new topic for entomologists and for farmers is invasive alien species and their distribution both on latitude and altitude. This is why we are considering that international and national regulations for bat protection are important to preserve and as much as it is possible to increase bat populations. According to the EUROBATS policy to protect bats, since 2000 there is Law No. 90 for bat conservation in Romania.

No more necessary to comment bat importance in ecosystem physiology. At the beginning of XIX-th century, the German biologist Johann Leisler (1771–1813) wrote about the need to protect bats. Up to him, these mammals are the only which can control nocturnal pests for agriculture, orchards and forestry.

Unfortunately 6th and 7th decades of the last century were with drastic decrease of some bat populations from Romania, and in Europe some species became extinct. These happened because of abusive use of insecticides and pesticides.

On the other side, in the same period it was an unusual development of uncontrolled tourism. Under the increased anthropic pressure on the underground shelters, both hibernation and nursery colonies were drastically disturbed and the result was numerically decreased individuals of bat species populations.

With this article we want to remember and promote some success projects in rehabilitation of underground habitats and restauration of former bat colonies.

CASE STUDIES

A. Our own data on bat populations from Romania are mainly after 1990. In 1995 we visited St. Grigore Decapolitul Cave (Fig. 1), close to Bistrița Monastery (Vâlcea County). In the past, that cave was an incredible shelter for bats. Dumitrescu *et al.* (1955) reported only three specimens of *Plecotus austriacus*, but there were visible parts of torches, fireplaces and arrangements of bivouacs in the cave.

After 1990, the Monastery's staff together with superior mother Mihaela Tamaș were very receptive to our suggestion to close the cave with a metallic gate to protect the speleothemes, disturbing bats and against vandalization of the monarchic building from inside the cave. In this way bat populations were better protected.

In 1997, we observed first a small colony of *Miniopterus schreibersii* installed in this cave for hibernation. Only in three years (in 2000) the colony of Schreibers' long-fingered bat was with 400 individuals for hibernation and 900 individuals for nursery colony.

However, we observed on the 18th December 2001 a decreased number of bats in St. Grigore Decapolitul Cave. Therefore on the occasion of a LIFE 00 NATURE/RO/7187 Project we decided to monitorize the site for four years. Thus we found that the decreasing number of bats was because of touristic activities organized by Monastery's staff to get money. Also, occasionally it was fire in the hermitage stove (Fig. 2 A, B).

Firstly we established a certain way for visitors, avoiding the entrance in the neighbour galleries where bats were sheltered.

Secondly it was prohibited fire in cave and in 2004 it was possible to use an electric heater in hermitage.

Third – Monastery's guide was informed and advised to ask visitors to respect regulations for persons who are visiting sites with bats; tourists were also informed with these rules printed on large panels in front of the entrance in the gallery.

Fourth – the electric light for visitor track avoided places with bats.

Fifth – we provided the Monastery library with flyers to inform visitors about the need to protect bats (Decu *et al.*, 2003; Murariu *et al.*, 2007).

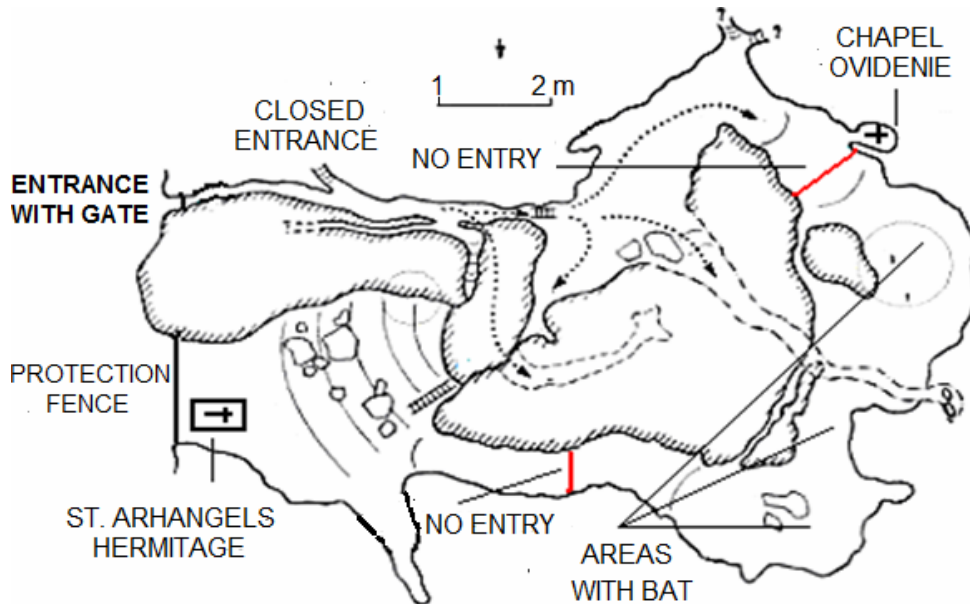


Fig. 1. Map of St. Grigore Decapolitul Cave (Bat Cave from Bistrița Monastery) (Dumitrescu *et al.*, 1955).

We can conclude that measures for minimum protection (*e.g.*, setting a gate) and control of tourism in the cave, respecting regulations for bat protection, led to an increasing number of hibernating bats from 180 individuals in December 2001, to 998 individuals in December 2002. After 2002, Schreibers' long-fingered bat formed a colony of about 1000 individuals and *Rhinolophus ferrumequinum*, *R. hipposideros*, *Myotis myotis* and *M. blythii* – about 200–250 individuals.

The nursery colonies increased constantly: 2950 individuals in 2002; 3040 individuals – in 2003 and 3800 – in 2004. They were species of *Myotis* – mostly *M. myotis*, *M. oxignatus* and *Miniopterus schreibersii*. Dumitrescu *et al.* (1962–1963) evaluated only *Myotis myotis* to about 3000 individuals.

A positive factor for presence of bats in St. Grigore Decapolitul Cave was also a decreasing number of tourists, because most of them were more attracted by the neighbour underground karstic structures – Polovragi and Women Caves (Gheorghiu & Murariu, 2007; Gheorghiu *et al.*, 2007). This experience with success in rehabilitation a shelter with nursery and hibernating chiroptera was the first one in Romania and one of the less known at those time in the world.

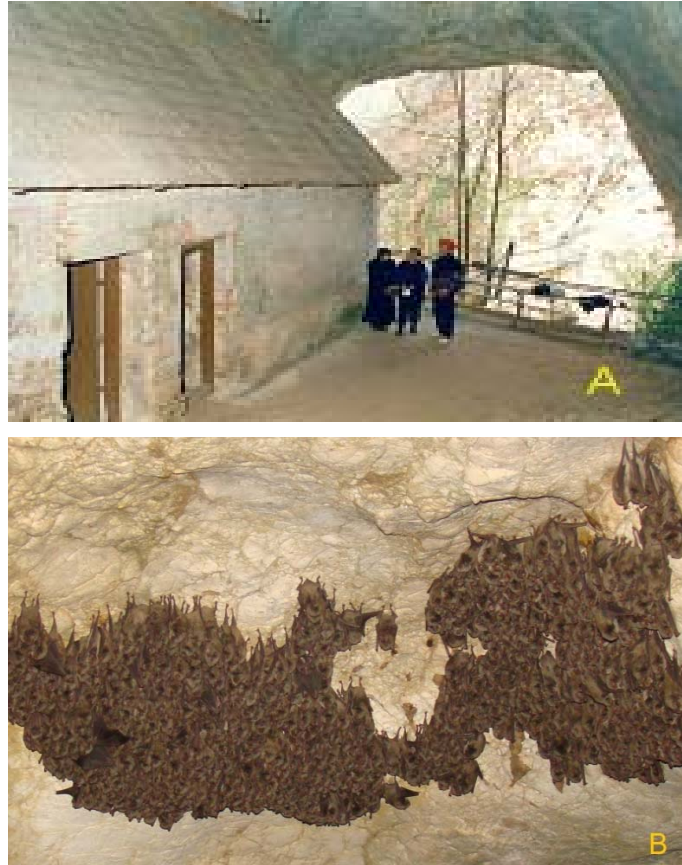


Fig. 2. A – St. Arhangels Hermitage; B – Hibernating colony of *Miniopterus schreibersii* in St. Grigore Decapolitul Cave from Bistrița Monastery.

B. Another interesting and successful experience in bat's shelter protection we had between 2004–2008. In November 2003, visiting Dry Ciclovina (Ciclovina Uscată) Cave in Sepei Room (Fig. 3) we observed a small group of bats. They were no more than 10 individuals of (probably) *Myotis myotis*/*M. blythii*.

Dry Ciclovina Cave is one of the underground shelters from Romania, which between 1912–2003 supported one of the most aggressive anthropic pressures. From there a deposit of guano-phosphate was under industrial exploitation for more than nine decades.

Also, in that cave there is an important paleontological deposit, with some fossils of *Homo sapiens* too. For geologists, this cave is *locus typicus* of *Ardealit* phosphatic mineral.

All these characteristics justified inclusion of Ciclovina Uscată Cave on the UNESCO List of the World Heritage and urgently Institute of Speleology “Emile

Racovitza”, Romanian National Geographic specialists, the Group of Speleological Exploration and Diving, together with a group of volunteers from the United States of America have taken measures to protect this site. The Project was named “Romania 2004 – Cave Bear Project” and was financed by the American Group of explorers.

A local NGO – the Speleological Association “Proteus” from Hunedoara County and Speleological Association “Live Fire” (“Focul Viu”) were implied in the Project and made a documentary movie entitled “The second extinction of the cave bear”. Since 2005, the financial support of the Project was granted by the Romanian Academy (GAR 69/2005; 72/2006; 87/2007 and 147/2008) to the Bucharest’s Institute of Speleology “Emil Racovitza” as a topic of scientific research.

Since the beginning we considered necessary an ecological restoration of Dry Ciclovina (Fig. 3). First it was necessary to restore the environmental conditions which were before the anthropic works in site. In 2004 and in 2005 at about 130 m distance from the entrance we set tight gates to separate the Anthropogenic Tunnel of access in the cave. This tunnel was dug between the First and Second World War to facilitate the guano-phosphate exploitation. Closing this hall it was re-established the ecological microclimate in the cave, on the one side, and it has avoided the entrance of the unauthorized visitors inside the cave on the other side. At about 10 m behind the Natural Entrance in the cave, we mounted a metallic gate (Fig. 4 A and B), with horizontal bars to allow bats flights.

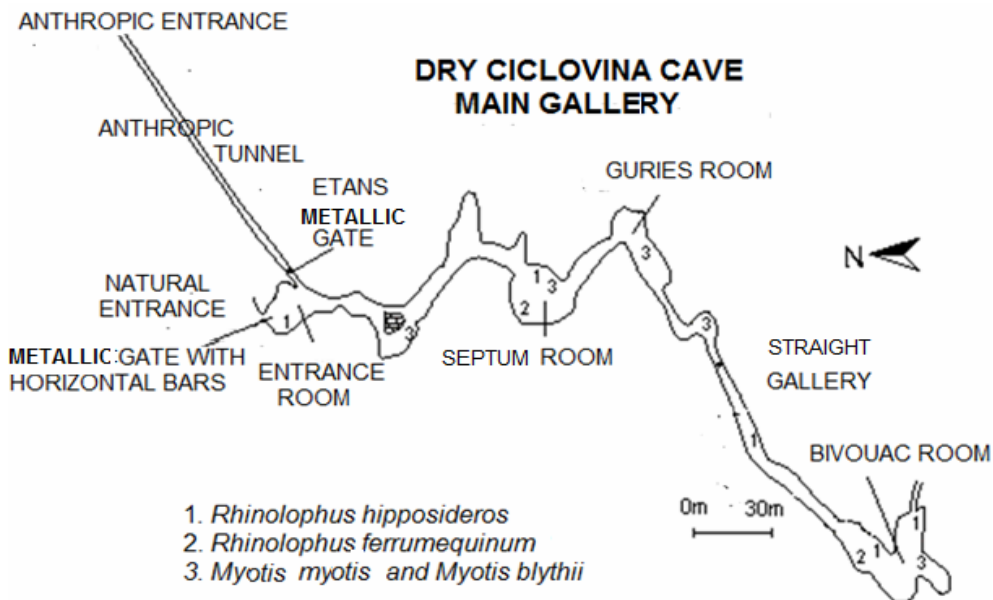


Fig. 3. Map of the Dry Ciclovina Cave (after “Proteus” Speleological Club from Hunedoara County).

In the monitoring process of ecological factors restoration in the underground habitat and changing unfavourable effects of the anthropic impact on biodiversity from Dry Ciclovina Cave we considered as an important part to observe as principal vector the presence and dynamics of bat populations in this site. It is known that the bats are the best bioindicators about the new ecological conditions and are the first beings which repopulate a habitat with favourable conditions for their low metabolism in the hibernating period. To these we also considered important bats fidelity for a shelter with suitable conditions (Fig. 4 C). On the other hand, only 5% of total caves (more than 12,000 in Romania) are favourable for nursing colonies. At the same time, bat colonies in a subterranean habitat increase organic substances or guano deposits important as a trophic base for cavernicolous invertebrate fauna.

However, the results in ecological restoration of Ciclovina Uscată Cave as an underground habitat prove increasing bat populations: 10 individuals in 2003; 83 individuals – 2004; 406 individuals – 2005; 520 individuals – 2006; 801 individuals in the winter 2007–2008 (Table 1). The success was not only numerical, but also qualitative. If in 2004 there were identified only four bat species, in 2008 there were ten species.

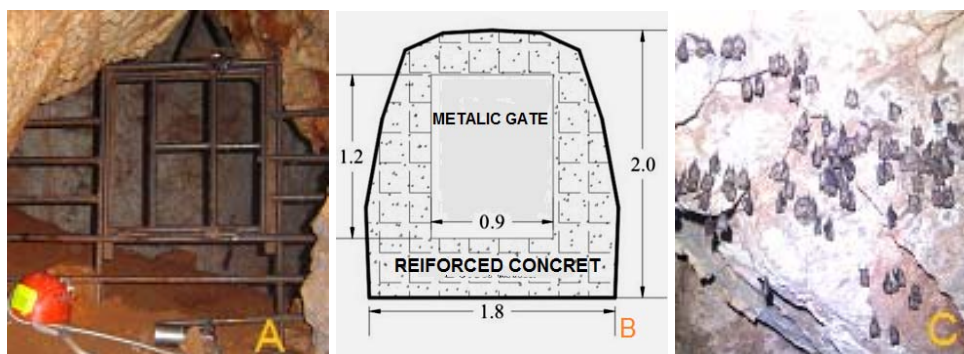


Fig. 4. A – Protecting gate at the Natural Entrance; B – Diaphragm of protection in the Anthropic Tunnel; C – Colony of *Rhinolophus ferrumequinum* in Bivouac Room of Dry Ciclovina Cave.

The serious quantitative and qualitative improvement of bat populations (increasing 80 times) was recorded in only four years of monitoring. Therefore this project could be considered as a model of ecological reconstruction which can be applied in other similar cases.

At the same time, on the occasion of ecological restoration monitoring they were also developed important surveys of mineralogy, sedimentology and palaeomagnetism in Dry Ciclovina Cave (Dumitraş *et al.*, 2009). A cooperation relation of biologists with archaeologists allowed to be published some interdisciplinary articles on palaeoanthropology and anthropology.

Considering that our successful experience can be used as working tool to rehabilitate and preserve underground habitats we co-operated with 14 scientists and printed a volume with our above mentioned results (Gheorghiu *et al.*, 2007; Petculescu & Murariu, 2009).

Table 1
Dynamics of increasing chiroptera populations in Dry Ciclovina Cave

Species	2003*	Hibernating period			
		2004–2005**	2005–2006	2006–2007	2007–2008
<i>Myotis myotis/M. blythii</i>	10	–	–	–	–
<i>Rhinolophus hipposideros</i>		4	24	45	99
<i>R. ferrumequinum</i>		8	138	182	140
<i>Myotis myotis/M. oxygnatus</i>		71	244	286	562
<i>Miniopterus schreibersii</i>		–	–	8	–
Total	10	83	406	520	801

Legend:

* Observation on 18.11.2003, before starting the ecological of the site.

**First visit for observation was on 14.11.2004, after closing Anthropic Tunnel in Dry Ciclovina in July 2004) and beginning the ecological reconstruction.

CONCLUSIONS FOR CASE STUDIES

1. Protecting systems placed in site proved their viability and resisted to the attitudes of vandalization; prohibiting auto access in that area decreased touristic pressure.

2. The model and methods used for ecological rehabilitation of Dry Ciclovina Cave (constructions and setting the diaphragm in ther Anthropic Tunnel) proved to be of great success.

3. All along the year, the temperature inside the cave became relatively constant; missing air flow allowed increase of the Relative Humidity.

4. The spectacular increase of the number of bats in only four years: 2003 – 10 individuals; 2004 – 83 individuals; 2005 – 406 individuals; in 2006 – 520 individuals; in 2007 – 801 individuals, was because of the new climatic conditions inside the cave.

5. In all Ponorici – Ciclovina karstic systems, Dry Ciclovina Cave became the most important hibernation shelter for bats (Table 1).

6. Observations and surveys using Bat Detector in 2006 allowed identification of more bat species in Dry Ciclovina Cave.

7. Monitoring bat species using a Bat detector, in 2006 we identified ten bat species, comparing with six species identified in 2005.

8. According to our observations, because of a reduced amount of guano, the invertebrate cavernicolous fauna is very poor in this cave.

9. Entomologists should mainly observe less collecting cavernicolous arthropods.

10. Next observation and monitoring of numerical and specific increase of chiroptera populations in Dry Ciclovina Cave should be compared with bat population structures in Ciclovina II Cave, Cioclovina with Water and Ponorici Caves from the area.

11. The results of this first monitoring project in Romania and ecological rehabilitation of one underground habitat drastically affected by anthropic pressure must encourage chiropterologists to trust in the possibility of rehabilitation of any underground habitat, to offer more shelters with optimum conditions both for hibernating and for nursery colonies.

A NEW PROJECT

Having success with rehabilitation of a bat population from St. Grigore Decapolitul Cave (Bistrița Monastery – Vâlcea County) as well as the ecological reconstruction of Dry Ciclovina cave as an underground habitat, we answered to a new provocation. It is about ecological reconstruction and restauration of one important shelter both for nursery and hibernating bat colonies in Women Cave from Iron Bath (Baia de Fier locality – Gorj County) up to half 20th century.

In a project LIFE NATURA 2000 we monitored chiroptera populations in this site, because in the Altar Room there are hibernating several hundreds of *Rhinolophus*. Based on our observations we recommended reorientation of lights to be off bat colony and for winter time to be prohibited Altar Room visits. The result was a three times increased number of bats for hibernation. Referring to the nursery colony in Guano Room, we observed a number of pregnant females of *Myotis myotis*, which dissapeared in May, when touristic pressure was increased.

In the last century, this site was deeply transformed by new improvements for touristic purposes, the Women Cave becoming the most visited in Romania. In the so-called Altar Room (Sala Altarului) it was an important colony of *Rhinolophus* and in time no more bats were there.

Visiting the cave we noticed that the lights were directed to the traditional place of bat colony. Changing the direction of lights and asking the administrator to close for visitors that room, immediately bats came back for hibernation. More, in spring, in a next-door room – Guano Room (Sala cu Guano) came several females of *Myotis myotis* to shelter for nursery period. Unfortunately, visitor's track was under this small colony and bats moved away.

A first analysis of the situation was in May 2007 in a workshop organized by the Gorj County Environmental Protection Agency with Mayor of Baia de Fier locality, scientists from the “Emile Racovitza” Institute of Speleology in Bucharest, the Romanian Federation of Chiropterology and the Romanian Association for Bat Protection. In order to protect bats in Women Cave, in that meeting there was discussed the possibility to cease public tourism, but because of a project to develop agro-tourism in the area, the local community rejected this idea.

The conclusion of the Workshop was that scientists from the Romanian Academy offered an alternative both to protect bats and to continue tourism in the cave. For this it was necessary a deep improvement of visiting tracks to reconstruct former ecological conditions according to Law 90/2000 – before to open cave for public tourism.

Localisation: The Women Cave is situated close by the National Road 67, between Râmnicu Vâlcea and Târgu Jiu – 4 km distance. The lateral secondary road is modernized and close to the entrance in cave there is a generous parking place, two hotels, one camping, two restaurants, three accomodation buildings plus agro-touristic units in the village.

A short history of the site and deep transformations in the cave could be useful to better understand the topic of bat protection there.

Women Cave from Iron Bath-Baia de Fier is located in Căpățâni Mountains, on the Sabrupt slope Galbenu river gorges. It is to the western end of Garba Top (751 m altitude), toward south-eastern part of Parâng Mountains at only 2 km North, far from this locality (Fig. 5 and Fig. 6 A, B). The gazeteer is: 45° 10`N and 23°45`E. The Women Cave is included in Romanian Law 5/6 March 2000 being classified to position 2,424 with 19 ha area (Fig. 5). It is a speleological reservation of III-rd IUCN category (Monument of Nature).

According to the Environmental Minister Order No. 604/2005, the cave is evaluated in the Class A, except for the touristic part which is of Class B. We are interested only in this part.

The mentioned area of 19 ha is the cave projection outside in the Garba block limestone which has a statute of Natural Reserve (Fig. 5). Grateful to speogenetic, archaeological, palaeontological, mineralogical and biological importance, the cave is under the protection of the Nature Monuments Commission of the Romanian Academy.

In this cave there was first discovered in all karstic system from Romania a speleotheme association of *dahlitt* – in the Red Room. Here were also discovered fossils of *Homo sapiens*. So that because of the scientific and of specific *dahlitt* the Women Cave is on the patrimonial list of UNESCO.

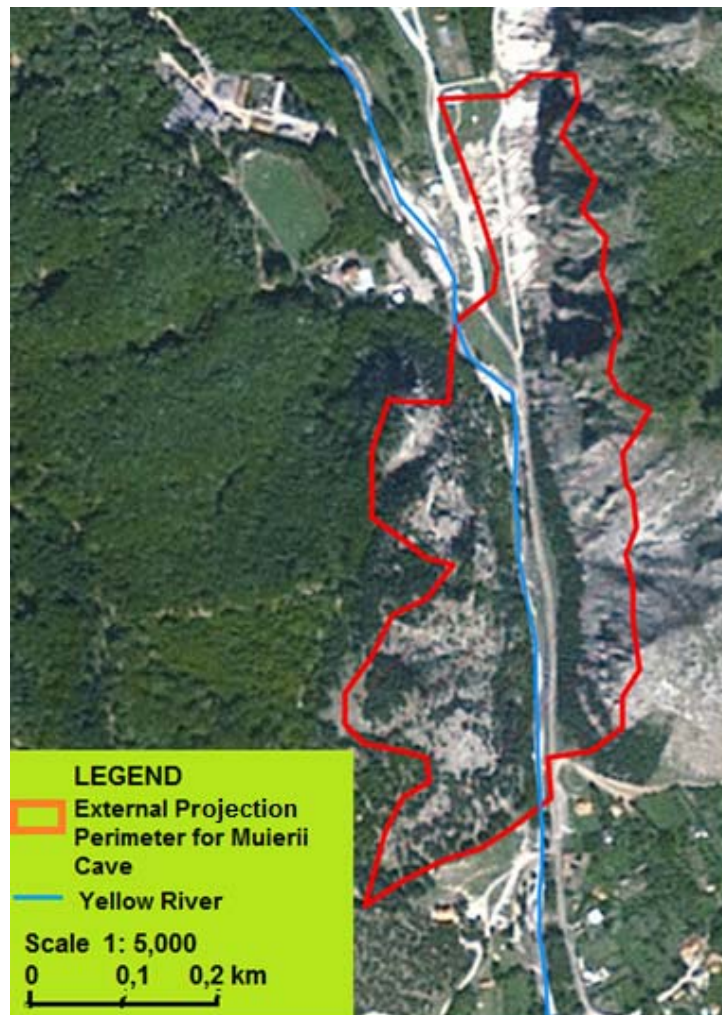


Fig. 5. External projection of Women Cave – Iron Bath.

This cave is like a tunnel, situated at 40 m above Galbenului Valley thalweg or the lowest level there and has two entrances: one to North (Fig. 6 A and B) and another one to South. The second entrance is before the river gorges.

But toward the East it was a third entrance, which was walled on the occasion of improvements for the touristic purpose. The geographers explain that when Galbenu river's gorges were forming, the infiltration waters degt the cave in Tithonic limestones.

Women Cave is laid on four different levels and the general orientation of all system of galleries is NNV-SSV (Fig. 7), according to some fracture line from the right slope of Galbenu river Valley (Diaconu *et al.*, 1980).

Considering our interest to restore underground shelter for nursery bat colonies we will refer to the first level. In the upper level there is a main gallery of 573 m length which is crossing Garbei limestone summit. Together with the alveolate net of the main gallery the total length of upper level is 1228 m.

Before improvements for touristic purposes, the main gallery has had three entrances: Northern (Fig. 6 C) – today entrance for tourists; Southern – former place of water reappearance from underground; Eastern – today walled. The third entrance was opened in the abrupt gorges slope.

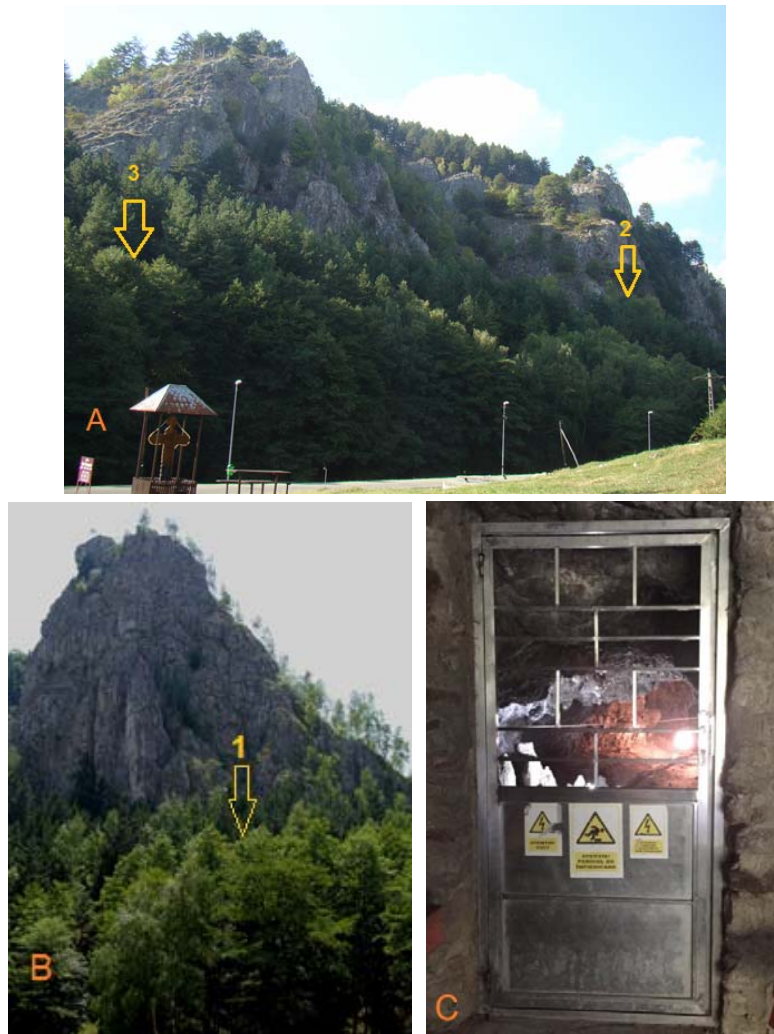


Fig. 6. A – Garba summit (lateral view 751 m altitude) in which it was developed. Women Cave from Iron Bath; B – Garba summit (front view with localization (1) of Northern Entrance (upstream); C – Entrance gate for tourists.

At 30 m distance from Northern entrance (Fig. 6 C), in the west wall is opening a prime diverticula or alveola which is steering to the Northern part of lower level – *Electricians Gallery* (Fig. 7) and after about 130 m is connecting with the *Altar Room* of 4–6 m width and 2 m height. The *Altar Room* is highly concretionate, at the entrance being an impressive chimney of 17 m height. Right here there is maximum density of a hibernating colony of bats; some solitary individuals are spread along all the *Electricians Gallery*.

From the *Altar Room*, continuing toward East, the gallery has many boulders and is opening a new room with the ceiling painted with chiropterit and on the floor there is deposit of guano. Both, spots of chiropterit on the ceiling and guano deposit on the floor are evidences of a former large nursery and hibernating colony, most probably of *Myotis myotis*, *M. blythii*, *M. capaccinii*, *M. dasycneme* and *Miniopterus schreibersii*. It is estimated to about 4000 individuals.

Because of the walled Eastern entrance, bats avoided this cave and today there is no more nursery colony and fresh guano.

Coming back to the main gallery, the track is directed to South and after 270 m *Turkish Room* is situated – one of the most concretionate chambers. From here a narrow passage is starting, with a ditch on the floor and visitors are arriving in the *Wanders Room*. The name of this room comes from the nicest microgures and stalactitic domes there.

After passing a very narrow part, the gallery is continuing toward the *Guano Room*, which also in former times was sheltering a huge nursery and hibernating colony of *Rhinolophus ferrumequinum*, *R. hipposideros*, *Myotis myotis*, *M. blythii* and *Miniopterus schreibersii*. Dumitrescu *et al.* (1962–1963) estimating up to 14,000 individuals in this colony.

The *Guano Room* is at 70 m distance up to the Southern exit. When touristic track was built, first it was necessary to excavate an important quantity of guano from the floor.

At about 40 m before the exit, on the western wall there is the entrance toward lower levels through a highly descending gallery. This one is continued by *Bears Gallery* at the lower level of Southern District. Exploration of this gallery revealed very important palaeontological and anthropological discoveries. All lower floors are included in a Scientific Reserve and access there should be restricted, setting metallic gates.

To us it is of interest the tourism effect with many disturbing activities in the cave, which finally ended with nursery and hibernating bat colony extinction. This risk was mentioned by Professor Margareta Dumitrescu (1955) and by Dumitrescu & Tanasachi (1961).

Examining carefully all disturbing factors because of anthropic activities in the cave we suggested an ecological reconstruction in order to recover, in new optimum conditions, both the nursery and hibernating bat colony (Murariu *et al.*, 2008; Murariu *et al.*, 2010; Gheorghiu *et al.*, 2009; Gheorghiu *et al.*, 2010).

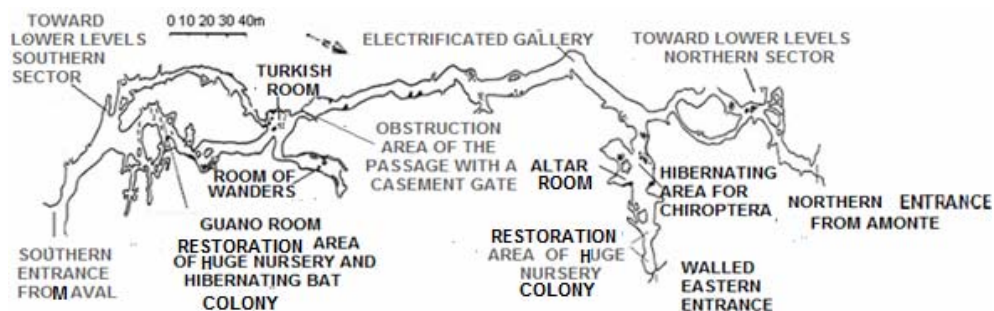


Fig. 7. Map of the touristic floor in Women Cave – Iron Bath.

We must remember that in former times, this cave was used as a refuge for women when the Turkish invaded the area. Therefore the cave name is Women. But without disturbing activities, two bat colonies continued to shelter together with quiet people. At those times, the access in the cave was in Southern entrance (Fig. 7) and the gallery was ending to the *Turkish Room*. The nursery colony was in *Guano Room*.

A second entrance (like in a second cave at those time) was in the Eastern part which today is walled. So that the second nursery colony of bats was in two rooms close to the Eastern entrance.

The Northern entrance (Fig. 7) which we mentioned before was artificially opened with detonation on the occasion of limestone exploitation for a chalk factory. Close to the cave there are still remnants of lime ovens. Later, exploring the cave, bat habitat from the Eastern entrance rooms was connected with *Turkish Room*, crossing the bat habitat from *Guano Room*.

In conclusion, bat habitat were disturbed by:

- opening the actual Northern entrance by occasional detonation, to get limestone for local use (Fig. 9 C);
- along the main gallery there were opened some stone barriers and connections between the former Women cave and sectors were established;
- these new openings allowed to increase the air flow speed decreasing the relative humidity; the climate and ecological balance were modified;
- in the second half of the 20th century there were mentioned improvements in the underground shelter, necessary for tourism purposes. But these improvements were missed measures to preserve the ecological balance and the optimum conditions for underground fauna, because:
 - a. the tourist track is crossing the *Guano Room*, exactly under the nursery and hibernation colony of bats, causing its extinction there;



Fig. 8. In the electrified cave green algae (lamp leprosy) were developed because of warm light.

b. Walling Eastern entrance as a measure to protect cave vandalization ended with extinction of nursery colony of bats in the next-door rooms;

c. Between 1952–1970 the cave was electrified without care of wires lines and searchlights orientation. There were used red-hot bulbs which facilitated the development of a kind of vegetation (Fig. 8) on walls, named “lamp leprosy”;

d. In the *Altar Room* and in *Guano Room*, the projector’s light was directed to the bat groups, to be seen by tourists. This idea was not suitable with the need of darkness and quiet condition, especially in the nursery and hibernation periods.

e. On crowded days, cave visit is organized in groups of 100 individuals each and this supposes increasing of anthropic pressure on bats and underground fauna extinction.

There are also some other sorts of negative effect of anthropic activities in the cave, outside of it and generally in all protected areas. One example is lack of tracks and directories for tourists which, after visiting the cave, do not know where to walk for a parking place. Therefore, they are spreading all over the protected area, leaving damages in the foraging habitat for bats. There are not enough pannels to present information about this Natural Reserve and at the entrance an Information Center for visitors would be necessary (Fig. 13 A, B and C). In this Center they can learn regulations to be respected both inside and outside of the cave.

Between 2003–2005 we insisted and finally lights were changed. Thus from 700–800 bats, the bat colony increased up to 2500–2800 individuals in 3–5 years only.

Gheorghiu *et al.* (2007) mentioned that all these successfully applied measures of ecological reconstruction and chiroptera population restoration were a first performance in Romania. All these rooms (close to the Eastern entrance, *Guano Room and Altar Room* – Fig. 9 B) became populated with larger colonies of bats.



Fig. 9. A – Panel with Visiting Program all over the year, organized in groups of 4–100 visitors;
 B – *Altar Room* – former hibernating place for a large colony of bats in Women Cave;
 C – Oven to burn limestone for Iron Bath community.

For better conditions offered to bat colonies we are suggesting:

1. Along *Guano Room* an artificial passage should be built (Fig. 10) of 30 m length, with an elastic tartan carpet on the floor to absorb walking vibrations. This construction will isolate bats all over the year, so that polluted air will not touch them, lights will not be seen, and visitors could observe bats without disturbing them in nursery and in hibernating periods.

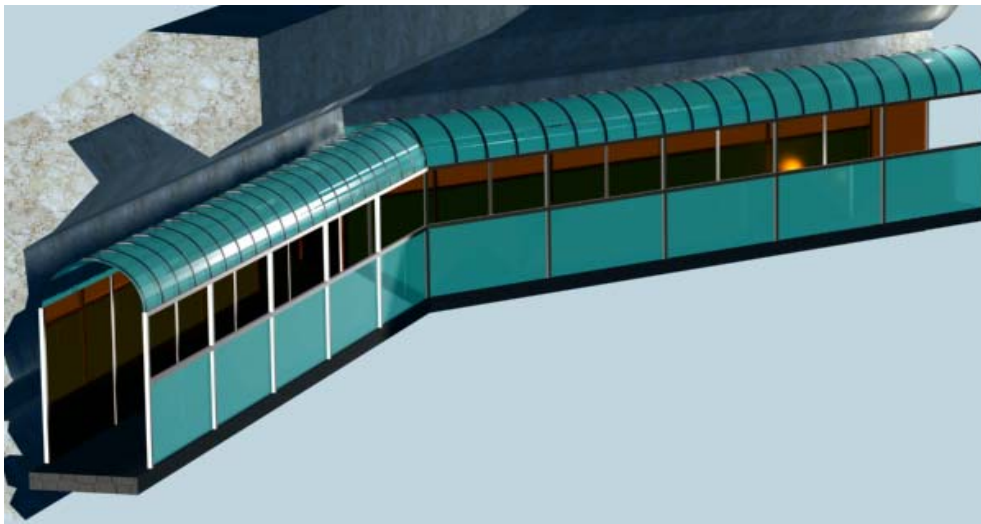


Fig. 10 – Sketch of the artificial passage of 30 m length and 2 m height on the touristic track, under bat colony in *Guano Room* – Women Cave.

2. In order to avoid the “light flora” development, the old system of lightening with LED system must be replaced, with cold light and in the area with chiroptera, light will be red – disturbing bats much less.

3. In order to reduce the air flow in the cave comparable with a tunnel, the door from the Northern entrance will be replaced with a compact metallic one.

4. In order to facilitate bats access in the cave with their span wings, the Southern gate will be replaced with a new one, with 15 cm between the horizontal bars and 70–80 cm between the vertical ones (Fig. 10).

5. In the narrow place toward *Turkish Room* two metal pannels like doors with two parts should be placed. Their role is to avoid access of tourists to the nursery colony and to diminish the air flow speed in the cave and will be opened for bat access to the *Altar Room* in the hibernating period. In this way initial habitats with optimum conditions for bats will be restaured.



Fig. 11. Southern entrance with an actually unsuitable gate (15 × 15 cm net of lattice) not allowing bat flying access.

6. Partial reopening Eastern walled entrance and mounting metal bars (15 cm between horizontal bars and 70–80 cm between those vertical) to facilitate bat access and restoration of a large (up to 4000 individuals) nursery colony (Fig. 12 A, B).

7. Over metallic bars set to the Eastern entrance a mobile metallic pannel will be placed which will be opened in summer time for nursery colony and will totally close the entrance in winter, to protect hibernating colony from the *Altar Room*.

8. Two metallic gates will be set to avoid entrances to the Northern and Southern Scientific reservations from the lower levels.

9. Totally rehabilitate the touristic track and improved it with lateral balustrades, both to protect tourists and to regulate their access in the cave.



Fig. 12 A. Project's team in the room close to the Eastern entrance, under former location (B) of a huge nursery colony driven away after walling this entrance.

10. Rehabilitation and moder building of the entire external tracks with lights (for night), from Southern exit to the parking place.

11. In restoration works only suitable materials will be used for underground conditions and avoiding habitat pollution.

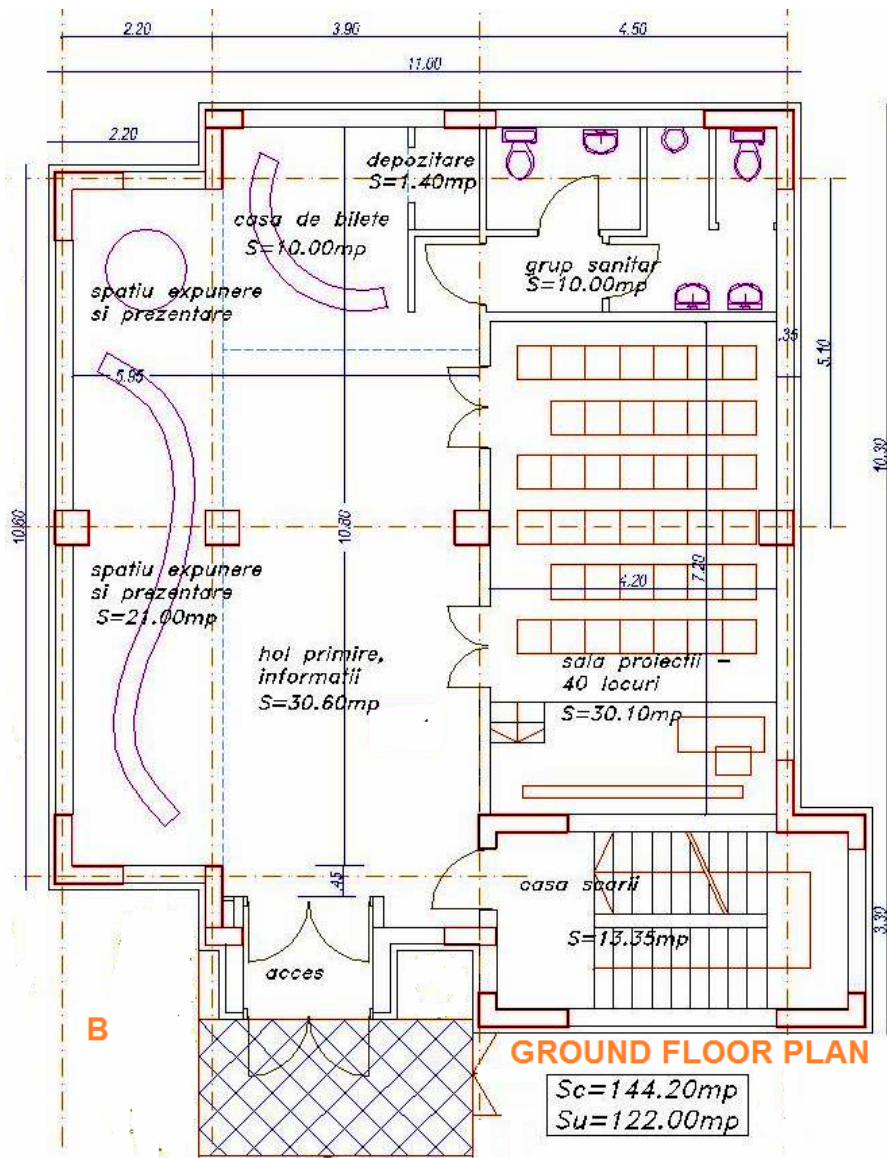
12. Monitoring bat population and disturbing works will be according to their life circle – between nursery and hibernating activities.

13. In monitoring time the bat answers to new ecological improvements in site will be observed.

14. The Project's team will adapt the strategy of rehabilitation according to the monitoring results.

15. Use of Video-traps suppose to avoid human presence inside the cave. But, using of different items to measure the temperature, relative humidity, air flow speed, pH, etc. will be connected to the monitors outside of the cave and checked online.

16. The Information Center (Fig. 13 A, B, C) will reduce the man impact on bats especially for monitoring purposes. Bat activities will be also watched by tourists inside this Information Center (Fig. 13 B). Also, in this Center will be rooms for administration staff and available information for tourists about the importance of the cave as well as recommendations to be protected.



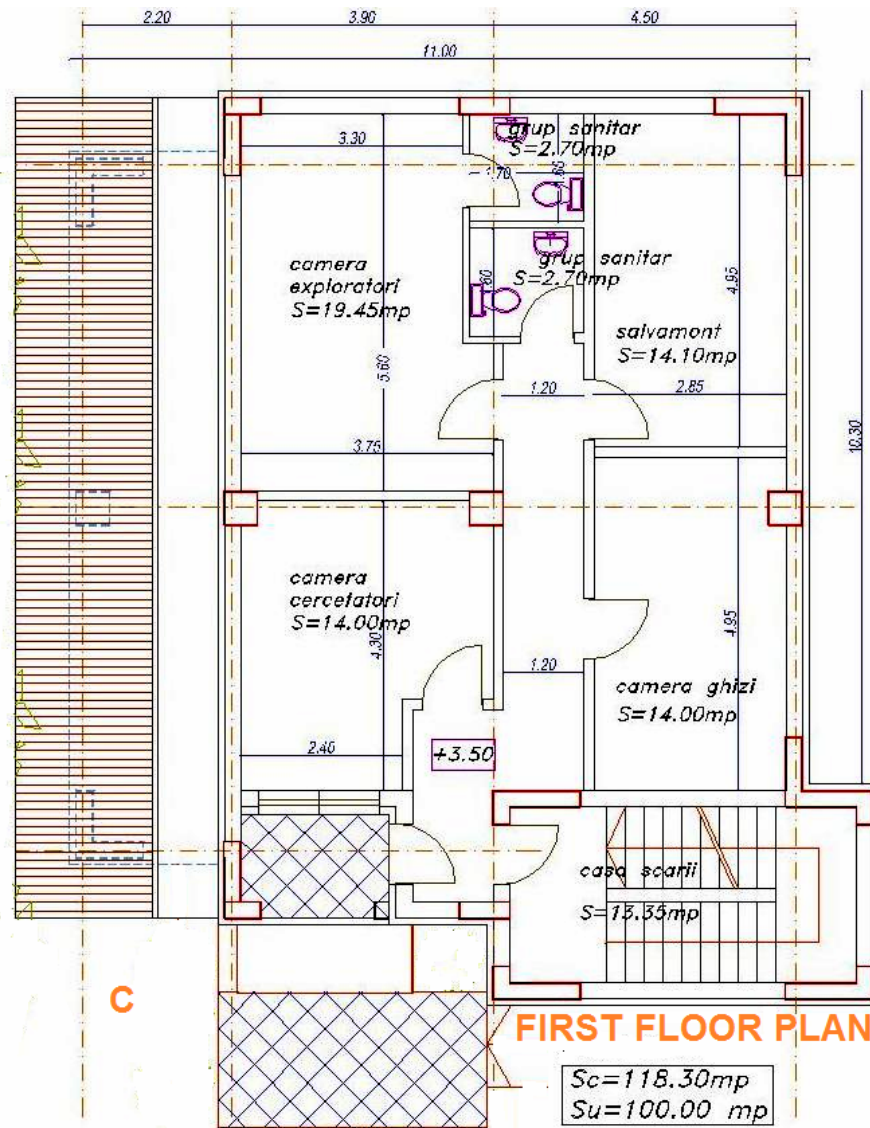


Fig. 13 A, B, C. Plans of Information Center to Women Cave – Iron Bath (architect Nadina Nistor).

CONCLUSIONS

1. The previous experience, research and results in reconstruction of some habitats allow us to be optimistic that after the suggested ecological restoration the bat colonies will be rehabilitated in only 5–8 years. The estimated number of bats

will be up to 4000 individuals for hibernation and 10–12,000 individuals in the nursery period. The most important will be to take into consideration all project details, including the monitoring method.

2. As we have already mentioned, realizing this project will achieve two main purposes: restoration and conservation of nursery and hibernating shelters for bats, according to Law (90/2000); much better conditions to receive and to offer information to visitors and this will be beneficial to the local community, increasing agrotouristic opportunities in the area.

3. Considering the Project's purposes to imply technical conditions and solutions compatible with touristic activities in a shelter for nursery and hibernating bat colonies and to realize their conservation we can emphasize its oneness character both for a protected area and bat conservation in a touristic cave.

4. Bat protection movement increased all over the world not only because of the anthropic pressure, but also because of their importance as bioindicators on the state of habitats, because of their important role in ecosystem physiology, controlling pest insects and not in the least some diseases which may decimate bat populations.

5. The Project is important considering the scarcity of suitable shelters and we can think more to fit up new underground refuges for bats, which today are not totally suitable to host chiropteran fauna.

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