BATS

METHODOLOGY FOR ENVIRONMENTAL IMPACT ASSESSMENT AND APPROPRIATE ASSESSMENT

A manual for developers, environmental experts and planning authorities

National Museum of Natural History – BAS

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National Museum of Natural History – BAS
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agriculture, nature and food quality

Author:
Boyan P. Petrov
(National Museum of Natural History – Bulgarian Academy of Science)

The table «Procedures for EIA and AA as they relate to bats» was prepared by **Assoc. Prof. Dr. Ivan Pandourski**
(Institute of Zoology – Bulgarian Academy of Science)

Consultants:
Eric Jansen, Herman Limpens
(Dutch Mammal Study and Protection Society VZZ)

Editors:
Svetlana Miteva, Radostina Tzenova

English translation: Teodora Valkova

Proof reading: Nicholas Parrott – TextualHealing <info@textualhealing.nl>

Prepress: Lyubomir Andreev

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ANNEXES

GLOSSARY OF ABBREVIATIONS

AA	Appropriate assessment (Assessment of plans and projects that will significantly affect Natura 2000 sites)
BFS	Bulgarian Federation of Speleology
BRCC	Bat Research and Conservation Centre
EA	Ecological assessment
EEA	Executive Environmental Agency
EPA	Environmental Protection Act
IZ	Institute of Zoology – Bulgarian Academy of Sciences
MEW	Ministry of Environment and Waters
NBMS	National Biodiversity Monitoring System
NGO	Non-governmental organization
NIMH	National Institute of Meteorology and Hydrology
NMNH	National Museum of Natural History – Bulgarian Academy of Sciences
NNPS	National Nature Protection Service
REIA	Report on environmental impact assessment
RIEW	Regional Inspectorate of Environment and Waters

This manual was made possible with the enterprise, effort and time invested by Teodora Ivanova (NMNH-BAS) and Svetlana Miteva (VZZ) without whom this project would have never taken place. We would like to express out gratitude to Ina Inkyova whose energy and knowledge helped us enormously in the management of the first stage of the project. Radostina Tsenova (Bulgarian Biodiversity Foundation) contributed greatly to good communications between the institutions, the organization of work meetings and the text editing. Elena Tilova prepared the texts on the rescue operations conducted by the Green Balkans in Plovdiv and Stara Zagora. We would expressly like to thank Rouslan Serbezov, Raina Hardalova, Alexandrina Yaprakova, Rositsa Dimova from MEW – NNPS and Katya Naydenova from MEW – Prevention Activity for their comments, which improved the quality and structure of this report. All statements and suggestions received from the RIEW experts were also greatly appreciated. Finally, we greatly appreciate the support and help of Alexi Popov in his capacity as the head of the NMNH-BAS.

WHY WAS THIS MANUAL WRITTEN?

- To provide a systematic synthesis of contemporary knowledge about bats in Bulgaria and specify the methods for studying them and appropriate periods to do so;
- To help conserve bats in regions where intensive changes are occurring in the landscape and more specifically in zones where there are direct conflicts of interest;
- To assist experts involved with environmental impact assessments and appropriate assessments so that their reports contain applicable measures to avoid, minimize, mitigate or compensate for negative impacts;
- To assist the different units of the Regional Inspectorates of the Ministry of Environment and Waters in their assessment of the quality of reports submitted that relate to bat conservation;
- For developers to identify and implement solutions for reducing the impact on bats in conflict zones;
- To facilitate the practical implementation of a number of laws relating to the conservation of endangered species.

FOR WHOM WAS THIS MANUAL WRITTEN?

- Experts at the Ministry of the Environment and Waters, RIEW and the Executive Environmental Agency;
- Developers and experts involved with environmental impact assessments and appropriate assessments;
- Experts from the NGO sector and others with an interest in this topic.

HOW TO USE THE MANUAL

Practical section – this provides the procedural checklist for assessing the impact of proposed infrastructure projects on bats living in the surrounding area. It presents the sequence of actions that need to be undertaken, so that a correct assessment of the impact of a development on bats can be made. It includes reference tables, the appropriate methods and periods of study and possible ways of avoiding, reducing and offsetting negative impacts in the most problematic zones. Practical tools are included for a rapid evaluation of these reports and assessments. This section also summarizes the laws that are relevant to the methodology.

Expert section – this discusses all the important aspects of the life cycle of bats and their specific biological and behavioural characteristics and the main methods for researching bats. It examines the most frequent problem situations that arise in relation to bats in Bulgaria and measures for their avoidance, mitigation and possible compensation. Additional information on bats living in forests and human settlements (not subject to impact assessment) is also included for the benefit of developers, environmental experts and decision-making institutions to advise them on how to best avoid conflicts over bats.

Tables with references (Annexes) – the most important information on bats: organized by type of habitats, functions, research methods, periods and measures.

Bats are one of the most widely distributed mammal groups on Earth. They inhabit all continents except for the Antarctic. There are about **1110 species**, all over the world divided into two sub-orders: **Microchiroptera** and **Old World Megachiroptera**.

- **Microchiroptera (over 930 species)** can be found almost everywhere, they feed almost exclusively on insects and are an important natural regulator of insect populations.

- **Old World Megachiroptera (around 180 species)** live in the tropics and feed mainly on fruits and seeds. They play a significant part in pollination and spreading seeds.

Species diversity is the highest in tropical regions and decreases away from the equator. Bulgaria has a uniquely high diversity of bats. Of the **35 species** present within in Europe, **33 species** are known to inhabit Bulgaria.

Among the reasons for this high diversity are the country's transitional geographic location, its mosaic of habitats which start at sea level and reach an altitude of over 2 900 m, the continued existence of wild nature in many parts of the country, extensive farming activities in the mountains and semi-mountainous regions, the presence of over **5,400 caves** and the high diversity and abundance of insects.

The greatest bat diversity can be found in the belt between 100 and 400 m altitude, where relatively small areas are inhabited by **17–20 species**.

Bats can be found almost everywhere in Bulgaria and as such are likely to be involved in all situations where an impact assessment on biodiversity is required. All bat species are strictly protected under Bulgarian and international legislation and are a priority in terms of study and conservation. The environmental impact assessment process involves all competent parties – bat experts, controlling institutions, developers and experts.

This manual is intended as a tool to help us to fulfill our responsibilities in observing the laws and to strike a balance between development and the conservation of Bulgaria's rich biodiversity!

PRACTICAL SECTION

Procedures for EIA and Appropriate Assessment as they relate to bats

Checklists for evaluating EIA and AA reports as they relate to bats

Legislation

PROCEDURES FOR EIA AND APPROPRIATE ASSESSMENT AS THEY RELATE TO BATS

The following procedure presents the sequence of actions (STEPS) that need to be undertaken to make an appropriate assessment relating to an infrastructure proposal (IP).

STEP 1. Collection and analysis of available information

A. What is the available information on the species composition of bats in the region of the IP?

B. What is the existing information on the habitats and the functional features of the terrain, which are relevant for bats?

C. What is the existing information on the structure (i.e. defining elements and characteristics) of the ecosystems in the region around the IP?

D. Is there any data about previous experience in implementing similar IPs in Bulgaria or abroad?

Guidelines: When there is a lack of detailed information on bats (very likely), consult Annexes 3, 4 and 6. They provide details of the species that can be expected to be found in different habitats and will provide an initial idea on what to expect, and look for, in the field if only habitat data is available. For additional information go to the section on «Roosts» and Annexes 3, 6 and 7. When looking for existing information on the habitats and the functional features of the terrain, that are relevant to bats, the expert must focus on areas with an abundance of insets, existing roosts, known flight corridors and linear landscape elements such as roads, forest clearings and flowing rivers with well developed vegetation along the banks, etc.
Information on potential bat migration routes can be drawn from documented migratory routes of birds.

Sources of information to consult: Reports and available information kept in the MEW, EEA, RIEW, IZ, NMNH, BFS, NATURA 2000 database, management plans of protected territories, topographic maps at the 1:20000 or 1:50000 scale, aerial photographs, preliminary surveys of the region, NIMH, vegetation maps, published hydrological reference books, meteorological bulletins, scientific articles and the Internet.

This stage needs to include at least one site visit and survey of the region where the IP is planned. For the field visit you must have a good topographic map on which the planned project is clearly shown. You should mark the main types of habitats and landscape elements on this map, as an essential preliminary evaluation of any possible conflicts.

STEP 2. Preliminary evaluation of the need for additional studies to establish the level of risk and the potential impact of the IP

A. Evaluation how up to date the information collected in Step 1 is. Analysis of Step 1 (A+B+C+D)

B. Which bat species can one potentially expect to find in the IP region?

C. What is the possible function of landscape elements in the IP region in the different periods of the life cycle of bats?

D. Identify potential conflicts which might result from the IP and have a direct (or indirect) negative impact on individual bats, bat populations or the functional landscape elements that relate to bats.

Guidelines: Compare the results of the bibliographic references, consultations performed and field visits and evaluate the information as per Annex 7. Assess the main functions of the identified habitats on bats and their possible flight corridors. Mark all the available data on the map. Check the points where these overlap with the IP – these are the conflict zones. Grade their level of significance. Each piece of available information must be critically evaluated in terms of its topicality, i.e. if the data collected correspond to the existing conditions within the IP region, if abrupt and lasting changes in the ecological characteristics have occurred since the data was collected and if any subsequent changes in the structure of the bat community may have occurred.

Sources of information: Annexes 4 and 7; see «Roosts», «Food and foraging», «Echolocation» and the table «Impact of human activities on bat populations».

The conclusive evaluation on the level of significance of conflicts must be arrived at in consultation with a bat expert. This saves time and money, not only for the developers, but also for the monitoring institutions. Additional field studies must be planned for all identified priority conflicts.

STEP 3. Developing and carrying out studies on bats and the related functional elements of the environment

A. To define appropriate methods of study (see Annexes 4 and 5).

B. To determine a suitable representative period to conduct the study (see Annexes 4 and 5).

C. To establish the intensity of the study depending on the specificity of sites and the study season.

D. To conduct the field studies and gather up-to-date information and interpret the collected information. *Analysis of Step 1 (A+B+C) and Step 2 (B+C).*

Guidelines: The appropriate methods for field studies should be selected on the basis of the type and specificity of the affected ecosystems and the characteristics of the potentially most vulnerable bat species. Obviously, research carried out in karst landscapes will be considerably different than research in open farming regions. The main purpose of the assessment process during this period is to obtain missing information on bats and their habitats within the region of the IP. Mark the new results on a map and use them as the basis for the next step in the research.

The duration of field research is mostly determined by a one-year life cycle between two breeding periods.

The periods of bat activity which are subject to assessment are as follows:

- Breeding period (from late May to late July);
- Period of active communication between the summer roosts (June–August);
- Activity of local populations (May–September);
- Dispersal of colonies and the start of the autumn migration (August–September);
- Autumn migrations and swarming behaviour at some roosts (September–October);
- Hibernation (December–March);
- Spring migration and mating (March–April).

The additional research would provide information on:

- The complete species composition;
- The characteristics of landscape elements of significance for bats;
- The presence, number and exact locality of the roosts;
- The presence and location of flight corridors and the species which use them;
- The presence and location of foraging habitats and the relative density and activity of the species that use them.

Sources of information: See chapters on «Methods for Bat Research» and «Life cycle», Annexes 4, 5.

Mandatory: if the IP is planned to be implemented within the boundaries of a NATURA 2000 zone at least 4–6 field studies must be carried out for each square kilometre of affected area. For projects outside NATURA 2000 zones 2–3 field studies must be performed for each 1–5 square kilometres of affected area.

STEP 4. Final assessment of the impact of the IP and measures to prevent, mitigate or offset the negative impacts

A. To present the conservation status of the established species under the national and international legislations.

B. To determine the species at risk from the IP and particularly the potential danger of destruction of individuals and colonies.

C. To locate the habitats and roosts affected by the IP and to assess the main risk factors during the different stages of implementing the IP.

D. To work out recommendations to reduce the negative impact of the IP and propose alternative solutions for mitigation and compensation.

Guidelines: The analysis of the results of Steps 1+2+3 and the information from the IP's technical assignment will identify the conflict zones of greatest importance for the bat communities within the region of the IP. Conflict analyses must be submitted for all stages of the IP, namely:

- research and planning;
- construction of facilities;
- period of operation of facilities;
- period of reclamation and rehabilitation.

The final report must contain basic information and recommendations for decision making that relate to the different stages of the IP's realization so as to prevent, reduce and/or compensate for the negative impact on the environment and on bats in particular. Alternative solutions are necessarily proposed in terms of relocating facilities and an assessment of the effect that their operation would have.

Depending on the type of IP, the final assessment report must contain some of the following specific components:

- assessment of the impact on migration routes (destruction and disconnection of communication corridors);
- assessment of losses of foraging habitats (sites with a great abundance of insects);
- evaluation of the heightened risk of collision during flight (mandatory during operation of wind turbines and construction of roads);
- assessment of the degree of disorientation of bats resulting from emissions of ultra sound noise;
- assessment of measures that would reduce the risk of increased bat fatalities specifically in relation to:
    1. migration corridors;
    2. areas of intensive activity of migrating species;
    3. important foraging habitats of resident and migrating species;
    4. affected summer and winter roosts;
- assessment of the climatic characteristics (speed and prevailing direction of wind, temperature of places subject to monitoring, etc.);
- assessment of the effect of artificial lighting which draws insects;
- assessment of the cumulative effect of the facilities;
- assessment of any possible barrier effect of the facilities.

Sources of information: See chapters on legislation, projects, plans and the tables on the conservation status of bats and the table «Impact of human activities on bat populations».

Mandatory: Consult the measures for avoidance, reduction and/or compensation of damages with a bat expert and the developer's engineering and technical consultants.

The assessment must contain a well-argued case as to whether the risks posed by the IP are acceptable.
The risk must be evaluated as UNACCEPTABLE if it affects a population level!!!

The next tables provide a schematic checklist for the evaluation of reports on environmental impact assessment and appropriate assessment. The purpose of these checklists is to facilitate experts at regulatory institutions in assessing the credibility, representativeness, adequacy and thoroughness of reports concerning bats.

CHECKLIST FOR EVALUATING APPROPRIATE ASSESSMENT (AA) REPORTS AS THEY RELATE TO BATS

Notification under Art. 10 from the Regulation for AA.					
1	Are there landscapes/habitats where bats can be expected? Check Annexes 3, 4 and 7.	**No**	Apply criteria for the evaluation of the negative impacts on bats under Art. 16 from the Regulation for AA.	**Submitted**	Proceed with the report/assessment.
		Yes	Apply criteria for the evaluation of the negative impacts on bats under Art. 16 from the Regulation for AA. Consider Art. 17 if necessary.	Considerable negative impact expected.	Request a report on the degree of the negative impact. Proceed to 2.
				No considerable neg. impact expected.	Approval and coordination following Chapter II of the Regulation of the AA.
					Approval and coordination following Chapter III of the Regulation for AA.
Evaluation of the quality of the reports on the degree of the negative impact on bats.					
2	Does the report/assessment contain a bat species list and details of the methods used to prepare the report/assessment?	**No**	Negative assessment.	Request that the report/assessment is reworked to include these two items, as per the requirements of this manual.	
		Yes	Positive assessment.	Proceed with the report/assessment.	
	YES: Compare with Annexes 3, 4, 5 and 7: adequate techniques/species and the chapter on methods for bat research.				
3	Are the methods adequate to ensure that the list of bat species will be full and reliable?	**No**	Request additional field studies or reworking of this part of report/assessment as per the requirements of the Bat Manual.		
		Not clear	Ask for details	**Missing**	Request reworking of the report/assessment as per the requirements of the Bat Manual.
		Yes	Consult with Annexes 3, 4 and 5: on use of habitats by bats, time of study, adequacy of methods.	**Submitted**	Proceed to 4.
4	Are the methods used and the time of their implementation adequate to provide a full picture of the use of habitats by bats?	**No**	Require additional field research at an appropriate time/season or reworking of this part of report/assessment as per the requirements of the Bat Manual.	**Missing**	Request reworking of the report/assessment as per the requirements of the Bat Manual.
				Submitted	Proceed to 5.
		Not clear	Consult with an expert.		
	YES: Consult with Attachment 5 and the chapter on «Projects and plans subject to EIA or to coordination with RIEW/MEW and which affect bats».				

5	Are the planned/possible changes in the main elements of the landscape presented?	**No**	Are such changes to be expected?	**No**	Proceed with the report/assessment.
		Not clear	Ask for more detailed information.	**Submitted**	Proceed with the report/assessment.
	YES: Consult with Attachment 5 and the chapter on «Projects and plans subject to EIA or to coordination with RIEW/MEW and which affect bats».				
6	Does the report discuss possible conflicts, impacts and fragmentations?	**No**	Are such conflicts, impacts and fragmentations to be expected?	**No**	Proceed with the report/assessment.
		Not clear	Consult an expert.		
	YES: Compare/consult with the chapter on «Projects and plans subject to EIA or to coordination with RIEW/MEW and which affect bats».				
7	Have possible conflicts, impacts and fragmentations been presented for the different stages of the IP: planning/research, construction, operation and maintenance/termination of operation.	**No**	Are specific conflicts, impacts and fragmentations to be expected during the different stages of planning/construction/operation?	**Yes**	Request detailed information so as to assess the conflicts in the different stages of the project implementation as per the requirements of the Bat Manual.
				No	Proceed to 8.
	YES: Proceed to 8.				
8	Has a qualitative and/or quantitative evaluation been presented of the significance of conflicts, impacts and fragmentations on the bat population in the region?	**No**	Request additional information (field studies if necessary) on the significance of impacts on the bats in the region and request consultations with a bat expert.	**Missing**	Return report/assessment for reconsideration due to insufficient data.
		Not clear	Consult a bat expert.	**Not clear**	Consult a bat expert.
	YES: Proceed to 9.			**Yes**	Proceed to 9.
9	Are solutions proposed on how to avoid, reduce/mitigate and/or compensate significant impacts?	**No**	Request additional information or a new report containing detailed proposals on avoidance/mitigation/compensation of the impact during the different stages of the project.	**Missing**	Return report/assessment for reconsideration due to insufficient data.
				Submitted	Proceed to 10.
	YES: Compare/Consult with the section concerning measures to avoid, mitigate/reduce or compensate impacts in the chapter «Projects and plans subject to EIA or to coordination with RIEW/MEW and which affect bats».				
10	Do the proposed solutions meet the requirements of the Bat Manual?	**No**	Request additional measures as per the requirements of the Bat Manual. Seek consultations with a bat expert.	**Missing**	Return report for reconsideration due to insufficient data.
		New situ-ation	Seek consultations with a bat expert, request monitoring of the situation + submission of results by a bat expert.	**Submitted**	Proceed to 11.
	YES: Proceed with the report/assessment applying the information on required measures.				
11	Proceed with the report/assessment.		Check/observe the implementation and quality of the compensatory measures.		

CHECKLIST FOR EVALUATING ENVIRONMENTAL IMPACT ASSESSMENT REPORTS AS THEY RELATE TO BATS

1	Is there a bat species list?	**No**	Are there landscapes/habitats where bats can be expected? Check Annexes 3, 4 and 7.	**No**	Proceed with the report/assessment.
				Yes	Request additional information as per the requirements of this manual. Rate the report with a grade C or D.
	YES: Compare with Annexes 3 and 4 on habitats/species				
2	Does the report/assessment contain details of the methods used to conduct the bat studies?	**No**	Request that the methods be indicated.	**Missing**	Request additional information as per the requirements of this manual.
				Submitted	Proceed to 3.
	YES: Compare with Annexes 3 and 5: adequate techniques/species and the chapter on methods for bat research.				
3	Are the methods adequate to ensure that the list of bat species will be f ull and reliable?	**No**	Request additional field studies or reworking of this part of report/assessment as per the requirements of the Bat Manual.		
		Not clear	Ask for details.	**Missing**	Request additional information as per the requirements of the Bat Manual. Rate the report with a grade C or D.
		Yes	Consult with Annexes 3, 4 and 5: use of habitats by bats, time of study, adequacy of methods.	**Submitted**	Proceed to 4.
4	Are the methods used and the time of their implementation adequate to provide a full picture of the use of habitats by bats?	**No**	Request additional field research at an appropriate time/season or reworking of this part of report/assessment as per the requirements of the Bat Manual.	**Missing**	Request additional information as per the requirements of the Bat Manual.
				Submitted	Proceed to 5.
		Not clear	Consult with an expert.		
	YES: Consult with Annex 5 and the chapter on «Projects and plans subject to EIA or to coordination with RIEW/MEW and which affect bats».				
5	Are the planned or possible changes in the main elements of the habitat and the landscape presented for all the project's alternatives?	**No**	Are such changes to be expected?	**No**	Proceed with the report/assessment.
		Not clear	Request detailed/additional information.	**Submitted**	Proceed with the report/assessment.
	YES: Compare/Consult with the chapter on «Projects and plans subject to EIA or to coordination with RIEW/MEW and which affect bats».				

<table>
<tr><td>6</td><td>Are the conflicts/impacts of the all projects' alternatives analysed and compared in the report?</td><td>No</td><td>Request detailed/additional field studies and information for this part of the report. Rate the report with a grade C or D.</td><td colspan="2" rowspan="2"></td></tr>
<tr><td colspan="2"></td><td>Not clear</td><td>Consult with an expert.</td></tr>
<tr><td></td><td colspan="5">YES: Compare/Consult with the chapter on projects and plans subject to EIA or to coordination with RIEW/MEW and which affect bats and proceed to step 7.</td></tr>
<tr><td>7</td><td>Has a qualitative and/or quantitative evaluation been presented for the significance of conflicts and impacts on the bat population during the different stages of the IP: planning/research, construction, operation and maintenance/termination of operation?</td><td>No</td><td>Are specific conflicts/impacts to be expected during the different stages of planning/construction/operation?</td><td>Yes</td><td>Request detailed information (field studies, if necessary) so as to assess the conflicts/impacts in the different stages of the project implementation as per the requirements of the Bat Manual. Rate the report with a grade C or D.</td></tr>
<tr><td colspan="2"></td><td>Not clear</td><td>Consult with a bat expert.</td><td>No</td><td>Proceed to 8.</td></tr>
<tr><td></td><td>YES: Proceed to 8.</td><td colspan="4"></td></tr>
<tr><td>8</td><td>Are there any solutions proposed as to how to avoid, mitigate and/or compensate for the significant impacts?</td><td>No</td><td>Request additional information or a new report containing detailed proposals on avoidance/mitigation and compensation of the impacts during the different stages of the project.</td><td>Missing</td><td>Request specific complementation of the report due to insufficient data. Rate the report with a grade C or D.</td></tr>
<tr><td colspan="4"></td><td>Submitted</td><td>Proceed to 9.</td></tr>
<tr><td></td><td colspan="5">YES: Compare/consult with the section concerning measures to avoid, mitigate or compensate impacts in the chapter on projects and plans subject to EIA or to coordination with RIEW/MEW and which affect bats.</td></tr>
<tr><td>9</td><td>Do the proposed solutions meet the requirements of the Bat Manual?</td><td>No</td><td>Request additional measures as per the requirements of the Bat Manual.</td><td>Missing</td><td>Request specific additions to the report that provide these missing data. Rate the report with grade C or D.</td></tr>
<tr><td colspan="2"></td><td>Not clear</td><td>Consult with a bat expert.</td><td>Submitted</td><td>Proceed to 10.</td></tr>
<tr><td></td><td colspan="3">YES: Proceed with the report/assessment applying the information on required measures. Rate the report with a grade A, B or C.</td><td colspan="2"></td></tr>
<tr><td>10</td><td>Has new information been provided during the public hearing?</td><td>No</td><td>Proceed to 11.</td><td colspan="2"></td></tr>
<tr><td></td><td colspan="5">YES: Run the new information against the check list, table «Procedures for EIA and AA as they relate to bats» and Annexes. Consult with a bat expert.</td></tr>
<tr><td>11</td><td colspan="2">Proceed with the report/assessment.</td><td colspan="3">Check/observe the implementation and quality of the compensatory measures.</td></tr>
</table>

LEGISLATION

A number of legislative acts/documents determine the order, terms and regulations under which different types of infrastructural projects can be undertaken. For almost all of them some form of coordination is required with different state institutions, such as the Ministry of Environment and Waters (MEW) and its regional units (RIEW).

INTERNATIONAL LEGISLATION ON THE CONSERVATION OF SPECIES AND HABITATS

The agreements and conventions signed by the Republic of Bulgaria determine the status of species and are based on international agreed measures for their conservation. The main texts and recommendations are integrated in Bulgaria's national legislation.

BERN CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS

Ratified on 25.01.1991 (SG 13/1991), effective in Bulgaria as of 01.05.1991 (SG 23/10.03.1995). Special attention is paid to threatened and vulnerable species, including threatened and vulnerable migratory species. Each contracting party undertakes to stimulate education and promote general information about the need to preserve these species of wild flora and fauna and their habitats. Each party shall undertake the necessary legislative and administrative measures to ensure the preservation of the natural habitats of these species of wild flora and fauna, particularly of those listed in Annexes 2 and 3. The parties undertake to focus special attention on the protection of areas which are important for the migratory species enumerated in Annexes 2 and 3 and which are suitably situated in terms of migratory routes, such as areas for wintering, gathering, feeding and mating.

Annex 2 – Strictly protected fauna species
All species with the exception of ***Pipistrellus pipistrellus***

Annex 3 – Migratory species
Pipistrellus pipistrellus

BONN CONVENTION ON MIGRATORY SPECIES OF WILD ANIMALS

Ratified on 23.07.1999 (SG 69/3.08.1999), became effective in Bulgaria on 01.11.1999 (SG 16/25.02.2000). The parties that have signed this convention acknowledge the importance of the conservation of migratory species and the importance of regional agreements and cooperation to undertake actions to this effect by, whenever possible and appropriate, paying special attention to migratory species whose conservation status is unfavourable and **by undertaking the necessary and appropriate measures, independently and in cooperation, to preserve such species and their habitats.**

The Parties more specifically shall:

a) encourage, cooperate and support research on migratory species;

b) make efforts to provide immediate protection of the migratory species included in **Annex 1;**

c) endeavour to conclude agreements for protection and management of the migratory species included in **Annex 2.**

All European bat species are included in **Annex 2.**

AGREEMENT ON THE CONSERVATION OF POPULATIONS OF EUROPEAN BATS

EUROBATS – *http://www.eurobats.org*

Effective in the Republic of Bulgaria as of 9.12.1999 (SG 16/2000). The Agreement was drafted on the basis of the Bonn Convention and stipulates that each party shall adopt and enforce such legislative and administrative measures as may be necessary for the purpose of maintaining a favourable conservation status of all species by prohibiting the deliberate capture, keeping or killing of bats, identifying the areas of importance in terms of bat reproduction and wintering, promoting research programmes on the protection and management of bats, taking into account the potential effect of pesticides on bats and making additional endeavours to save the bat populations designated as threatened.

The provisions of this Agreement shall in no way affect the right of Parties to adopt stricter measures concerning the conservation of bats.

The fundamental obligations under EUROBATS are as follows:

1. Each Party shall prohibit the deliberate capture, keeping or killing of bats except under permit from its competent authority.

2. Each Party shall identify those sites within its own area of jurisdiction that are important for the conservation status, including for the shelter and protection, of bats. It shall, taking into account as necessary economic and social considerations, protect such sites from damage or disturbance. In addition, each Party shall endeavour to identify and protect important feeding areas for bats from damage or disturbance.

3. When deciding which habitats to protect for general conservation purposes each Party shall give due weight to habitats that are important for bats.

4. Each Party shall take appropriate measures to promote the conservation of bats and shall promote public awareness of the importance of bat conservation.

5. Each Party shall assign to an appropriate body responsibilities for the provision of advice on bat conservation and management within its territory particularly with regard to bats in buildings. Parties shall exchange information on their experiences in this matter.

6. Each Party shall take such additional action as it considers necessary to safeguard populations of bats that it identifies as being subject to threat and shall report under Article VI on the action taken.

7. Each Party shall, as appropriate, promote research programmes relating to the conservation and management of bats. Parties shall consult each other on such research programmes, and shall endeavour to co-ordinate such research and conservation programmes.

8. Each Party shall, wherever appropriate, consider the potential effects of pesticides on bats, when assessing pesticides for use, and shall endeavour to replace timber treatment chemicals that are highly toxic to bats with safer alternatives.

National Implementation

1. Each Party shall adopt and enforce such legislative and administrative measures as may be necessary for the purpose of giving effect to this Agreement.

DIRECTIVE 92/43/EEC ON THE CONSERVATION OF NATURAL HABITATS AND WILD FLORA AND FAUNA

(HABITAT DIRECTIVE)

The main purpose of this Directive is to **« enable the natural habitat types and the species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status in their natural range» .**

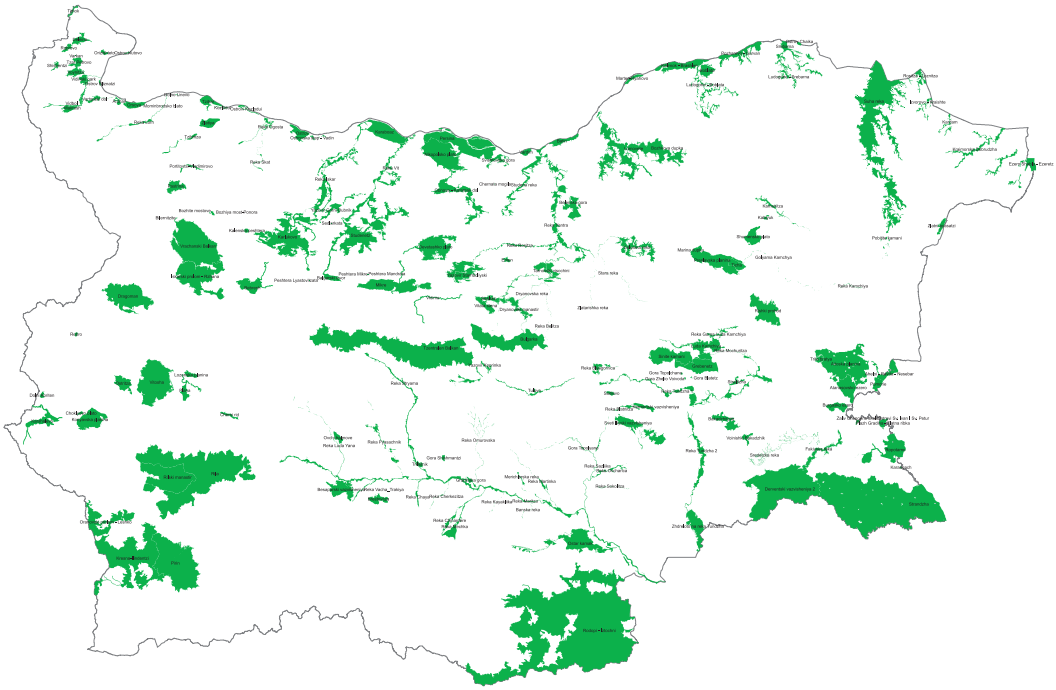
Annex 2 includes **13** bat species: *Rhinolophus blasii, Rh. euryale, Rh. ferrumequinum, Rh. hipposideros, Rh. mehelyi, Barbastella barbastellus, Miniopterus schreibersii, Myotis bechsteinii, M. blythii, M. capaccinii, M. dasycneme, M. emarginatus* and *M. myotis.*

The member countries are obliged to guarantee adequate protection of these species and their habitats particularly within the ecological network of NATURA 2000 sites.

Upon discovery of the presence of any of these species, the assessment of the status of their populations in the examined territory must be particularly thorough. For all species listed in Annex 2 standard forms have been worked out with specific criteria to determine if the species enjoys a **favourable conservation status.** Achieving such a status is the major purpose of the Directive and all the ensuing obligations for our country to guarantee adequate protection for bat roosts and foraging habitats.

NATURA 2000 SITES OF IMPORTANCE FOR BATS IN BULGARIA

In many existing and established protected areas there are considerable underground bat habitats.
Some of the areas have been protected precisely because of the existence of caves with large breeding or hibernating bat colonies (e.g. **BG0000269** Lyastovitsata cave, **BG0000266** Mandrata cave, **BG0000304** Golak, **BG0000594** Bozhiya Most-Ponora, **BG0000591** Sedlarkata, **BG0000589** Marina Dupka, **BG0000605** Bozhkova Dupka, **BG0000587** Varkan, etc.).
The majority of the remaining areas, particularly those covering large areas (for example **BG0001040** the Western Stara Planina Mountains and the Predbalkan, **BG0001030** the Western Rhodopes, **BG0001007** Strandzha Mountain, etc.), also contain a large number of bat caves, foraging habitats and migration corridors.
In each of these areas management plans are to be developed, that will specify the management and conservation of all components of the biological diversity, including bats.



Map of the NATURA 2000 sites approved by the Council of Ministers under art. 6, para. 1, items 1 and 2 of the Biodiversity Act
http://www.natura2000bg.org

NATIONAL LEGISLATION FOR ENVIRONMENTAL IMPACT ASSESSMENT AND APPROPRIATE ASSESSMENT

The following legislative acts have direct or indirect effect on the practical implementation of this manual. Specific articles are quoted which have direct bearing on the essence and grounds for the mandatory nature of the use of this methodology for the assessment of bats and their habitats, as well as on the evaluation of the quality of the respective reports.

1. ENVIRONMENTAL PROTECTION ACT – EPA
(published SG 91/25.09.2002 with all following amendments and additions)

This manual is an approved methodology under the meaning of art. 11, para. 1, item 5 of the Act through which the quality of the reports/assessment in the parts concerning bats will be evaluated. The manual is a modern methodology as defined in art. 1, items 1–7, art. 2, items 5, 7 and 8 and art. 3, item 7 of the Act. It is based on the provisions of art. 81 on how to carry out an assessment and art. 83 on the competence of the experts who make up the team undertaking the REIA.

2. REGULATION ON THE TERMS AND PROCEDURE FOR ASSESSMENT OF ENVIRONMENTAL IMPACT
(published SG 3/10.01.2006 with all following amendments and additions)

The manual is primarly intended for licensed experts involved with preparation of reports on the environmental impact assessments and appropriate assessments. It also provides developers with information on assessing whether they need to carry out EIA procedures. The methodlogy will help to collect representative and adequate data for the species of conservation importance, including bats, within REIA.
The manual is developed as a modern methodology under the meaning of art. 11, para. 1 of the Regulation. It refers to art. 2, para. 1, items 2, 3, 4, 6 and 7, art. 10 para. 3, items 2 and 3 of the Regulation for the purposes of making an EIA. By virtue of art. 14, para. 1, items 4 and 5 the omission of species which have conservation significance, including bats, from the REIA undermines the objectivity and the quality of assessment and can cause it to be sent back for reworking under art. 15, para. 2 and 3 of the Regulation.

Evaluation of the quality of the reports on EIA and the thoroughness of the information (as set out in Annex 2 of the Regulation for investment proposals) must necessarily be run through the key provided above entitled «Checklist for evaluating reports on environmental impact assessment and appropriate assessment (Bats section)». The lack of assessment of the impact of an IP on bats, in particular in the cases enumerated in chapter on «Projects and plans subject to EIA or to coordination with RIEW/MEW and which affect bats» within this manual will provide grounds for requesting more detailed information to be provided. This will also apply in the event of shortcomings wihin the report, such as a failure to identify measures for the avoidance or reduction of harmful impacts on bats. The mitigation measures recommended in this manual must be listed in the conclusions of the EIA, with details of how they will be implemented (or if not why not). Their implementation will be subsequently checked by the controlling institutions (in sense of art. 22 of this Regulation).
The competent bodies which exercise control over the implementation of EIA decisions, under the meaning of art. 22 of the Regulation, must consider the mitigation and avoidance measures listed in this manual. The manual must be used by EIA-certified experts when working out their positions in reference to art. 99, para. 3 of EPA and art. 22a, para. 3 of the Regulation.

3. REGULATION N 1 ON THE PROCEDURE FOR SETTING UP AND KEEPING A PUBLIC REGISTER OF EXPERTS ENGAGED WITH ECOLOGICAL AND ENVIRONMENTAL IMPACT ASSESSMENTS AND THE PROCEDURE ON HOW TO APPLY FOR REGISTER ENTRY
(published SG 22/11.03.2003 with all following amendments and additions)

The Regulation on the procedure for setting up and keeping a public register of experts engaged with ecological and environmental impact assessments register kept by the MEW.

4. REGULATION ON THE TERMS AND PROCEDURE FOR THE ASSESSMENT OF PLANS, PROGRAMMES, PROJECTS AND INVESTMENT PROPOSALS WITH THE SUBJECT AND PURPOSES OF PROTECTED AREAS CONSERVATION (= Assessment of plans and projects significantly affecting Natura 2000 sites)
(published SG 73/11.09.2007). **(Appropriate Assessment)**

This regulation stipulates the terms and procedure for making an assessment under art. 31 of the Biodiversity Act with regard to plans, programmes, projects and investment proposals and their compatibility with the subject and purposes of conserving protected areas. The competence of the experts, who are assigned to make the assessment under art.7, item 4, is regulated by art. 9 of this Regulation. The Manual shall apply to art. 2, 7 items 3, 4 and 5, art. 13, 15, 16, items 3 and 4, art. 22, 23, 24, para. 3, items 4–7, para. 4 and 5, art . 26, 29 and 32, para. 2 of the Appropriate Assessment.
The Manual will help assess the degree of impact that such plans, programmes, projects and investment proposals would have on bat populations. The measures proposed in the assessment for the avoidance, reduction and possible elimination of unfavorable impacts and the compensation of damages resulting from the realization of the investment proposals, plans, programmes, projects, must correspond to the measures stipulated hereunder for each particular case (as per art. 22 of this regulation). The quality of prepared assessments submitted as reports shall be evaluated by the competent body under art. 8 and criteria listed in art. 24, para. 3 of the Appropriate Assessment.

5. FORESTRY ACT (excerpts)
(published SG 125/29.12.1997 with all following amendments and additions)

The development and adoption of forest management plans is a key stage of forest management in Bulgaria. On the grounds of art. 25 (para. 6) of this Act the Ministry of Environment and Waters may refuse to coordinate a proposed forest management plan if it lacks or contains insufficiently developed measures for the preservation and maintenance of populations of forest dwelling bat species. The controlling bodies must use the methodology herein during coordination procedures required by the state forestry administrations, the Regional Forestry Directorates and the State Forestry Agency. For additional information and measures regarding bats see the chapter «Forest management – recommended forest practices».

«**Article 25.**
(1) (Amended, SG 16/2003) Forests and the lands of forest stock are structured, managed and used in accordance with forest management plan and related programmes.
(3) (Amended, SG 16/2003, 64/2007) Forest management plans are approved by the Chairman of the State Forestry Agency **after coordination with the relevant ministries** and departments.
(5) (Amended, SG 16/2003) Forest management plans are approved by the directors of the regional forestry directorates and organizational forest programmes and by the Director of the state forestry administration after coordination with the interested parties.
(6) (New SG 16/2003, amended, SG 82/2006) The bodies under paragraphs 3 and 5 must notify the **Ministry of Environment and Waters,** the Ministry of Regional Development and Public Works, the National Service for Fire Safety and Public Protection and the respective municipal administration under the procedure of the Code of Civil Procedure that the organizational forest projects, plans and programs are ready, and they are subject to **coordination within 14 days** of receipt of the notification. Failure to respond within the deadline is regarded as implicit agreement.»

6. HUNTING AND GAME PROTECTION ACT (excerpts)
(published SG 78/26.09.2000 with all following amendments and additions)

Projects for intensive game management farms with an area exceeding 5 ha require coordination with the Ministry of Environment and Waters (art. 8, para. 6). In many cases these projects will involve clearing forest areas (including cutting of trees with hollows), which impacts upon the conservation of bats that roost in tree hollows. The RIEW representatives who participate in commissions on reserves must use the methodology herein on issues concerning the organization of hunting grounds, reserve management and game management. To reduce the project impact and provide the required coordination under this Act see the chapter in this manual on «Forest management – recommended forest practices».

«**Article 8.** (Amended, SG 79/2002)
(1) State hunting farms, game breeding stations as well as intensive game management farms shall be established with the purpose of enhancing game stocks, promoting game diversity and protecting the gene pool.
(3) The establishment of intensive game management farms, which exceed 5 hectares, shall be coordinated with the Minister of Environment and Waters.

Article 18.
(1) (Amended, SG 79/2002) Hunting commissions shall be established at state forestry administrations and state hunting farms as consultative bodies over issues connected with hunting area organization, hunting and game management.
(2) The Director of a regional forestry directorate shall by order approve the membership of the commission under Paragraph 1, which shall consist of representatives of the state forestry administrations, state hunting farms, the RIEW, regional police departments, municipal administrations, as well as the individuals managing the game.»

Mediterranean horseshoe bat *(Rhinolophus euryale)*

WHY ARE BATS IMPORTANT?

Bats are a group of mammals with high conservation status determined by national and international legislation. This and the widespread distribution of bats all across Europe means that, in practice, bats are always an important feature of the ecological assessment within an environmental impact or strategic environmental assessment. Given the high conservation status of bats, **the ommission or neglect** of bats from such documents will undermine the credibility of the report and the objectivity of the assessment and is likely to be a cause for the assessment to be returned for reworking.

The legislative acts, which define the current conservation status of bats must be applied when conducting an assessment!

NATIONAL LEGISLATION ON CONSERVATION OF SPECIES AND HABITATS

The legislation which sets out the priorities, aspects and regimes for the conservation of species and habitats is laid out in the following documents:

BIODIVERSITY ACT
(published SG 77/09.08.2002 with all following amendments and supplements) – **BA**

This act regulates the relations between the state, municipalities and legal and physical persons in terms of the conservation and sustainable use of the biological diversity of the Republic of Bulgaria. Under this act **all bat species in the country are proclaimed strictly protected** (see Annex 3).

Annex 2 to art. 6, para. 1, item 2
(Amended and supplemented – SG 88/2005, amended – SG 94/2007)

« Art. 6.
(1) Special areas of conservation shall be designated for:

2. (amended, SG 94/2007) conservation of habitats referred to in Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora in respect to the species of animals and plants listed in Annex 2 hereto;»

The symbol **« ! »** before a species name denotes that the species is included in the Annex to Resolution № 6 (1998) of the Permanent Committee of the Bern Convention.

	Order BATS	**CHIROPTERA**
	Family Horseshoe Bats	**Rhinolophidae**
!	1. Blasius's horseshoe bat	*Rhinolophus blasii*
!	2. Mediterranean horseshoe bat	*Rhinolophus euryale*
!	3. Greater horseshoe bat	*Rhinolophus ferrumequinum*
!	4. Lesser horseshoe bat	*Rhinolophus hipposideros*
!	5. Mehely's horseshoe bat	*Rhinolophus mehelyi*
	Family Vespetilionid (common) Bats	**Vespertilionidae**
!	6. Western barbastelle	*Barbastella barbastellus*
	7. Schreiber's long-fingered bat	*Miniopterus schreibersii*
	8. Bechstein's bat	*Myotis bechsteinii*
	9. Lesser mouse-eared bat	*Myotis blythii*
!	10. Long-fingered bat	*Myotis capaccinii*
!	11. Geoffroy's bat	*Myotis emarginatus*
!	12. Greater mouse-eared bat	*Myotis myotis*

Annex 3 to art. 37
(Amended and supplemented SG 88/2005, amended SG 94/2007)

« Art. 37.
The wild animal and plant species listed in Annex 3 hereto shall be designated as protected across the entire territory of Bulgaria.»

Order BATS	**CHIROPTERA**
Horseshoe Bat family	**Rhinolophidae**
1. Mediterranean horseshoe bat	*Rhinolophus blasii*
2. Blasius's horseshoe bat	*Rhinolophus euryale*
3. Greater horseshoe bat	*Rhinolophus ferrumequinum*
4. Lesser horseshoe bat	*Rhinolophus hipposideros*
5. Mehely's horseshoe bat	*Rhinolophus mehelyi*
Family Free-tailed Bats	**Molossidae**
6. European free-tailed bat	*Tadarida teniotis*
Family Vespertilionid (common) Bats	**Vespertilionidae**
7. Western barbastelle	*Barbastella barbastellus*
8. Northern bat	*Eptesicus nilssoni*
9. Serotine	*Eptesicus serotinus*
10. Savi's pipistrelle	*Hypsugo savii*
11. Schreiber's long-fingered bat	*Miniopterus schreibersii*
12. Alcathoe whiskered bat	*Myotis alcathoe*
13. Steppe whiskered bat	*Myotis aurescens*
14. Bechstein's bat	*Myotis bechsteinii*
15. Lesser mouse-eared bat	*Myotis blythii*
16. Brandt's bat	*Myotis brandti*
17. Long-fingered bat	*Myotis capaccinii*
18. Pond bat	*Myotis dasycneme*
19. Daubenton's bat	*Myotis daubentonii*
20. Geoffroy's bat	*Myotis emarginatus*
21. Greater horseshoe bat	*Myotis myotis*
22. Whiskered bat	*Myotis mystacinus*
23. Natterer's bat	*Myotis nattereri*
24. Giant noctule	*Nyctalus lasiopterus*
25. Lesser noctule	*Nyctalus leisleri*
26. Noctule	*Nyctalus noctula*
27. Common pipistrelle	*Pipistrellus pipistrellus*
28. Nathusius' pipistrelle	*Pipistrellus nathusii*
29. Kuhl's pipistrelle	*Pipistrelus kuhlii*
30. Brown long-eared bat	*Plecotus auritus*
31. Grey long-eared bat	*Plecotus austriacus*
32. Particoloured bat	*Vespertilio murinus*
33. Pigmy/soprano pipistrelle	*Pipistrellus pygmaeus*

IMPORTANT TO KNOW!

On the grounds of ***art. 49, para. 1, item 1*** *of the Biodiversity Act and by virtue of* ***Regulation N 8*** *(published SG 4/16.01.2004) on the terms and procedures for granting permits on exceptions from the bans introduced under the BA concerning the animal and plant species in Annexes 3 and 4 and the use of non-selective appliances, means and methods for capturing and killing (Annex 5),* ***everyone who is engaged in bat studies and has direct contact with them must possess a valid permit issued by the MEW.***
The permits apply for a specific term and are issued for a certain person (physical or legal) and a specifically defined territory within the country.
The document stipulates the species, the number of specimens, the time and place, the appliances, the means and methods, the ways of handling species and the other conditions under which the exception can be permitted, as well as the body or person assigned with the responsibility to exercise control over the fulfillment of these terms.

PROTECTED AREAS ACT
(published SG 133/11.11.1998 with all following amendments and supplements)

This act defines and categorises the protected territories within Bulgaria, the procedures for their establishment and provides for the implementation of their management plans. **Around 40%** of the caves known to be host to large colonies of roosting bats in Bulgaria **are included in the protected territories** (PT): national parks, protected areas (PA) and natural landmarks (NL). Some of these important bat caves have the status of natural landmarks. In the majority of the cases the protected are also includes adjacent territory (forests or land).

TARIFF OF INDEMNITIES FOR DAMAGES CAUSED TO PLANT AND ANIMAL SPECIES INCLUDED IN ANNEX 3 OF THE BIODIVERSITY ACT
(Published SG 76/15.09.2006)

« Art. 1.
For damages caused to plant and animal species the guilty parties shall pay an indemnity as determined under Annexes 1 and 2.

Art. 2.
The due indemnities under art. 1 shall be transferred/remitted as follows:
1. to the institution for management of environmental protection activities – when the penalty is issued by officials within the system of the MEW or the Ministry of Agriculture and Forests;
2. to the respective municipal budgets – when the penalty is issued by the officials of the municipal administration.
Art. 3.
Indemnities under art. 1 shall be paid irrespective of liability for material damages under other legislative acts or of penal or administrative penal liability.
Art. 4.
The indemnities shall be collected under the procedures of the Administrative Violations and Sanctions Act.

Additional Provisions

§ 1. (1) Damages under this tariff shall mean:
1. the harming, crippling or killing of specimens or taking them away from nature; annihilation or taking their eggs and destruction of their nests – for the animal species included in Annex 1;
2. picking, cutting off, uprooting, damaging in any other way or destroying specimens in their natural ranges; taking plants or parts of them away from nature – for plant species included in Annex 2.
(2) the use of traditional farming practices for maintenance of the ecosystems (pasture, hay-making, etc.) shall not be considered as damage.

Final Provisions

§ 2. The tariff is adopted on the grounds of art. 129a, para. 2 of the Biodiversity Act.
§ 3. The control over the implementation of the tariff is assigned to the Minister of Environment and Waters, the Minister of Agriculture and Forests and to the mayors of municipalities.»

Annex 1 to art. 1 (bats only)

FAMILY/SPECIES	INDEMNITY (BGN/number)
Order BATS CHIROPTERA	
1. Horseshoe Bats (Rhinolophidae)	
1.1. Blasius's horseshoe bat *(Rhinolophus blasii)*	**50**
1.2. Mediterranean horseshoe bat *(Rhinolophus euryale)*	**50**
1.3. Greater horseshoe bat *(Rhinolophus ferrumequinum)*	**50**
1.4. Lesser horseshoe bat *(Rhinolophus hipposideros)*	**50**
1.5. Mehely's horseshoe bat *(Rhinolophus mehelyi)*	**50**
2. Free-tailed Bats (Molossidae)	
2.1. European free-tailed bat *(Tadarida teniotis)*	**50**
3. Vespertilonid (common) Bats (Vespertilionidae)	
3.1. Western barbastelle *(Barbastella barbastellus)*	**50**
3.2. Northern bat *(Eptesicus nilssonii)*	**50**
3.3. Serotine *(Eptesicus serotinus)*	**50**
3.4. Savi's pipistrelle *(Hypsugo savii)*	**50**
3.5. Schreiber's long-fingered bat *(Miniopterus schreibersii)*	**50**
3.6. Steppe whiskered bat *(Myotis aurascens)*	**50**
3.7. Bechstein's bat *(Myotis bechsteinii)*	**50**
3.8. Lesser mouse-eared bat *(Myotis blythii)*	**50**
3.9. Brandt's bat *(Myotis brandtii)*	**50**
3.10. Long-fingered bat *(Myotis capaccinii)*	**50**
3.11. Daubenton's bat *(Myotis daubentonii)*	**50**
3.12. Pond bat *(Myotis dasycneme)*	**50**
3.13. Whiskered bat *(Myotis mystacinus)*	**50**
3.14. Geoffroy's bat *(Myotis emarginatus)*	**50**
3.15. Greater mouse-eared bat *(Myotis myotis)*	**50**
3.16. Natterer's bat *(Myotis nattererii)*	**50**
3.17. Giant noctule *(Nyctalus lasiopterus)*	**50**
3.18. Lesser noctule *(Nyctalus leisleri)*	**50**
3.19. Noctule *(Nyctalus noctula)*	**50**
3.20. Common pipistrelle *(Pipistrellus pipistrellus)*	**50**
3.21. Nathusius' pipistrelle *(Pipistrellus nathusii)*	**50**
3.22. Kuhl's pipstrelle *(Pipistrelus kuhlii)*	**50**
3.23. Pygmy/soprano pipistrelle *(Pipistrellus pygmaeus)*	**50**
3.24. Brown long-eared bat *(Plecotus auritus)*	**50**
3.25. Grey long-eared bat *(Plecotus austriacus)*	**50**
3.26. Particoloured bat *(Vespertilio murinus)*	**50**

CONSERVATION STATUS OF BATS ESTABLISHED IN BULGARIA ACCORDING TO THE INTERNATIONAL UNION FOR CONSERVATON OF NATURE (IUCN 2007 RED LIST) AND THE NEW EDITION OF BULGARIA'S RED DATA BOOK

Latin name	English name	IUCN 2007	Bulgaria's Red Data Book (new edition)
1. *Barbastella barbastellus*	Western barbastelle	**VU**	**vulnerable**
2. *Eptesicus nilssoni*	Northern bat	LR	data deficient
3. *Eptesicus serotinus*	Serotine	LR	least concern
4. *Hypsugo savii*	Savi's pipistrelle bat	LR	least concern
5. *Miniopterus schreibersii*	Schreiber's long-fingered bat	LC	**vulnerable**
6. *Myotis alcathoe*	Alcathoe whiskered bat	–	–
7. *Myotis aurascens*	Steppe whiskered bat	–	–
8. *Myotis bechsteinii*	Bechstein's bat	**VU**	**vulnerable**
9. *Myotis blythii*	Lesser mouse-eared bat	LR	near threatened
10. *Myotis brandti*	Brandt's bat	LR	least concern
11. *Myotis capaccinii*	Long-fingered bat	**VU**	**vulnerable**
12. *Myotis dasycneme*	Pond bat	**VU**	–
13. *Myotis daubentonii*	Daubenton's bat	LR	–
14. *Myotis emarginatus*	Geoffroy's bat	**VU**	**vulnerable**
15. *Myotis myotis*	Greater mouse-eared bat	LR	near threatened
16. *Myotis mystacinus*	Whiskered bat	LR	least concern
17. *Myotis nattereri*	Natterer's bat	LR	least concern
18. *Nyctalus lasiopterus*	Giant noctule	LR	**vulnerable**
19. *Nyctalus leisleri*	Lesser noctule	LR	**vulnerable**
20. *Nyctalus noctula*	Noctule	LR	least concern
21. *Pipistrellus kuhlii*	Kuhl's pipistrelle	LC	–
22. *Pipistrellus nathusii*	Nathusius' pipistrelle	LR	least concern
23. *Pipistrellus pipistrellus*	Common pipistrelle	LC	least concern
24. *Pipistrellus pygmaeus*	Pygmy/soprano pipistrelle	–	–
25. *Plecotus auritus*	Brown long-eared bat	LR	near threatened
26. *Plecotus austriacus*	Grey long-eared bat	LR	least concern
27. *Rhinolophus blasii*	Blasius's horseshoe bat	NT	**vulnerable**
28. *Rhinolophus euryale*	Mediterranean horseshoe bat	**VU**	**vulnerable**
29. *Rhinolophus ferrumequinum*	Greater horseshoe bat	LR	near threatened
30. *Rhinolophus hipposideros*	Lesser horseshoe bat	LC	least concern
31. *Rhinolophus mehelyi*	Mehely's horseshoe bat	**VU**	**vulnerable**
32. *Vespertilio murinus*	Particoloured bat	LR	least concern
33. *Tadarida teniotis*	European free-tailed bat	LR	data deficient

NATIONAL BIODIVERSITY MONITORING SYSTEM

THE NATIONAL BIODIVERSITY MONITORING SYSTEM (NBMS) is a complex mechanism for monitoring and reporting on changes in the biological diversity of Bulgaria in the long run. This is achieved through a system for assessment and analysis of the impacts on biodiversity, its state and the measures that need to be undertaken to prevent its loss. The NBMS is the basic instrument for assisting decision-makers in protecting and conserving Bulgaria's biodiversity at a national level, and to provide information to as many other users as possible. The monitoring focuses on species of different biological groups and selected types of habitats. The information is gathered regionally and summarized nationally. Regional databases are kept in the RIEW and the departments of national parks.

HIGH MONITORING PRIORITY	
Schreiber's long-fingered bat	*Miniopterus schreibersii*
Bechstein's bat	*Myotis bechsteinii*
Lesser mouse-eared bat	*Myotis blythii*
Long-fingered bat	*Myotis capaccinii*
Geoffroy's bat	*Myotis emarginatus*
Greater mouse-eared bat	*Myotis myotis*
Blasius' s horseshoe bat	*Rhinolophus blasii*
Mediterranean horseshoe bat	*Rhinolophus euryale*
Greater horseshoe bat	*Rhinolophus ferrumequinum*
MEDIUM MONITORING PRIORITY	
Lesser horseshoe bat	*Rhinolophus hipposideros*
Mehely's horseshoe bat	*Rhinolophus mehelyi*
Noctule	*Nyctalus noctula*
Serotine	*Eptesicus serotinus*

All the listed bat species are monitored by expert teams, who visit underground habitats such as caves, disused mine galleries and bunkers, which are known to have been inhabited in recent years by hibernating or breeding bat colonies. The list of monitoring sites corresponds with the caves and galleries included in the document «Important Bat Underground Habitats in Bulgaria» (IVANOVA, 2005). The document was drafted in compliance with Resolution 4.3 MoP4 («Guidelines for the protection and management of important underground bat habitats») and represents is the official Bulgarian position (through MEW) for the EUROBATS Convention. This national report evaluates all the important underground habitats (92 in total) in terms of the number of species and the seasonal character of the habitat, their number, protection status and level of importance (regional, national or European/world). **Fifty two** caves and galleries are considered to be highly important on a national and European level.

EXPERT SECTION

BATS IN BULGARIA –
GENERAL INFORMATION

METHODS FOR BAT RESEARCH

PROJECTS AND PLANS SUBJECT TO EIA
OR TO COORDINATION WITH
RIEW/MEW AND
WHICH AFFECT BATS

Bechstein's bat

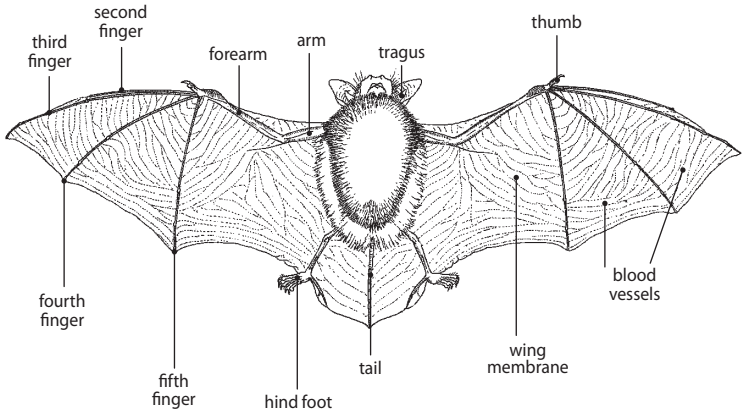
Greater mouse-eared bat

Lesser noctule

Western barbastelle

THE FEATURES OF BATS

The earliest bat fossils have been found in deposits dating back 55 million years. The direct ancestors of bats were ancient insect-eating mammals who possibly had gliding or even flying abilities. While the shape of the body and limbs of all other animals has gradually and constantly evolved, the most interesting thing with bats is that the appearance of modern species is almost the same as the appearance of their fossil forms.



The body structure and anatomy of bats is very similar to that of other mammals. The main differences are in the length and proportions of the forelimbs and the presence of a wing membrane. Though the eyes are not the main organ of orientation and foraging, all species have eyes of different sizes and can see surprisingly well in the dark.

The first finger (thumb) ends with a small nail, which helps the bat to move on the ground. The wingspan of Bulgarian species reaches up to 46 cm and their weight varies between 5 and 55 g. The Giant noctule *(Nyctalus lasiopterus)*, is the largest Bulgarian species and the smallest one is the Pigmy/soprano pipistrelle *(Pipistrellus pygmaeus).*

Some species have elongated wings (e.g. *Miniopterus schreibersii, Nyctalus noctula*), which make them faster and agile flyers capable of covering great distances without great effort. Other species have broad and short wings, which give a slower, fluttering, flight.

The ears of all bats (except for the horseshoe bats) have a fleshy projection called *tragus*, the function of which is not fully understood. The body is covered with thick and soft fur which protects the body from the cold during times of rest and when flying through cold air.

ROOSTS

Depending on the season, bats inhabit different types of roost.

During the winter all bat species inhabit roosts with a permanent temperature of between 2º to 10ºC. Such conditions are most often found in water caves and flooded mine galleries and, occasionally, in the attics and basements of residential buildings.

During the spring and the autumn bats can be found in different roosts with a variable or constant temperature, including abandoned or inhabited residential or industrial buildings, underground bunkers, galleries, discharge and ventilation shafts, pipes, chimneys, hollow posts, small and large caves, abysses, rock crevices, etc.

During the summer bats prefer dwellings with a higher temperature and this is where they breed. Species which form larger colonies congregate in caves with larger entrances so that in the evening hundreds, or even thousands, of bats can fly in or out simultaneously.

Bats can be generally grouped into four main categories, according to their environment preferences:

- **Cave-dwellers** – breed and hibernate exclusively in caves or other underground shelters. They are found mainly in karstic, volcanic or sea caves. The size of colonies can reach between 100 and 10,000 individuals in the summer and between 50 and 100,000 individuals in the winter.

- **Forest-dwellers** – breed mainly in hollows, crevices and under the bark of trees; some of these species spend the winter in caves. They can be found in broad-leaved deciduous, mixed and more rarely coniferous forests which offer roosts and a supply of food. The number of individuals roosting in the hollows is usually around 10 to 50, rarely more, with colonies well distributed throughout a large woodland area.

- **Wetlands** – due to their high biological potential and rich biodiversity wetlands provide one of the most important foraging habitats for nearly all bat species. They are particularly important during the summer months when thousands of bats hunt above the water surface and become an important part of the regional food chains. Most species that depend on water areas live in close proximity to, or within, such areas: in tree hollows, residential or industrial buildings, caves and other nearby roosts.

- **Synantropic** – live almost in man-made shelters such as attics, basements, shafts, chimneys, ventilation facilities, etc, throughout their entire life cycle. They can be found everywhere – in villages, towns, resorts and other urbanized areas. The colonies of some species vary from 5 to 20 individuals and of others from 50 to 1000 individuals.

Derivation tunnels and channels

Military bunkers

Abandoned buildings, basements, attics

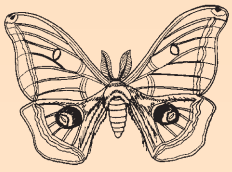
Settlements Photo St. Beshkov

Caves, rock niches and crevices

Newly born Greater horseshoe bat

Female Greater horseshoe bat
with a two-week old baby

Long-fingered bats in hibernation



Major insect groups
that form the bat menu

LIFE CYCLE

The life span of bats is uniquely high for mammals of such a small size and can reach up to 20–30 years.

Bats in temperate latitudes hibernate between December and the end of March. In early spring some species migrate to their summer roosts and prepare for reproduction. Sedentary species leave their winter hibernacula and spread across in the region they inhabit. During spring all bats feed very actively to restore the fat reserves lost during the winter and regain body mass.

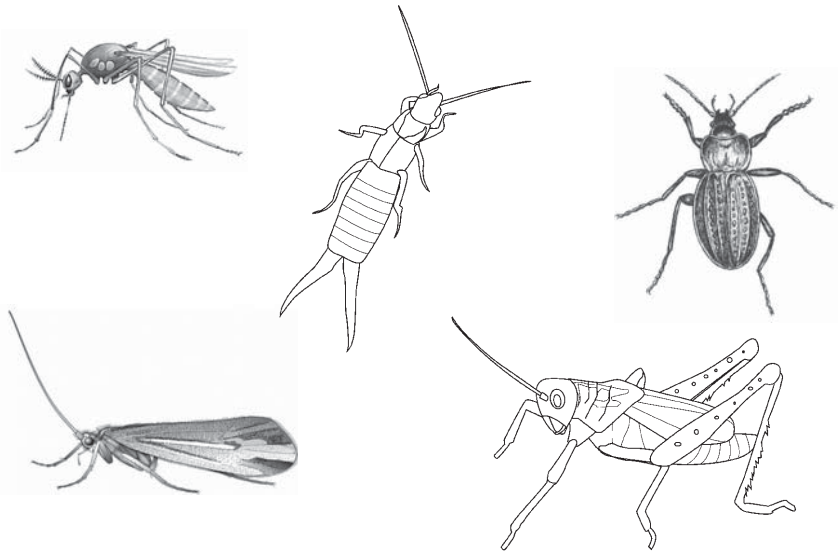
Depending on the geographical latitude and the climate, babies are generally born after May 20th, and more often in early June. In the first few weeks the juveniles are completely helpless and entirely dependent on their mothers. Within 30–40 days they have learnt how to fly on their own but continue to live in the breeding colonies, which consist of females and young males.

In late summer and early autumn bats again start to feed actively so as to gain sufficient fat reserves for the winter. The swarming period, which starts in mid August and lasts until mid October is when the majority of bats mate. However fertilisation does not occur before the late winter (or early spring) due to delayed ovulation. At different times over the autumn, all the migratory species leave their summer roosts and fly to their winter hibernacula. On the way, they may stop for several nights in transitional roosts.

With lower night temperatures during the late autumn, the number of insects decreases and bats become less active. As winter approaches they go into torpor more often and for longer periods.

FOOD AND FORAGING

Bats can forage practically everywhere that flying or crawling night insects can be found. Most often they are found around lakes, swamps and other wetlands, where the number of insects is usually the largest. In settlements they hunt around lamp posts in parks, along roads and above parks and water channels. In forests they hunt around small water bodies, near rivers, forest meadows, openings and the edges of open spaces. To reach their hunting habitats bats usually fly through other territories following the linear elements of the landscape – rivers, alleys, clearings, etc.



A guano hill in the Lyastovitsata cave, Glozhene village, Teteven region

Guano from a Greater mouse-eared bat

Bats can eat up to 1/3 of their own weight per night. The larger bats in Bulgaria have an average weight of 20–30 g, which means that a colony of 300 individuals can eat some **550 kg** of insects in one summer. In one night this means approximately 20,000 mosquitoes, beetles, butterflies and other insects, many of which are considered pests. This illustrates the great importance of bats in the ecosystems that they inhabit. As predators they occupy the upper levels of the food chain and this makes them particularly sensitive to the use of agro-chemicals.

ECHOLOCATION

All bats have eyes but in view of their nocturnal activity they use them less than their other sensory organs. Insectivorous bats orient themselves and do most of their foraging by using echolocation. The ultrasonic calls of bats can either be constant or modulated (ultra short waves) sounds, with a frequency above 18,000 Hz, which makes them inaudible to the human ear. They are generated by bats, emitted into the open air, are reflected by the surrounding objects or by the prey and are then picked up again by the bats through their highly sensitive ears.

- **The ultrasound calls** are generated by the larynx, which is much more developed than in all other mammals.

- **The hearing sensitivity** is very acute and bats can catch echoes reflected by objects smaller than 0.5 mm!

- **The bat brain** processes information on flying victims and obstacles in the span of milliseconds.

- **Horseshoe bats** (Rhinolophidae) emit constant frequency (CF) calls.

- **Vespertilionid (common) bats** (Vespertilionidae) specialize in finding directions and food with the help of frequency modulated sounds (FM) within a broad spectrum.

MAIN FOOD STRATEGIES

To avoid competing with each other bats use the space in night sky differently.

- **Hawking in open spaces** – *these bats fly high above the vegetation, emitting low frequency FM signals.*

- **Foraging in and around sparse vegetation** – *these bats fly in thinly vegetated woods, emitting high frequency FM signals.*

- **Hunters in vegetation** – *these bats fly in or around tree crowns, have an agile flight pattern and intercept their victims from a close distance.*

- **Perch-hunting** – *these bats feed by hanging from a tree branch or a wall, intercepting passing prey.*

- **Gleaning and hovering** – *these bats usually hover over the prey, which is most often detected crawling on the ground or on tree leaves, most often by hearing the sounds generated by the prey.*

THE IMPACT OF HUMAN ACTIVITIES ON BAT POPULATIONS

ACTIVITY	EFFECT	CONSEQUENCE
• Destroying caves and galleries • Closing caves with impenetrable gates or walls • Development projects and water catchments • Mass visits	Deterioration in the quality of **underground habitats**	• Large colonies disappear • The microclimate changes and the roosts become unsuitable for breeding or/and hibernation • Individual bats die during construction works • Continuous disturbance, which drives whole colonies away
• Drainage and drying out of swamps and lakes • Alterations to of river flows • Domestic and industrial pollution	Deterioration in the quality of **wetlands**	• The quality and quantity of food diminish • Disappearance of key species of insects • Bio-accumulation of toxic elements
• Cutting down old forests and trees with hollows • Clear cutting forests • Replacing broadleaved forests by coniferous ones • Use of insecticides	Deterioration in the quality of **forest habitats**	• The number of appropriate roosts decreases • Increased competition with other hole-nesting birds and mammals • Direct death of bat individuals and colonies during logging • Shortage of food supplies • Bio-accumulation of toxic elements
• Wind turbines installed along migration corridors	Difficult to predict and manage	• Decrease in the number of local bat populations • Increase of the fatality rate among bats during migration
• Road infrastructure without adequate crossing structures and mitigation facilities	Lasting changes in the landscape and its functions for bats	• Permanent high fatality rate • Barrier effect and isolation of populations • Fragmentation of habitats
• Construction works and building maintenance • Filling in joints and crevices	Loss of **bat roosts**	• Thousands of bats can be killed on construction sites • Destruction of bat roosts without compensation activities
• Use of non-selective poisonous chemicals for remedial timber treatment and roof renovation	Attics and roofs become harmful for bats	• Many individuals get poisoned • Bio-accumulation of toxic substances

METHODS FOR BAT RESEARCH

Modern technologies and access to internet resources make it considerably easier to prepare and conduct scientific studies and prepare expert positions and reports. Each assessment of the presence or status of bat populations should be carried out using ***at least one*** *of the methods listed below or a combination of them, depending on the assignment.*

1. **Analysis of existing information – bibliographic references**
2. **Field visits and bat census**
3. **Mist-nets and traps for bats**
4. **Ultrasound detection**
5. **Radiotelemetry**
6. **Genetic and molecular methods**

• The expert member of the EA or EIA team decides upon which method(s) should be used in each particular assignment and bears responsibility for this decision. The assignment must state the minimum range of methods to be performed within each research task.

• When choosing the appropriate technique for the study the guiding principle must be to seek **the minimum impact** on bats.

• With almost all types of assessment it is desirable for the experts to combine different methods of study, so as to obtain reliable and proper results.

• All methods, which involve **direct contact** with bats, require a permit under **Regulation № 8** (SG 4/16.01.2004) of the MEW (see above).

Appropriateness of survey methods

ACTIVITIES	METHODS							
	Inspection of caves, galleries and bunkers	Inspection of buildings	Inspection of roads	Owl pellets	Nets	Detectors	Radio tracking	Molecular methods
Management of caves, mine galleries and bunkers								
Road construction								
Construction of hydro-power plants								
Forest management								
Installation of wind turbines								
Wetland management								
Reconstruction of buildings								

Climbing gear must be used to reach tree hollows to set funnel traps in higher trees

Movements of bats from one roost to another can only be proved by ringing with special split rings. The techniques and methods for bat ringing are not covered in this manual

Almost all publications on bats in Bulgaria are accessible in institutional and academic libraries

ANALYSIS OF EXISTING INFORMATION – BIBLIOGRAPHIC REFERENCES

Bat studies in Bulgaria started more than 100 years ago. They became particularly intensive after 1989, when most of the modern research methods came into practice. A large amount of information has been accumulated, only part of which has been scientifically published. The different species and regions of the country are not evenly studied. The best studied species/areas are the cave-dwelling bat species of the Western Stara Planina mountain, the Predbalkan region and the Eastern Rhodopes mountain. The species composition of bats in the national parks (Central Balkan, Rila and Pirin) has only been studied in broad regional terms, and this is also true for some natural parks (e.g. Strandzha, Vrachanski Balkan) and some geographical regions (e.g. the Strouma valley). Due to research difficulties forest bats are one of the least studied ecological groups in Bulgaria. Information on synantropic species is rarely collected systematically and there is only data from some of the larger Bulgarian towns (e.g. Sofia, Plovdiv, Stara Zagora).

Advantages. The method requires almost no investment. The experts engaged with the assessment must become acquainted with, and analyze, the main sources of published information. The expert is responsible for assessing the accuracy of the available information and deciding whether it is necessary to carry out a field study.

Limitations. Lack of information on the site/region, subject to the EIA and of up-to-date information **(up to 5 years before the date of the assessment)** are reasons enough to plan and conduct a mandatory field study using some of the other research methods described below.

Notes

- At present Bulgaria does not have a publicly accessible database on the regional distribution of bats or the specific underground sites that they inhabit.
- The collection of information from the monitoring studies carried out by the NBMS is in its early stages; the information is administered by the EEA and will be kept by the local offices of RIEW.
- Major sources of information on distribution of bats in Bulgaria are summarized in the chapter «Selected References».

Counting bats from a close distance gives the most exact estimation of their number

FIELD VISITS AND BAT CENSUS

The expert should visit the study site (e.g. cave, gallery, karst region, residential, industrial buildings, etc.) and carefully look for bats and possible bat roosts within that particular habitat. The species present at the site can be determined by observation from a distance or by catching a few individuals, taking measurements and releasing them. For a precise assessment of numbers and species it is necessary to visit as many places as necessary within the study region that might provide potential bat roosts. Potential roosts should be carefully examined for the presence of bat guano or owls' pellets. The latter frequently contain bones from bats, and these can be indicative of the species that inhabit the region.

Sections of the roads that cross the region must be also examined since bats are often killed by night traffic and their remains stay on the road for up to several hours after an accident.

Advantages. This is the easiest and a relatively low-cost method for *in situ* assessment of species composition, abundance and the function of the various bat habitats.

Limitations. A single visit to some roosts before or after the breeding or hibernation season may show no signs of bats living there at all. For this reason it is necessary that the visits are carried out during periods when the bats are likely to inhabit the studied site. Such periods are from May 15th to August 1st and from December 1st to March 30th. Information on the number of individuals in the winter and summer colonies can

vary due to experts' level of experience in counting bats in large numbers. Digital photographs can be a very good way of documenting the size of larger colonies, for archiving and substantiating the original estimates.

Recommendations

- Bats can be counted one by one when they emerge from their roost or when they are hanging on the walls in torpor. Larger clusters of hanging bats can be photographed with a digital camera and then counted on a computer screen.
- During field checks it is necessary to have a proper head lamp so that all suitable crevices, holes and other dark places can be examined.
- Hollows of trees and deeper rock crevices can be examined with the use of a dental mirror.
- Large galleries and caves must be examined using high power lamps.

MIST-NETS AND TRAPS FOR BATS

Mist-nets are made of a very thin polyester fibre. Some nets designed for catching small birds can also be used for catching bats. The nets should be set at the entrance of caves, galleries, bunkers, above rivers and streams, in forest clearings or above pathways.

The harp trap consists of one or two rectangular aluminium frames each coiled with a monofilament fishing line and with a canvas bag beneath the frames. The bats are stopped by the fishing lines and fall into the bag. This trap is used to catch bats emerging from small entrances where mist-nets can not be properly set.

The funnel trap consists of a cone shaped plastic tube, rings connected with a monofilament fishing line and a guiding polyethylene tunnel with a cloth bag at the end. The trap is usually set at tree holes/small crevices. Bats are deflected by the fishing line onto the rings, fall into the tube, through the tunnel and into the bag.

Telescopic fishing poles without drivers are the best for setting mist-nets

Advantages. These are the most reliable methods for catching bats when there is no direct access to them and cannot observe their colonies in order to count their number and species composition.

Limitations. The setting and positioning of nets and bat traps at the right places requires previous experience to obtain the optimum results. Whenever a large colony is involved it is necessary to have assistants who can quickly release the caught specimens and minimise any stress to them.

The hardest part in setting up a funnel trap is to reach the hollow, which can be 25 m above the ground

The nets are set by the river during high waters

Recommendations

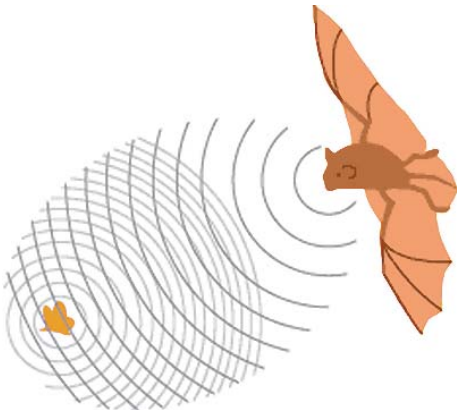
• Depending on the place and the number of field assistants one or several nets should be set before sundown. In forests more than one net must be set in order to increase the capture success.

• During catching the experts must stay close to the net/trap and the captured bats must be promptly identified, examined and released. Bats can be kept in soft, cloth bags for a short period until they have been carefully examined.

All modern detectors are small, light, and easy to tune devices, which consume little energy

ULTRASOUND DETECTION

This is one of the most specialized methods that registers and identifies bats by the sounds they emit. The method requires an ultrasound detector (usually an expensive, hi-tech device), good acoustic sensitivity, special training and prior practice. It is a good way of detecting the activity of those species that emit strong and direct calls. The ultrasounds are recorded on a digital carrier and are usually analyzed in the laboratory using special software.



Advantages. Use of bat detectors is a good technique for monitoring bats in open territories such as wetlands, the forest and steppe areas of Dobrogea or in the alpine habitats of the high mountains. This is the most reliable method for monitoring bats, which can be repeated following the same tracks.

Limitations. Due to the high regional diversity in bat species in Bulgaria, the use of detectors by themselves is inadequate, as not all species can be identified by a sonogram analysis. The use of detectors by themselves will not provide a complete or exact list of species and so this approach needs to be used in combination with other research methods.

Recommendations

• Even a simple detector with limited detecting functions can register whether bats are flying over the region being assessed.

• Detectors can therefore be used to indicate whether there is value in mist-netting at certain places, and identifying sites with the greatest activity of bats.

• An expert who has carried out an initial field bat detector survey must decide if a more experienced specialist is needed to identify the exact species flying in the region.

• Detectors are expensive devices but they can help in identifying the exact places with greatest abundance of bats and thus save a lot of search effort, particularly when vast open areas need to be surveyed.

RADIOTELEMETRY

Radiotelemetry (or radio-tracking) is a method for studying the movements and behaviour of animals, including bats. The following devices are needed to carry out a telemetric study:

- **Transmitter** – this emits constant signals within the 149.XXX or 151.XXX MHz range. In ideal conditions, a tagged bat can be detected from a distance of 5–7 km and from ca. 2 km in hilly regions.
- **Receiver** – digital or analogue. The new models are highly sensitive, lighter and easier to use.
- **Directional antenna** – longer antennae ensure a better signal.

The method enables a researcher to know at any time where the bat is. The transmitter's weight is up to max. 10% of the bat's weight, usually some 0.50–0.70 g. Normally the bat is radio-tracked for 4–7 days and over this period it becomes clear where exactly its foraging ranges, resting sites and migration corridors are. The information accumulated during the radio tracking surveys is the best source of behavioural data, which can provide a basic foundation for the management and protection of bats in a given habitat type. The method is widely used when the habitat is too complex to establish how bats use the different territories and can help clarify the most appropriate measures for their management. Telemetry is of undoubted value in helping to depict and analyse the exact home ranges of bats, which is particularly useful when new protected territories are declared.

Advantages. It is the only method for collecting rich information on the exact roosts of bats, their activities, foraging biology, hunting territories and individual behaviour in a short period.

Limitations. Transmitters cost some €100 each and it is necessary to order them several months in advance. A new model receiver and antenna can be found for less than €500. The tracking team needs at least two researchers. A GPS receiver can also be used to allow accurate mapping of the home range.

Recommendations

- Ideally the researcher will have a digital interactive map (e.g. from Google Earth) on which the data from the GPS point tracking can be plotted for better visualisation.
- Telemetry is one of the few methods which can show exactly where a bat or a colony live (useful in regions with no caves), what flight paths they use for their local movements, the size and the type of foraging territories (e.g. it becomes whether the bats hunt in an old forest, above shrubs, in wetlands or above farming areas) and how much time they spend hunting and resting.
- Radiotagging should only be used for well-organised and authorised projects where essential data cannot be acquired with less intrusive methods.

Bechstein's bat with a transmitter LB-2 (0.52 g). The transmitter is attached to the fur of the bat's back with a natural rubber adhesive and the battery lasts for 21 days

Photo N. Treyman

A tissue sample is taken using a special sterile punch of 3 mm diameter. The resulting hole heals within a month without impairment to flight or reproductive success

GENETIC AND MOLECULAR METHODS

Some of the bat species found in Bulgaria and Europe are hard, and sometimes even impossible, to identify precisely under field conditions. The only way for exact determination of the cryptic species requires a genetic and molecular analysis of a small piece of tissue (most often taken from the wing membrane) collected from the animal.

Advantages. This method is appropriate when the assessment needs to be absolutely accurate in terms of species identification of bats which inhabit certain roost or a habitat.

Limitations. The method is very expensive way to identify individuals or species, especially when a larger number of samples have to be processed.

Recommendations

- Before taking a tissue sample it must be clear who will analyze it.
- There are no laboratories in Bulgaria which can analyze tissue samples taken from cryptic species of bats.

Note

In the majority of the cases, this method is only an option when preparing the report for the environmental impact assessment, appropriate assessment or a review of the above.

HEALTH AND SAFETY RISKS

HEALTH PRECAUTIONS

Like all other wild animals bats can transmit diseases that affect people. Although medical statistics in Bulgaria have never registered any such case, it is important to know that bats are potential transmitters of the **rabies virus.** The infection can take place only following a bat bite, although in exceptionally rare cases one can be infected through the saliva of an infected animal, if the saliva contacts the bare mucous membrane of a human eye or a wound. If either event occurs, antirabies treatment should be sought as soon as possible in a medical facility.

OTHER THREATS

Bats inhabit a variety of places which pose access hazards for humans. Entering caves, abysses, disused mine tunnels, unfinished construction sites, climbing up towers, chimney-stacks, shafts, buildings and other man-made structures and land forms are potentially dangerous activities and must be undertaken only by qualified experts with relevant professional experience.

All measures for personal safety and proper equipment must be taken and used when the study requires access to relatively inaccessible bat roosts! Don't take risks unless you are experienced and sufficiently fit!

PROJECTS AND PLANS SUBJECT TO EIA OR TO COORDINATION WITH RIEW/MEW AND WHICH AFFECT BATS

Striking a balance between the need for infrastructure and social development is compatible with bats dwelling within the same habitat.

The first step in striking this balance is to establish how bats use the resources of a given region (i.e. where they roost, fly or forage) in order to trace the possible conflict points. After analysis of the requirements of the infrastructural development, it is always possible to plan measures to avoid or mitigate the negative impact on the bat populations.

MANAGEMENT OF UNDERGROUND HABITATS

Practically all types of underground sites with comparatively stable microclimate and temperature above 0°C are potential bat habitats. These are:

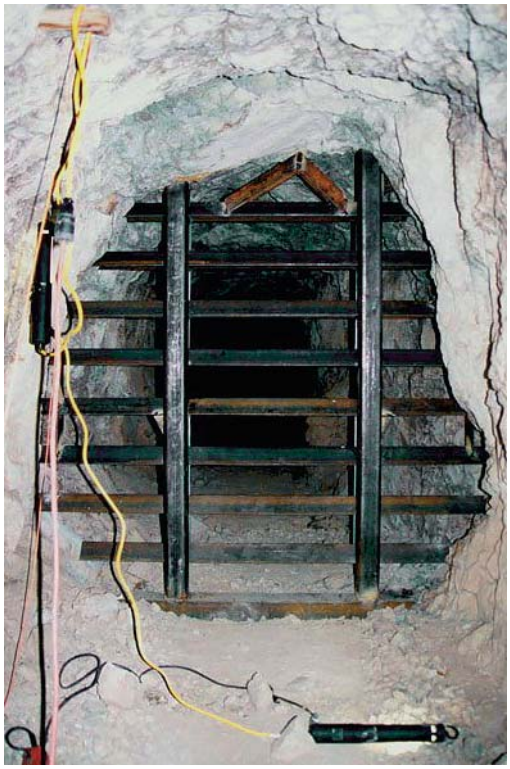
- *Caves and abysses*
- *Abandoned mine and research galleries*
- *Military bunkers*
- *Shelters and catacombs*
- *Underground tunnels used for water derivation and discharge*
- *Ventilation shafts, wells, etc.*

In almost all cases the use of these by people requires changes in the access, complete or partial enclosure of the entrance, construction of electricity or water transmission routes, excavating and levelling the floor, filling in crevices or holes and many other activities. All these activities inevitably change the interior and the climate of the caves, which immediately, or during the operation, disturbs bats and can lead to a decrease in their numbers or to them abandoning the site completely. This completely contradicts the commitments to conserve protected animal species and is utterly unacceptable, especially when these activities threaten Bulgaria's most important underground bat habitats.

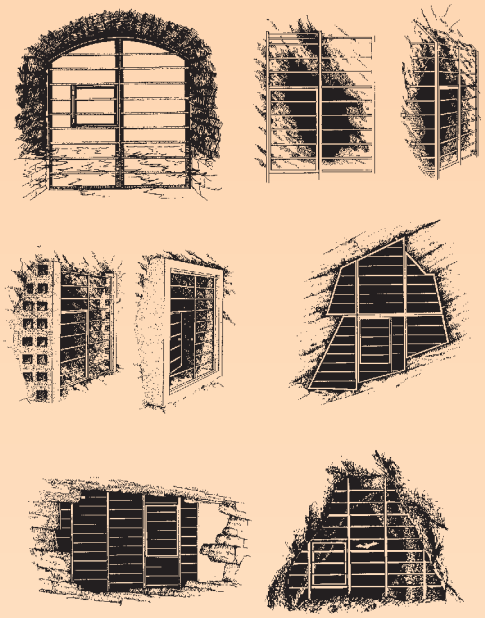
It is absolutely unacceptable to use impenetrable material (bricks, stones or construction panels) to close an underground roost. This will completely change the underground microclimate, which will inevitably lead to the complete extinction of the entire cave's fauna!

INSTALLATION OF GATES AND GRILLS AT ENTRANCES

When it is established that an underground site intended for business development is seasonally or permanently inhabited by bats it is necessary to consult a bat expert. Depending on the specific conditions, the species present and functions of the roost, the expert can determine the optimal design, technical specifications and materials for the fencing and/or gating. Generally, the distance between the bars must allow for bats to freely fly between them (a minimum of **35 cm** between the horizontal bars and **20 cm** between the vertical bars). If the cave is inhabited by more than 50 bats the distance between the bars must be increased by at least **5 cm,** to facilitate the simultaneous passage of a larger number of bats.



Restricting access to authorized visitors is made possible by installing a lockable sliding bar in the middle of this gate
http://www.frontier-environmental.com



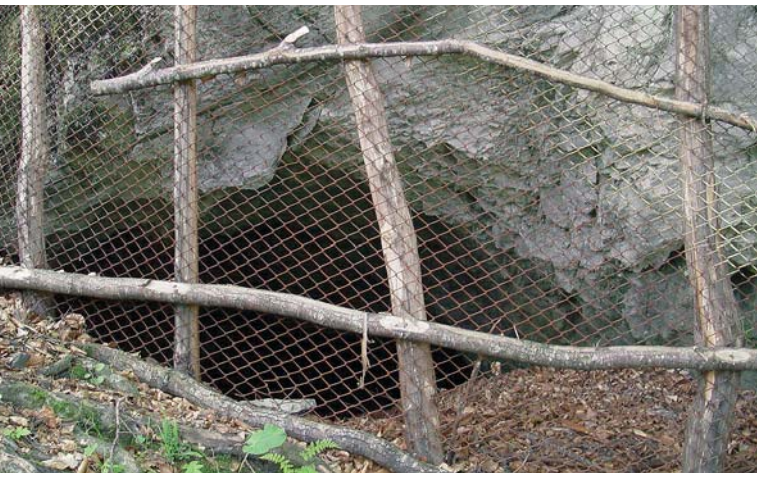
The design of grills depends on the size and shape of the entrance. After measuring its dimensions and proportions, the grills should be constructed in a workshop. In general, installing the gate will require a generator, powerful drill and a cutter, fixing anchors, bolts, cement or resin glue and all relevant construction accessories and consumables

Rectangular or triangular grills made of solid metal should be used to close pits and mine shafts

BAD SOLUTIONS

«Bad» gates can significantly alter air flow or act as a physical barrier to bats or other species using the cave or mine. They can also be so poorly constructed that they are easily vandalized and bypassed.

This gate restricts the number of bats that can fly through it at any time



No bats could fly through this gate

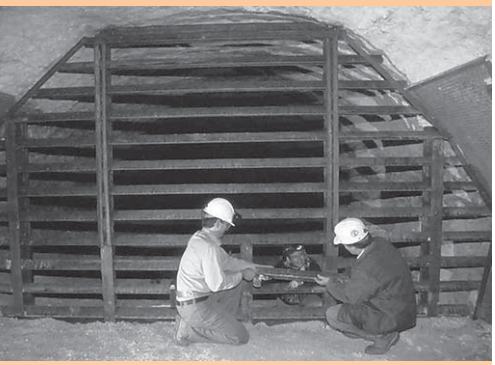
Bad gate: small square holes which hinder the free flight of bats

GOOD SOLUTIONS

A «good» gate is effective in controlling human access and is vandal resistant while maintaining unrestricted airflow and bat movement.

http://www.frontier-environmental.com

http://www.frontier-environmental.com



Recommended design of the entrance gate in a disused mine inhabited by a bat colony (Illinois, USA)

ABANDONED MINE GALLERIES

Most abandoned mine, geological and research galleries make excellent roosts for bats. The galleries may be fully dry, have flooded entrances or be full of water and the elements of the environment (temperature, humidity, airflow, etc.) are in most cases completely identical with those of natural caves. Most often bats use mine galleries for hibernation. According to studies only 5% of abandoned galleries **are not inhabited** by bats.

Impact – plans for closing most galleries generally envisage sealing the entrances by demolition or cementing. In some cases the entrances will be flooded and embanked to restrict the access of children.

Methods of study – The expert must visit the gallery several times and mostly during the winter. Placing mist-nets at the entrance from the end of August to the beginning of October will provide the best results in terms of the general species composition in the region of the gallery. Some galleries are mostly inhabited by migrating bats (April – May, September – October) and the netting time might need to be adjusted accordingly.

Avoidance and mitigation measures

- If the field surveys show that the gallery (or complex of galleries) meets the criteria of being an important underground bat roost, demolition or full closure of its entrance must be strictly forbidden.
- The design of the entrance gate (see above) must allow sufficient «permeability», consistent with the maximum number of bats observed during the assessment. Most of the gate/fencing should have horizontal bars instead of vertical ones to avoid bats colliding with the bars during swarming. If *Miniopterus schreibersii* is present in large numbers, gating can lead to abandonment of the site.

ATTENTION:
many mine galleries are dangerous to enter and work in because of erosion and collapses which might have taken place after their abandonment and the decay of the pillars supporting the floor and the ceiling!

The entrance of the abandoned mine gallery below Izdremets peak above Lakatnik village is threatened by a landslide due to natural erosion of the slope. There are 15 bat species established in this gallery. (NATURA 2000 site: Iskar River Gorge -Rzhana - BG0001042)

UNDERGROUND WATER CATCHMENTS

Methods of study – the cave must be visited by the expert and surveyed for bats. Almost all water caves in Bulgaria are inhabited by bat colonies and require a visit during the winter season, which is the most likely season for their occurrence. Mist-netting gives good and reliable results about species composition, particularly in the autumn.

Species list – the list must contain data on the relative number of established species and the periods when which different bat species depend on this roost. The expert is responsible for studying which species hibernate, which breed, which use the cave as a stopover roost on their migration route, etc. Colonies of more than 100 individuals are considered important colonies (particularly those of the cave-dwelling species *Myotis capaccinii, M. blythii, M. myotis* and *Miniopterus schreibersii*).

Avoidance and mitigation measures

- In underground water catchments the water source and any built facilities need to be protected by a sanitary and security zone.
- All construction activities **must be** conducted outside the breeding and hibernating periods – from March 30th to May 15th and from August 1st to October 30th.
- The building of the collection reservoir/basin must be in accordance with the location of the colony (if any is located above the subterranean river) and must be properly protected against guano pollution.
- The design of the front gate (see above) must allow access for the **maximum possible** number of bats known to live in the cave.
- There must be a lockable door to allow controlled access for maintenance and bat monitoring.
- It is not permitted to close the entrance of water caves with a solid wall (e.g. bricks, concrete) without openings!

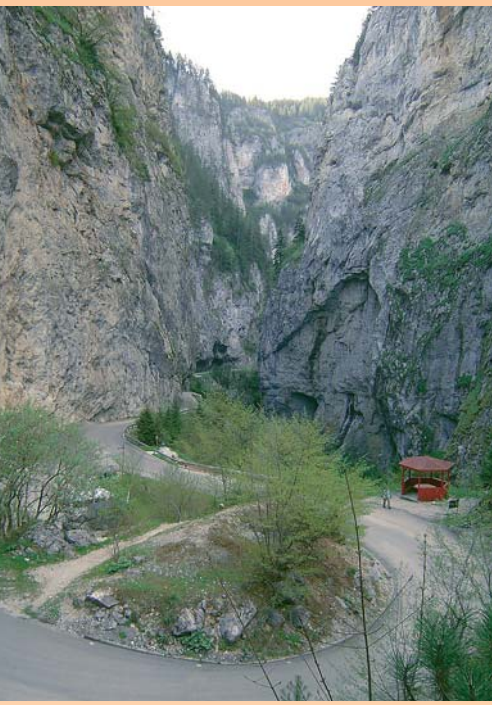
Catchment facility at the entrance of Gargina Doupka cave, Mostovo village, Western Rhodopes Mt.

The catchment facility at the entrance of Vodni Pech cave, Dolni Lom village, Western Stara Planina Mt., allows free access to bats but hinders casual visitors from entering

Construction of the catchment facility at the entrance of Gargina Doupka cave, Mostovo village, Western Rhodopes Mt.

Gargina Doupka cave was declared a natural landmark by Order №.1005/04.08.2003 of the MEW. The reason for its being designated a protected territory is that «the cave is an important underground habitat of protected and rare species of bats and of rich invertebrate fauna». The cave is a key site for bats within the National Biodiversity Monitoring System and falls within the Mid Rhodopes protected zone – (BG0001031 of the NATURA 2000 ecological network).

In 2005 an investment proposal was received by the MEW to provide an additional water supply for the Krastova Gora monastery complex above Mostovo village, Assenovgrad municipality and Borovo village, Lacky municipality. The proposal sought to build a water catchment from the underground river at the entrance of the Gargina Doupka cave. Consultations were carried with experts on bats and cave fauna from the NMNH-BAS, specialists from Plovdiv RIEW and from the National Nature Protection Service at MEW. They set the ecological terms and conditions for going ahead with this proposal. Between May and October 2006 the investor constructed the collection facility and the respective infrastructure according to these recommendations and the sanitary and security requirements of the Waters Act. In the spring of 2007 a team from NMNH performed a field study and established that the investor had observed the limitations imposed by the cave's status as a protected territory and the recommendations stipulated in the terms and conditions. The cave entrance was partially closed with a high metal gate, which allowed free access for bats, even of large colonies. The construction activities had had minimal impact on the entrance area and the collection reservoirs catch not more than 70% of the natural run-off of the underground river. Visitor access is controlled by the Mayor of Mostovo village.



There are 20 studied caves within Trigrad gorge protected area

Cover page of the «Trigrad gorge» protected area management plan

SHOW CAVES

Development of management plans for existing show caves and protected areas with caves

There are **10** show caves in Bulgaria, 9 of which are currently open for tourists. These are: **Magurata** (Rabisha village), **Ledenika** (the town of Vratza), **Bacho Kiro** (Dryanovo town), **Saeva Doupka** (Brestnitsa village), **Orlova Chuka** (Pepelina village), **Dyavolskoto Garlo** (Trigrad village), **Yagodinskata cave** (Yagodina village), **Uhlovitsa** (Mogilitsa village) and **Snezhanka** (Peshtera town).

The most important of these for bats are **Orlova Chuka, Dyavolskoto Garlo** and **Magurata.** These three caves contain large colonies of wintering horseshoe bats (Orlova Chuka and Magurata) and of Schreiber's long-fingered bats (Dyavolskoto Garlo) sometimes reaching 100,000 individuals! By imposing strict management regimes it is possible for such large colonies to winter in caves that are open for visitors. Limited tourist visits during the hibernation period and the efforts of caves' guides have contributed towards minimising the impact on the bat populations.

The management plan of the Trigrad Gorge protected area imposes a special regime of winter tourist visits at Dyavolskoto Garlo cave. Between December 15th and March 15th film and video productions, organized caving events and visits by large groups are strictly forbidden. Order № 663/21.08.2007 from MEW forbids tourist access to Orlova Chuka cave from November 1st to April 1st due to the presence of a large hibernating bat colony.

Methods of study – the most comprehensive initial information on the seasonal dwelling of bats can be provided by the cave's tour guides. The expert needs to conduct several field visits during the winter and the summer (June – July). Mist-netting at the entrance areas from the end of August until the beginning of October will complement the list of the species that depend on the cave for swarming and mating.

Species list – the list of species must necessarily contain data on the relative number of all the established species and the period when they depend on this particular roost. Priority species for protection are those species which use the cave as an important roost for hibernation, breeding or as a stop-over site along their migration route.

Though a bat silhouette is hanging at the entrance of «Uhlovitsa» cave in the Western Rhodopes Mt., design of the gate does not allow enough room for bats to fly through

Avoidance and mitigation measures

- The assessment must indicate the specific underground passages and places where the different bat species hang on the walls or live in the crevices during different periods of the year. The seasonal use pattern of bats should be addressed.
- The «permeability» of the entrance door must be assessed and if necessary a new design proposed.
- If necessary, a change of lighting may be recommended, with attention paid to the direction of spotlights and arrangements made for them to be turned off during critical periods for bats.
- If the cave is an autumn swarming site, lights at the entrance should be switched off at night from 15th August till 15th October.
- A permanent or seasonal restrictive regime must be introduced for the access of visitors, film productions and speleologists into the passages that are of greatest importance for bats and cave fauna.
- The organisation of concerts, celebrations and other mass events must be completely banned during the breeding and hibernation periods of bats.

Installation of infra-red cameras with a remote control is a safe method for monitoring bat colonies, roosting in passages with restricted access. The image can be displayed on a monitor outside the cave. This can satisfy visitor curiosity and will reveal interesting facts about the breeding biology of the species and their movements under the ground during all seasons (Orlova Chuka cave, Pepelina village, Ruse district)

The entrance of Snezhanka cave above Peshtera is closed with an impenetrable metal door and concrete wall. As a result only single bats manage to fly in the cave

The entrance of Saeva Doupka cave at Brestnitsa village is closed with a gate that does not allow many bats to fly in and out

NEW CAVE DEVELOPMENT PROJECTS

Quite a number of caves in Bulgaria have been partially developed. Before 1989 activities were undertaken to allow access, clear the ground and make preparations for concrete flooring. When planning or adapting a cave development project it is necessary to carry out up-to-date research so as to correctly assess the impacts and possible negative effects and threats. Consultations with a bat expert are a necessary step during the planning and coordination of the technical design, and prior to issuing an operation permit.

During construction the following impacts are likely to occur:

- permanent disappearance of all bat species due to the constant disturbance, noise and light for a relatively long period of time. The period of construction and fitting works must fit with the biology and the seasonal occurrence of the established bat species (i.e. if bats use the cave for hibernation, construction works must be performed in the summer and vice versa).
- direct destruction of unique cave microhabitats for troglobites.

There is always moss, fungi and algae around the conventional light beams installed on the walls of show caves

During operation:

1. The lights and human presence will alter the microclimate, inevitably raising the temperature in the cave by some 2–4ºC depending on the siting and direction of the light beam. The higher temperature increases the dryness of the air. Most bat species cannot adapt to this and simply disappear.

2. Moss and fungi develop on the lit walls, these are not typical flora in a natural cave environment. Visitors also inevitably bring in microorganisms from the outside, most of which more or less manage to adapt to life underground, thus causing changes in the food chain and consequently in the composition of a largely isolated ecosystem.

3. Colonies of bat species are constantly disturbed and if there are no mitigating or compensating measures/regimes, they will disappear from the cave. The experts must indicate the underground passages and places that are important for bats to rear their young, for swarming and/or hibernation, where all activity must be absolutely forbidden.

Avoidance and mitigation measures

- Select a safe period for carrying out the construction works.
- The lighting system must be of a low-level LED (light emitting diode) or similar type and the direction and operating regime of the spotlights must not disturb the bats.
- A permanent or seasonal restrictive regime must be introduced to control the access of visitors, film productions and speleologists into the passages of the greatest importance for bats and invertebrate cave fauna.
- The design of the front gate must allow for free access of bats.

Lower entrance of Gargina Doupka cave – grills through which bats can fly

USE OF CAVES FOR BUSINESS PURPOSES

The conversion of caves into mushroom cellars, dairies and wine cellars

Cultivating mushrooms and ripening cheeses under the ground are common practices in northern Bulgaria. These are the most frequent reasons why cave entrances have been converted in the past (without an EIA). The use of caves as wine cellars is still rare in Bulgaria. The approach to assessing the conversion of caves for business purposes is the same as for the development of caves for tourist purposes.

Methods of study – the expert needs to conduct several field visits during the winter and the summer months (June–July). Mist-netting at the entrance from the end of August until the beginning of October will show which species visit the cave for swarming and mating.

Species list – the list of species must contain data on the number of all species and the period during which they roost in a cave. Priority species in terms of protection are those which use the cave as an important place for breeding, hibernation or as a stop-over roost along their migration route.

Impact – to maintain a constant temperature in caves used as mushroom cellars or dairies, the entrances are often closed with brick walls and/or solid metal door. The ground near the entrance is often covered with concrete and the cave's natural formations are destroyed. Cables and lights are installed in the walls. In most places, during working days, there is a power generator working at, or close to, the entrance. These conditions make the roosting of bat colonies problematic or impossible.

Avoidance and mitigation measures

- The expert assessment should explicitly state the size and design of the gate and the ventilation openings so that the free passage of bats will be possible.
- Construction and repair works must be performed only in the periods between April 1st and May 15th and from August 1st to October 30th. If the cave is an autumn swarming site, lights and works at the entrance at night should be forbidden from 15th August till 15th October.
- Power generators and other equipment servicing the business must not generate noise in excess of 45 Leq (dBA) and exhaust fumes should not enter, or be transported into, important bat passages.

Mushrooms are currently cultivated in Mandrata cave near Alexandrovo village

Abandoned building at the entrance of former dairy aka Golyamata Peshtera (Mandrata), Mikre village

RESTRICTIONS ON THE RECONSTRUCTION AND DEVELOPMENT OF CAVES*

When EIA experts and RIEW/MEW employees review reports and work out positions, we recommend that they consider, on a case by case basis, the following list of **prohibitions** and **restrictions** with a view to protecting the underground environment, and the bats that live in them:

- Disturbing, intoxicating, killing, catching, carrying, or restricting the freedom of movement of the animals which permanently or temporarily inhabit caves during the stages of their development;
- Destroying, damaging, collecting or shifting nests or dens of animals which permanently or temporarily inhabit caves;
- Removing sediments, taking out, shifting, damaging or destroying palaeonthological or archaeological findings;
- Using the caves to dispose of live or dead animals or parts of them;
- Use of lighting with open flames, except for acetylene, gas or gasoline lamps;
- Use of explosives during development or repair works or when expanding the natural openings of cave walls, ceilings and floors;
- Making noise which exceeds 45 Leq (dBA);
- Causing vibrations;
- Flushing and/or storing items, substances or wastes, except for those specifically allowed under the management plan;
- Construction and fitting works, except in the cases specifically indicated by the management plan;
- Activities, which destroy, damage or cause the removal of historic paintings, inscriptions, archaeological and other artefacts, which are evidence of human presence in the caves, except when rescue operations are underway and there is no other way of saving human life;
- Destroying, damaging or removing elements of the cave structure;
- Covering over, blocking or destroying cave entrances;
- Lighting fires or using flares in the cave or at its entrance which will blacken the walls;
- Destroying, damaging and/or removing items from the cave infrastructure, except during repairs and reconstruction as envisaged by the development plan;
- Taking out elements of the cave structure;
- Making inscriptions or signs on the walls, ceiling or floor (visible or not) except for mapping purposes.

Note*: texts from a draft LAW ON CAVES (adopted from http://www.speleo-bg.com/)

Cave developments must not compromise the design requirements of the entrance areas

ROAD CONSTRUCTION

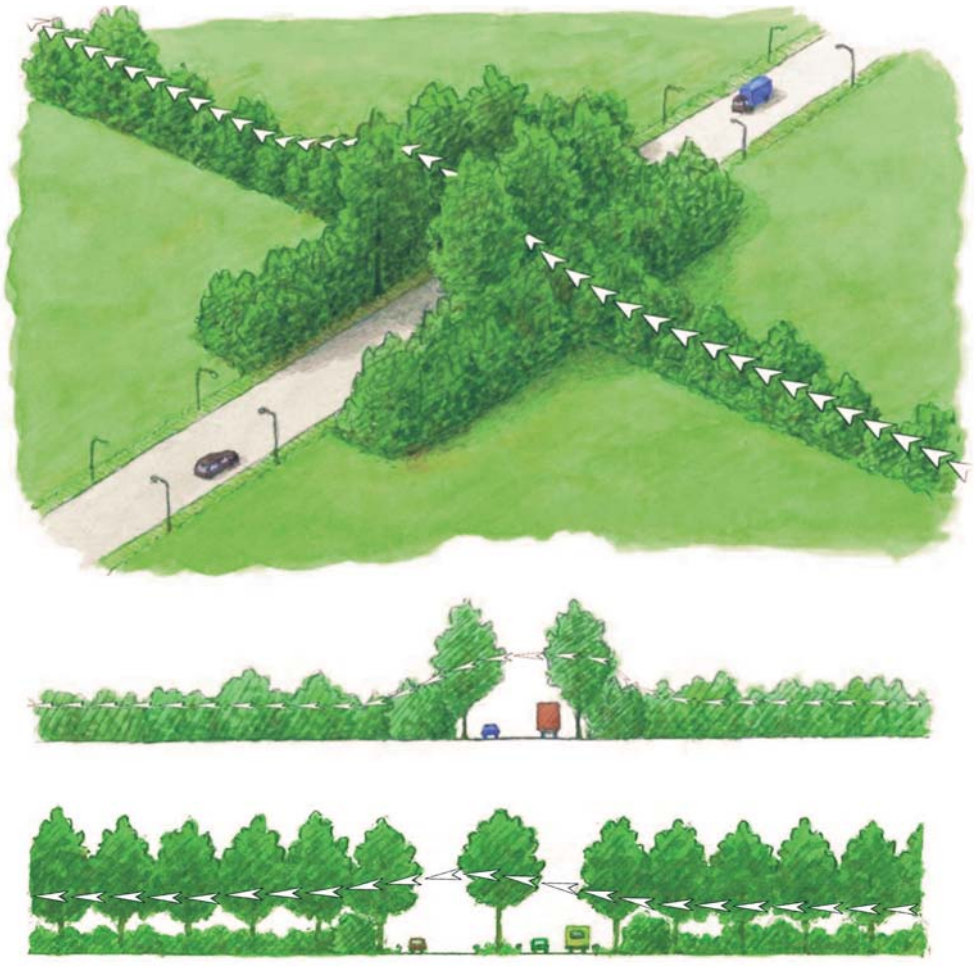
The planning of road infrastructure must be approached from a broad perspective, as it can have multiple effects on bats inhabiting the region of the proposed scheme. A road can destroy a habitat, a flight corridor, a foraging territory and/or migration route of bat populations in the region. Constructing road infrastructure is an expensive and complex undertaking, which undergoes several stages of pre-design studies, technical planning, commissioning, construction and maintenance.

▪ *The EIA procedure must necessarily include a study of all bat roosts existing along and close to the road and address the impact on more distant populations whose flight paths will be crossed by the road.*

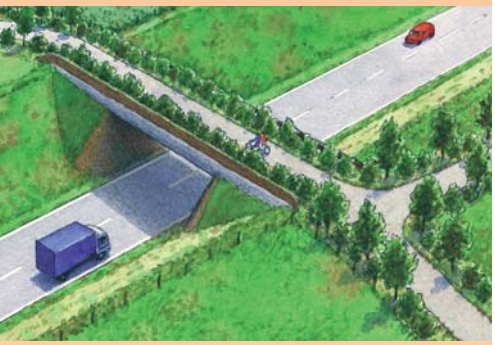
▪ *Alternative routes for the new road should be investigated. The report should include the location of the major foraging habitats of each of the established species in and around each alternative route.*

Methods of study – the research must show the degree to which all species will be affected directly or indirectly. The survey's methods must include field visits of all the alternatives along the route, searches for bat roosts and colonies, setting mist-nets by foraging corridors, use of bat detectors (in open habitats) and radio tracking of the species with the highest conservation importance so as to establish their foraging sites and the ways bats get there.

The species list must contain data on their relative number, important roosts and a comparative table of the degree to which they will be affected by the construction and operation of the project.



By planting a hop-over along a local migration/foraging bat corridor, the flight path is kept at safe height above the road



A "green viaduct" planted with trees or shrubs is excellent for guiding bats over a road

Avoidance and mitigation measures

- The ultimate goal is to prevent the project from disrupting diurnal local and seasonal migrations, and to avoid high mortality rates among flying and foraging bats and other wild animals during the construction and operation of the scheme.
- The working map must indicate the most appropriate places for constructing wide under and overpasses, as well as sections where the natural vegetation must be preserved and where new and or compensatory shrubs and tree patches should be planted along the shoulders of the road.
- Illumination should be kept away from flight paths and important hunting habitats.
- Where appropriate, protective walls must be constructed for noise insulation purposes as well as to decrease road kills of animals, including bats.

Existing old guiding vegetational structures must be rerouted towards the newly built bridges and underpasses.

Extra lighting should be erected at sites where large number of bat casualties can be expected (e.g. where an old flightpath crosses the new road)

The building of bridges, tunnels and longer (oversized) underpasses requires the planting of new vegetational strips, which will guide bats towards these facilities.

Tunnels for access roads to fields should be situated so that they are close to the sites where important bat flight paths crosses the new road. Bats can be guided to these passes by an alley of trees or high hedges

A spacious underpass for a secondary road provides a safe crossing under heavily used highways for many species of wild animals including bats

BAT MORTALITY ALONG THE E79 IN THE KRESNA GORGE, SW BULGARIA

Kresna gorge is a narrow ravine through which Strouma river flows between the Pirin and Maleshevska mountains. The Sofia-Kulata railway runs to the left of the river and the E79 international road (part of the European transportation corridor № 4) to the right. Peak traffic flow is **280** to **320** vehicles/hour. The gorge is a biodiversity hot spot and has the highest density of species per square km in Bulgaria. Eighteen bat species have been found, as well as two large breeding colonies of horseshoe bats *(Rhinolophus* spp.*)* and Geoffroy's bat *(Myotis emarginatus)*. During 2003–2004, a field survey was conducted in which all the animals that had been killed on the road were collected three times a week over six months. During the study in 2003, **187** killed bats were found, **25%** of all mammals killed on the road. Notably the number of bat mortalities was almost as high as the number of dead birds, even though night traffic is considerably lower. One conclusion was that the car lights attract flying insects and the bats, which then feed over the road, become easy victims of fast moving trucks.

After lengthy delays over the plans to upgrade the Strouma highway (bought about by attempts from the former National Road Infrastructure Fund to sidestep responsibilities under the Habitats Directive) the problem with the routing of the highway through the Kresna gorge is about to be solved. The tunnel option was recently adopted as the only feasible option for routing the highway through the gorge. Several long tunnels will be dug through the slopes of Maleshevska mountain and the road will emerge in open defiles of not more than 300–700 m. The technical design envisages constructing protection walls in areas with a high number of hunting bats.

Based on information from:

http://www.kresna.org;
http://www.balkani.org
unpublished author's data

Kresna gorge view

The warning signs are not enough to save the wild animals, which are crossing the road

A Leopard snake killed on the road

A Land tortoise killed on the road

A Greater horseshoe bat – a victim of the traffic along E79

BATS AND WIND TURBINES

The construction of wind turbines in Bulgaria to receive energy from renewable sources is a relatively new initiative and is quickly gaining in popularity. There is a lack of practical experience in planning, constructing and operating wind farms and they are frequently sited in places where they interfere with the migration of birds and bats. According to one survey each wind generator in Europe kills between 4 and 43 birds per year. The RIEW and potential investors need to adopt a responsible approach to this problem and ensure that wind turbine construction in Bulgaria is not the cause of excessive kills of rare and threatened bird and bat species

The risks include:

DIRECT RISKS	INDIRECT RISKS
Direct strikes by the rotor blades	Changes in the characteristics of the habitat
Clashes with the power-transmission network	Fragmentation of habitat
Turbulence spin while in flight	Barrier effect
Noise pollution	Cumulative fatalities effect

Methods of study – all EIA reports need to address the following basic questions:

1. Which species of bats use the project area, and how do their numbers vary throughout the year?

2. How much time do bats spend in the risk zone (rotor-swept area), what is their flight behaviour and do these parameters vary by season?

3. What is the estimated range of bat fatalities from the project based on data from other wind power sites from which fatality information is available?

4. What design and mitigation measures could reduce impacts?

The EIA report must contain information on the species composition, relative number and average altitude at which bats fly during periods of high foraging activity (April 15th to 15th October) and during migration (April 1st – May 10th, August 20th – October 15th). The basic method of study must be acoustic detection using bat detectors (4 minutes of recording at each point) for 2 hours after sunset along a route that traverses the whole site. Acoustic monitoring provides information about bat presence and activity, as well as seasonal changes in species composition, but it does not measure the number of individual bats or population density. Additional modern methods include the use of a Doppler radar and thermal infrared imaging.

Year-round surveys are particularly important at proposed project sites if, in the opinion of bat experts involved in scoping the initial studies, the sites are likely to support resident bat populations and include habitat features that are conducive to general bat activity (for example, nearby roosts or water bodies).

If year-round surveys are not feasible, acoustic monitoring should include at least spring (from the end of March till the beginning of May) and the autumn migration period (from late August until the middle of October), the periods that pose the greatest risk to bats. Data on environmental variables such as temperature, precipitation, and wind speed should be collected along with with the acoustic monitoring so these weather data can be correlated with bat activity levels.

The species list must contain data on the relative number of each of the species within and around the study area, important bat roosts, flight corridors and a table that shows the degree to which each species will be affected by the project's construction and operation.

Avoidance and mitigation measures

- ***Reduce impacts with appropriate turbine layout***

Pre-permission studies must be sufficiently detailed to establish the normal movement patterns of resident and migratory species, which will inform detailed siting decisions for the configuration of the turbines. Turbine alignments that separate roosts and feeding sites pose a permanent collision threat. The working map must show the places with the highest concentration of foraging and migrating bats, so that no wind energy facilities are constructed in these places. Some of the main traditional bird and bat migration corridors in Bulgaria pass along the Black Sea coast, the Strouma River valley, the Danube, the valley of the Maritsa River and the Iskar River Gorge). At the local scale each well-defined mountain pass (or saddle) definitely constitutes a bottleneck of migration. Careful siting of new wind turbines can contribute substantially in reducing fatality risks.

- ***Reduce habitat for prey near turbines***

Areas around turbines and along roads that have been disturbed by construction and operations activities may provide habitat for prey species such as insects, small mammals and weedy vegetation. Increases in prey availability may in turn attract bats, insectivorous birds and raptors, increased the risk of collision. Biologists should be aware of these potential impacts when reviewing the site design and recommend construction and management practices that will minimize activities that might attract prey and predators to the wind turbine site.

- ***Avoid lighting that attracts insects, birds and bats***

The responses of birds and bats to lighting is still poorly understood but it is known that steady burning lights attract insects and increase the potential for large-scale fatalities of their predators. Thus it is preferable to install flashing lights on the turbines with the minimum «on» period without breaking safety and security needs. Use white lights with sensors and switches that keep the lights off when they are not required. These lights should be directed so as to minimize the illumination of areas outside the facility.

- ***Minimize power line impacts***

To prevent avian collisions and electrocutions, all connecting power lines associated with wind energy development should be placed underground, unless burial of the lines would result in greater impacts in biological resources.

- ***Decommission non-operational turbines***

Turbines should be removed when they are no longer operational so they do not present a collision hazard to birds and bats. All applications should include a plan for decommissioning and reclamation plan. The plan should discuss in reasonable detail how the wind turbines and associated structures will be dismantled and removed. Decommissioning a project typically involves the removal of turbine foundations (to one metre below ground level), of access roads, unnecessary fencing and ancillary structures. The decommissioning plan should also include documentation showing the financial capability to carry out the decommissioning and restoration requirements. Plans for decommissioning can also be addressed as an obligation of the property owner as part of the lease arrangement with the wind developer.

Compensation

Regardless of the form of the compensatory mitigation, MEW/REIW should establish a balance between the level of impact and the amount of mitigation. Unlike habitat impacts, in which 1ha of habitat loss can be compensated for protecting or restoring an appropriate number of hectares of habitat, there is no obvious compensation measure for bird and bat collisions with wind turbines.

The following potential compensation options are known to protect and enhance bird and bat populations and could form part of a compensation programme:

1. Offsite conservation and protection of essential habitat

- Nesting and breeding areas
- Foraging habitat
- Roosting or wintering areas
- Migratory rest areas
- Habitat corridors and linkages

2. Offsite conservation and habitat restoration

- Restored habitat function
- Increased carrying capacity

3. Offsite habitat enhancement

- Predator control programme(s)
- Exotic/invasive species removal

Post-construction monitoring protocol for birds and bats

At a minimum, the primary objectives for post-construction monitoring are to determine:

1. The accuracy of the estimated bird and bat fatality rates in the EIA.

2. The adequacy of the avoidance, minimization and mitigation measures implemented for the project.

3. Whether additional corrective action or compensatory mitigation is warranted.

4. Whether overall bird and bat fatality rates are low, moderate, or high relative to other projects.

The duration of post-construction monitoring should be sufficient to determine whether the initial estimates of the impacts on birds and bats were reasonably accurate and to determine whether the turbines are causing unanticipated fatalities that require additional impact avoidance or mitigation actions. Project sites with little existing information and no (or uncertain) indicators of the wildlife impacts will need two years of carcass count data to evaluate the effectiveness of mitigation measures in order to capture possible annual variability. For comparisons, risk and fatality estimates should be quantified in a uniform measure of bird or bat fatalities per megawatt (MW) of installed capacity per year.

Number of carcass search plots. Search for carcasses around approximately 30% of the turbines, either selecting these turbines randomly, via stratification, or systematically. The selection process must be scientifically defensible and should be developed in consultation with the controlling institutions (MEW/RIEW), knowledgeable scientists and appropriate stakeholders.

Search plot size. Configure the search plots at selected turbine sites so that the search width is equal to the maximum height of the rotor tip. For example, for a turbine with a rotor tip height of 120m, the search area would extend 60 metres from the turbine on each side. The search area may be a rectangle, square, or circle depending on turbine locations and other site-specific characteristics.

Search Protocol. Use trained and qualified searchers to look for bird and bat carcasses. Search along a standardized transect width of 6m, with the searcher looking 3m to either side. Conduct searches at least every two weeks for two years. The search frequency may need adjusting depending on rates of carcass removal (high scavenging rates warrant more frequent searches), target species, terrain, and other site-specific factors.

HYPOTHESES FOR BAT FATALITIES AT WIND ENERGY FACILITIES

1. Linear corridor hypothesis.
Wind energy facilities constructed along forested ridge tops create clearings with linear landscapes that are attractive to bats.

2. Roost attraction hypothesis.
Wind turbines attract bats that see them as potential roosts.

3. Landscape attraction hypothesis.
Bats feed on the insects that are attracted to the altered landscapes that commonly surround wind turbines.

4. Low wind velocity hypothesis.
Fatalities of feeding and migrating bats are highest during periods of low wind velocity.

5. Acoustic attraction hypothesis.
Bats are attracted to audible and/or ultrasonic sound produced by wind turbines.

6. Visual attraction hypothesis.
Nocturnal insects are visually attracted to wind turbines.

7. Echolocation failure hypothesis.
Bats cannot acoustically detect moving turbine blades or miscalculate rotor velocity.

8. Electromagnetic field disorientation hypothesis.
Wind turbines produce complex electromagnetic fields, causing bats to become disoriented.

9. Decompression hypothesis.
Rapid pressure changes cause internal injuries and/or disorient bats while foraging or migrating in proximity to wind turbines.

10. Thermal inversion hypothesis.
Thermal inversions create dense fog in cool valleys, concentrating both bats and insects on ridge tops.

Source: Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses
http://www.bu.edu/cecb/reprints/2007/Kunz.Bats%20&%20Wind.07.pdf

RESULTS FROM PUBLISHED STUDIES – BATS AND WIND ENERGY FACILITIES

BULGARIA

So far in Bulgaria only few preliminary studies have been conducted of the species composition and activity of bats in an area designated for constructing wind energy facilities. One site which has been the subject of study is located within the boundaries of Balchik town, south of the Momchil residential area. The investment project envisaged construction of 12 wind turbines and the assessment of the impact on bat activities is only a part of the general report on the potential impact of the wind energy park on the biodiversity of the region. Between August and October 2003, a team conducted a survey using bat detectors. For three nights in each of the three months, recordings were made of the bats passing in the projected area of each of the planned wind turbines. The results showed that every hour an average of 2.2 individuals from 3–4 species flew into the immediate vicinity of the planned turbines. The study showed that bats did not forage on the territory of the planned wind energy park, but only flew over it as part of their journey between their roosts and their foraging grounds. The bat report recommended that this methodology be used in other applications to construct wind energy parks.

Source: Ivanova T. 2005. Preliminary study on the bats (Mammalia:Chiroptera) in the region of Kayraka (residential area Momchil in the town of Balchik) – a model for evaluation of the impact of investment projects for establishing wind energy park in Bulgaria on bats. - In: Results of the study of the migration of birds and bats in a location of a planned wind power plant near town of Balchik, Northeastern Bulgaria. BSPB/BirdLife Bulgaria, Technical Report Series № 2, 2005, 39–43 p.

NORWAY

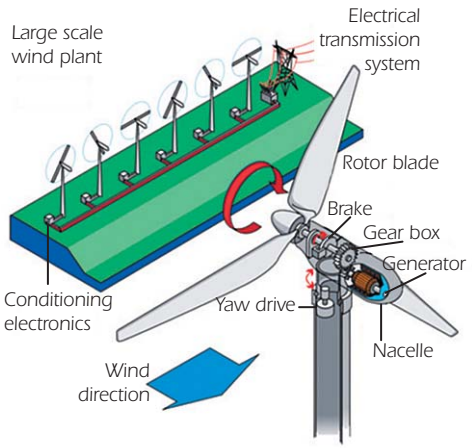
A study conducted in the northern part of the country (Smøla island) on the impact of **44** wind turbines (2.3 MW each) provides a striking example of the high mortality rate and effect on local biodiversity. Once a week from April to November a team of collectors, using a specially trained dog, inspected the areas below each of the wind turbines and documented all the found fatalities. During the study, beside the hundred of killed birds, a total of **475** killed bats belonging to **8** species were found. A statistical model showed that the percentage of discovered carcasses is less than 25% of the total number of killed birds and bats. This means that in order to get the real number of fatalities we have to multiply the number of found carcasses by at least 4. The figures exceed our worst-case scenarios on the impact of this type of wind energy facilities. Only 9 bat species occur on the studied island, almost all in low numbers. Most regions of Bulgaria (excluded the high mountain peaks) have between 10 and 20 species, most in abundance. This makes it very difficult to make exact predictions on the impact of wind energy facilities on bats, although the figures would certainly be very high.

Source: *http://www.ivt.ntnu.no/bat/mb/vindkraft/2006/2006innlegg/Innlegg30aug2006.pdf*

USA

There are surprisingly few studies on this topic considering the thousands of installed wind energy facilities in the USA. One representative and comparative study on the impact of wind facilities on regional biodiversity across the USA established that large numbers of bats are killed at utility-scale wind energy facilities, especially along forested ridge tops in the eastern United States. The highest fatality rate for bats (**41.6** bat fatalities/**MW–1 year**) was reported at the Buffalo Mountain Wind Energy Center, TN, where estimates were consistently corrected for both search efficiency and scavenging. Another study, conducted in the summer of 2006 in a mixed-grass prairie in Woodward County, north-central Oklahoma found 111 dead bats beneath wind turbines, 86% of which were pregnant or lactating. Generally in the USA and Europe the highest fatality rate among migratory bat species is in the late summer and early autumn. The few bat fatalities reported during spring migration and early summer may reflect less intense fatality searches being conducted during this period, but may also be due to bats migrating at higher altitudes during spring. A study by different authors provided evidence that bats are more at risk of being killed by wind turbines during summer, and, thus, more rigorous fatality assessment is warranted during this season.

Source: Kunz et al. 2007. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses – *http://www.bu.edu/cecb/reprints/2007/Kunz.Bats%20&%20Wind.07.pdf*



Courtesy of RW Thresher

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- Assessment and Prediction of Bird and Bat Mortality at Wind Energy Facilities in the South-eastern United States
http://www.tva.gov/environment/bmw_report/bird_bat_mortality.pdf

- Information for the use of automated, unattended, 24h collection of high-quality data on bird and bat activity at proposed wind farm sites that can be used to develop detailed pre-construction risk projections.
Bird & Bat Radar Technologies – *http://www.detect-inc.com/wind.html*

- For more sources see «SELECTED REFERENCES – bats and wind turbines»

Quarries alter the landscape forever… Photo K. Metodiev

In the late 1950s a large natural cavity was found in the research gallery during the development of the marble quarry above Ilindentzi village. After study by speleologists it became clear that there were 420 m of exceptionally beautiful underground passages with unique formations. The development works were abandoned, the entrance was left open and gradually hundreds of bats living in the Southern parts of the Strouma River valley started using it for hibernation

OPENING AND EXPANDING QUARRIES AND CONCESSIONS

The opening of new quarries or expansion of existing ones in limestone massifs is highly likely to affect caves, rock crevices or other places suitable for bat roost. The EIA must necessarily confirm the presence of or provide proof of the absence of bat roosts within the concession area.

Methods of study – a field study, carried out between April and October, is enough to assess the extent to which the landscape elements are potential bat roosts (e.g. presence of caves, niches, rock crevices, etc.). Extra attention is needed to assess whether the site offers roosting opportunities for (mass) hibernation of *Nyctalus noctula* and *Pipistrellus nathusii*.

Species list – this must identify the species found within the assessed territory or observed/detected foraging overhead or nearby.

Impact – the deliberate withholding of information on the presence of caves on the territory designated for concession will be considered as intended destruction of the geological heritage and the unique cave dwelling fauna. The exclusion of a known or a newly found cave from the concession area is usually not a problem, as its area compared to the total project area will usually be insignificant.

Avoidance and mitigation measures

- If it is established that the quarry may affect a cave the team must refer to the database held by the **Bulgarian Federation of Speleology**

http://www.speleo-bg.com/

- After a study of the direction in which the underground passages develop, the cave must be excluded from the concession and a buffer zone created around the entrance.

BATS IN BULGARIAN SETTLEMENTS

Residential and public buildings, city parks, industrial zones, road infrastructure and other elements of the urban landscape offer a large number of suitable roosts which bats have learned to permanently or seasonally use. At least 5 bat species *(Nyctalus noctula, Hypsugo savii, Pipistrellus pipistrellus, Pipistrellus pygmaeus* and *Eptesicus serotinus)* are regular inhabitants of almost all settlements in Bulgaria. The size of bat colonies in towns can vary between 5–20 individuals up to 50–150 individuals and in exceptional cases over 1000 individuals. They settle in attics, basements, bunkers, underground garages, expansion joints and building facades, shafts, chimneys, ventilation facilities, under bridges, in gaps behind cladding tiles or wood, between under-felt and boards or tiles and in many other places. Some species are very conservative and use only one or few roosts. Others can use up to 40–70 different sites during a summer. The most critical period for carrying out construction/renovation works is when bats give birth and nurse their young (from 25th May to the end of July). About 5 other species inhabit man-made structures during the autumn or winter period. Some species prefer to spend the winter in a city instead of the nearby mountains or forests where they normally live during the summer. These species can congregate locally in very large numbers and, near national borders, can include individuals from neighbouring countries. Disturbance of these sites in winter will cause great stress, which could result in the early death of some, or many individuals.

FILLING IN BUILDING JOINTS

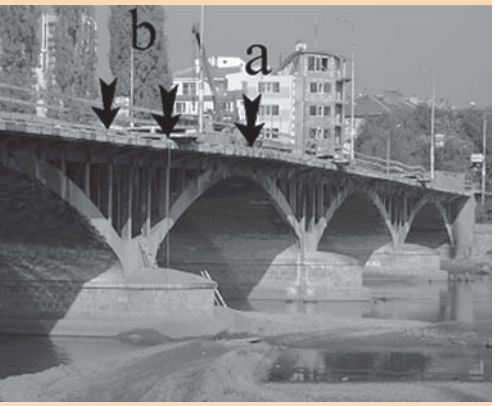
Part of the maintenance and insulation of old blocks of flats involves filling façade joints, most often involving industrial rope access techniques. In majority of the cases the plaster of such buildings fell off a long time ago and over time individual bats and even colonies have come to settle there, either permanently or temporarily. The noctules *(Nyctalus noctula),* serotines *(Eptesicus serotinus)* and, during the winter, the parti-coloured bats *(Vespertilio murinus)* are the most frequent inhabitants of crevices and joints in Sofia. The best approach, after establishing the presence of bats in the joints to be filled in, is to remove the bats and release them at an appropriate alternative location. Removing the bats from the crevice requires willingness, gloves, a thin stick (or a long pincette), a cotton bag or a plastic bottle with cut-open top. If the bats are active it may take several minutes to take them out. If they are in an inactive state (i.e. in torpor), they need to be warmed a little using human breath and a small pipe, when they start crawling then they can be caught. Their release can be immediate, if the day is warm, or if they are inactive, they must be taken out in the bag or the plastic bottle and released into an appropriate attic space with open shutters

Photo Sl. Stoycheva

DISCOVERY OF A MATERNITY COLONY IN AN OFFICE BUILDING IN THE TOWN OF PLOVDIV

On 02.07.2007 the Green Balkans office in Plovdiv received a message about the presence of a bat colony in a company office on the top floor of a building in the town's industrial area. The extermination company that was called earlier had fortunately declined to solve the «problem», as it concerned a protected species. An inspection conducted by a team of the Green Balkans confirmed the presence of bats, inhabiting the vertical joints of a concrete slab situated above the office suspended ceiling. The dead body of a Kuhl's pipistrelle *(Pipistrellus kuhlii)* was found. During the next inspection recordings were made with a Pettersson D240x bat detector. Analysis of the calls confirmed that it was a colony of this rare species. Observations showed that the colony consisted of over 50 individuals and the capturing of a juvenile specimen proved that it was also a maternity colony. The company was sent a letter explaining the high conservation status of the bat species, that they are protected by law, and that their presence did not pose any threat to the people working in the office. It was recommended that the company seal joints in the suspended ceiling to avoid bat droppings in the office and to put anti-mosquito nets on the windows to prevent bats from entering the office. A message was sent to the RIEW indicating a possible threat to the bat colony.

Information: Elena Tilova, Green Balkans *http://www.greenbalkans.org/*



RELOCATION OF A HIBERNATION COLONY OF NOCTULES *(NYCTALUS NOCTULA)* DURING THE RECONSTRUCTION OF GERDZHIKA BRIDGE IN PLOVDIV

The end of 2005 saw the start of reconstruction works on the Gerdzhika Bridge in the town of Plovdiv. There were plans to reconstruct the pavement, shift the slabs, break the pillars and close the hollows underneath the bridge. At the very start of the repairs the workers found that many of the joints below the bridge were full of bats in torpor which were being squashed when the slabs were shifted, buried under construction debris or falling into the water of Maritsa river. After the alarm was raised by concerned citizens volunteers from the local NGO Green Balkans took urgent action to save the hibernating noctules *(Nyctalus noctula).* Over 6 days a total of 977 live bats were taken out one by one (an average of **80** individuals in a joint). Considering the number of individuals that fell in the river, the found dead bodies and the ones who managed to escape, the total number of wintering bats was calculated as approximately **1500.** After coordination with RIEW Plovdiv all the bats were transported and temporarily accommodated in the Wildlife Rehabilitation and Breeding Center in Stara Zagora town. Meanwhile, consultations were held with the Bat Research and Conservation Centre at the NMNH-BAS and the bats were later transported and released in the Devetashkata cave.

Information: Elena Tilova, Green Balkans *http://www.greenbalkans.org/*

RENOVATION OF HISTORICAL BUILDINGS (MONASTERIES/CASTLES) WITH BAT ROOSTS – RECOMMENDED PRACTICES

Several species of bats (e.g. *Rhinolophus ferrumequinum, Rh. hipposideros, Myotis emarginatus, Hypsugo savii* and other) can be found in basements, attics, construction crevices or between the bricks of old buildings. Many local populations of bats have a long tradition of using the same sites, often attracted by the special climate, which historical buildings often keep for long time. Renovation work or change of use should take into account the high possibility of the presence of bats. The planning proposal must **assess the presence** or **provide proof** of the absence of bat roosts before restoration plans can be approved by the competent authority.

Methods of study – a single visit of all attics, basements and cellars of the building complex is enough to find bat droppings. A talk with the staff is an additional source of information for the presence of bats.

Species list – contains the species or possible species from, which the droppings have been found. A map of the exact locations of roost-sites and an estimation of number of individuals using these roosts should be included within the assessment report.

Impact – the most critical time for carrying restoration works is the breeding season (June – July). Disturbance of maternity colonies will result in a high mortality of juveniles or the loss of the local population.

Avoidance and mitigation measures

- A detailed schedule should be drawn about when the work will start and end, especially at and close to the bat roost sites.
- When a nursery colony of bats is present works should be planned and carried out outside the critical period according to the avoidance principle.
- Roost sites should be adequately shielded from noise, light and moving people.
- If restoration works at the roost site cannot be avoided during the critical period, a special approved plan is needed. This plan should provide detailed information on alternative sites and how bats will be discouraged from using this part of the building during construction works.
- If there is a bat colony present, the progress of the renovation work should be regularly checked by a bat-expert.

Best practice guidelines for renovation can be found in:

Reiter, G. & A. Zahn – Bat roosts in the Alpine area – Guidelines for the renovation of buildings.
http://www.isn.tirol.gv.at/en/doc/guidelines.pdf

Almost every historical building gives plenty of opportunities for bat roosting

The Assenovata Krepost castle, above Asenovgrad town, is regularly inhabited by small colonies of *Rhinolophus ferrumequinum* and *Rh. hipposideros*

The attic of the Cherepish Monastery is inhabited by bats even though it is surrounded by rocks with caves

Studies show that a colony of **300** Mouse-eared bats (*Myotis myotis/blythii*) will eat around **550 kg** of insects in a summer.
A number of agencies that manage state and private forests in the USA, Canada and Germany have funded studies which show that forests with diverse bat fauna are considerably less damaged by insects than forests with poor or scarce bat fauna.

Hollows like these can be inhabited by a maternity colony of 20–30 female Bechstein's bats

FOREST MANAGEMENT – RECOMMENDED PRACTICES

At least **10** of the 33 bat species that occur in Bulgaria belong to the group of the forest-dwelling bats. These are species that widely use forests as a habitat for roosting and foraging. These forest bats feed on moths, caterpillars, mosquitoes, beetles and dozens other flying and crawling insects, often classed as pests. With their exceptionally agile flight bats catch their prey in the air, glean them from the leaves, ground or tree bark.

Modern concepts of forest management include a number of practical measures that aim to promote the occurrence of a rich fauna of bats.

Methods of study – studies of forest-dwelling bats generally take more time than studies of bats in caves or mine galleries. The research team must be larger, work more nights and possibly cover a larger area. Mist-nets are set above rivers, streams, ponds, swamps, forest clearings, dirt roads. To guarantee a catch the overall length of the nets set in the forests must be over 50 m. If there are cave entrances, rock niches or streams in the forest the chances of netting more species increase. Radio-tracking surveys can establish with certainty where bats forage, the routes they use to reach their hunting territories, where they rest and precisely which hollows they inhabit. Detectors can register whether the bats fly over, pass or hunt in young forests or in patches with low-growing vegetation where there are no appropriate places to set nets.

Species list – there are many difficulties that hinder bat research in the forest. Some bat species exist in very low numbers, others are very cautious and successfully avoid the mist-nets, others still fly straight up out of hollows and almost never go close to the ground. A complete list of the species inhabiting a forest can be drawn only after several years of studies, using a range of different methods. It is important to know that some forest areas (for example a young forest) might not be inhabited by bats but might be used for foraging or for temporary resting by several species.

Avoidance and mitigation measures

- Under **art. 25, para. 6** of the Forestry Act all new forest management plans and programmes must be coordinated with the MEW, which may require and impose the inclusion of specific measures (see the table below) for the conservation and maintenance of forest-dwelling bat fauna.

PRACTICAL MEASURES SUPPORTING THE FOREST-DWELLING BAT FAUNA

PURPOSE	MEASURE
1. Increase the number of appropriate bat roosts – trees with hollows, loose bark and crevices	• maintaining at least 7–10 trees/ha with 25–30 hollows due to rotting or made by woodpeckers, cracks in the trunk, or loose bark • mark and protect trees with known roosts (summer and winter roosts)
2. Support of a canopy with high food production	• introducing deciduous tree species suitable for the site, e.g. oak, beech, hornbeam • no harvesting of old trees (especially oak) and enhancing the amount of light that falls on such trees and their surroundings to increase insect abundance
3. Promotion of feeding habitats for species that forage in open air space (for example *Nyctalus leisleri*)	• provide clearings or clear cuts no larger than 0.5–1 ha through natural processes or measures of restocking • harvesting trees in clusters • establishing pond (200 m² minimum)
4. Promotion of hunting habitats for species that feed in dense vegetation (for example *Myotis bechsteinii, Myotis nattereri*)	• increase the substratum and intermediate layer so that it provides up to 20–30 % coverage • partial thinning of the canopy to increase light intensity and thus promote undergrowth (density of canopy about 80 %) • toleration of succession areas
5. Structures and sources of food in general	• designing inner forest margins along waysides, e.g. by promoting tall perennial herbs • development of outer margins of forests (minimum 30 m in depth) • no use of pesticides, especially insecticides, but reliance on preventive steps • re-establishing wet forest parts by closing drainage ditches and/or diverting waters; restoring riparian forests
6. increase the number of appropriate roosts and promote regular monitoring.	• installation of bat boxes in young forests or in forests where there are few hollow trees

For more information see «Bats in Forests - Information and recommendations for forest managers», vol. 4 «Landschaft als Lebensraum», German Association for Landcare Deutscher Verband für Landschaftspflege e.V., Federal Agency for Nature Conservation Bundesamt für Naturschutz (BfN), July 2001.

The old growth forests in Bulgaria offer plenty of roosting opportunities for bats

Bats prefer to forage near the small ponds in the forests, where there is great diversity and richness of insects

Continuous forests provide enough space for a rich and diverse fauna of bats

ANNEXES

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Bats and forest management

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http://www.fws.gov/habitatconservation/windpower/Meeting_Feb_26_28_2008/Technical_Workshop_and_FACA_Mtg1.html

Wind turbine interactions with birds and bats: a summary of research results and remaining questions
http://www.nationalwind.org/publications/wildlife/wildlife_factsheet.pdf

GLOSSARY OF BAT TERMS

Roost	Every place (e.g. cave, mine gallery, bunker, cellar, attic, crevice, joint, etc.) inhabited by one or more bats
Maternity roost	A roost inhabited by pregnant females which give birth and take care of their young (20th May to 1st August) most often roosting together with non-breeding females and young males
Hibernaculum	A winter site with a more or less constant temperature where the bats enter torpor during hibernation (from 1st December to 30th March)
Day roost	Site where one or more bats spend the day
Transitional roost	A roosting site usually used for one or several days in spring and autumn migrations before and after using a maternity roost
Satellite roost	A smaller roost than a maternity roost but nearby
Guano	Collective term used for bat droppings or faeces. Bat droppings contain indigestible parts of their insect prey and are easily crushed when dry. In comparison, rodent droppings are unsegmented, harder, more fibrous and do not contain shiny fragments
Autumnal swarming	Bats gathering in flight at an underground site (usually a cave or a gallery) from the middle of August till the middle of October searching for a partner
Colony	Group of genetically or socially related bats, which inhabit one or several satellite roosts. A colony usually consists of 15 to 50 specimens (for forest-dwelling bats), but can reach 10,000 or more individuals for cave-dwelling bats
Migration	Seasonal, usually two-way, movement from one place or habitat to another to avoid unfavourable climatic conditions. The spring migration of bats in Bulgaria usually starts at the end of March and lasts till the beginning of May. The autumn migration might start in the middle of August and continue until the middle of October
Torpor	Usually a short-term state of decreased physiological activity, characterized by a reduced body temperature and rate of metabolism
Hibernation	State of inactivity and metabolic depression in animals, characterized by lower body temperature, slower breathing and lower metabolic rate

ANNEX 1:
Contacts with RIEW, departments of national parks, basin departments (valid as of 01.07.2008)

RIEW	CONTACT	ADDRESS	GREEN LINE	Fax, E-mail Address
BLAGOEVGRAD *http://www.blriosv.hit.bg*	073/ 885 161 0888199 196	Blagoevgrad 2700 1, Svoboda St.	073/ 885 160	073/ 885 158 *blriosv@yahoo.com*
BOURGAS *http://www.riosvbs.unacs.bg*	056/ 813 207 056/ 813 205 088 790 641	Bourgas 8000 Lazour res. estate, 67, Perushtitza St. 3 floor, PO box 219	056/ 813 212; 056/ 813 199	056/ 813 2 00 riosvbs@unacs.bg *riosvbs_direktor@unacs.bg*
VARNA *http://www.riew-varna.org*	052/ 634 581 0888 517 559	Varna 9000 4, Ian Palah St.	052/ 634 589	052/ 634 593 riosv-vn@mbox.contact.bg *varna@riew.org*
VRATZA *http://www.vracakarst.com*	092/ 644 761 0887 128 374	Vratza 3000 81, Ekzarh Yossif St.	092/ 629 211	092/ 624 761 *riosv_vr@m-real.net*
VELIKO TARNOVO *http://www.riosvt.org*	062/ 620 351 0888 352 971	Veliko Tarnovo 5000 68, Nikola Gabrovski St. PO box 11	062/ 646 829	062/ 623 784 *riosvt-vt@riosvt.org*
MONTANA *http://www.riosvmon.net-surf.net*	096/ 300 960 0887 718 071	Montana 3400 4, Julius Irasek St.	096/ 300 961	096/ 300 960; 300 961 *riosv_mont@net-surf.net*
PAZARDZHIK *http://www.riewpz.hit.bg*	034/ 401 938 0886 000 744	Pazardzhik 4400 3, General Gurko St. 4 floor, PO box 220	034/ 441 875	034/ 445 585 *riewpz@b-trust.org* *riewpz_direktor@b-trust.org*
PLEVEN *http://www.riewpleven.hit.bg*	064/ 801 768 0886 399 144	Pleven 5800 1A, Alexandar Stamboliyski St.	064/804 030	064/ 806 951; 800 711 *riosvpl@yahoo.com* *office@riew-pleven.org*
PLOVDIV *http://www.riosv-pd.hit.bg*	032/ 650 190 032/ 628 994 0886 099 959	Plovdiv 4000 122, Maritza Blvd.	032/ 643 245	032/ 628 994; 643 245 *riosv_plovdiv@dir.bg*
ROUSSE *http://www.riosv.ruse.bg*	082/ 820 771 0888 705 041	Rousse 7000 20, Pridunavski Boulevard St. PO box 26	082/ 809 280	082/ 820 779 *riosv@ruse.bg*
SOFIA *http://www.riew-sofia.org*	02/ 955 93 62 02/ 940 64 98 0887 787 484	Sofia 1000 136, Tzar Boris III Blvd. 4 floor	02/ 856 51 52	02/ 955 93 62 Office Pernik Fax 076/ 670 270 *riew-sofia@riew-sofia.government.bg*
STARA ZAGORA *http://www.riosvsz.dir.bg*	042/ 692 222 0887 802 777	Stara Zagora 6000 2, Stara Planina St. PO box 143	042/ 692 200	042/ 602 447 *riosvsz@stz.bg*
SMOLYAN *http://riewsm.my.contact.bg*	0301/ 62 764 0301/ 60 113 0888 809 184	Smolyan 4700 16, Dicho Petrov St.	0301/ 60 112	0301/ 60 121 *riosv-smolyan@mbox.contact.bg*
HASKOVO *http://www.riosv-hs.org*	038/ 664 608 038/ 601 610 0888 927292	Haskovo 6300 14, Dobrudzha St. 2 floor	038/ 665 344	038/ 622 173; 038 601 611 *riosv_hs@mbox.contact.bg*
SHOUMEN *http://www.riosv.icon.bg*	054/ 5 74 60 054/ 5 49 13 0886 737 608	Shoumen 9700 71, Saedinenie St. 3 and 4 floors	054/ 5 49 27	054/ 5 68 40; 054/ 5 49 16 *riosv-shn@icon.bg*

ANNEX 1:
Contacts with RIEW, departments of national parks, basin departments (valid as of 01.07.2008)

DEPARTMENT	CONTACT	ADDRESS	TELEPHONE	Fax, E-mail Address
CENTRAL BALKAN NATIONAL PARK *http://www.centralbalkannationalpark.org*	066/ 801 277 0885 202 540	Gabrovo 2747 3, Bodra Smyana St.	066/ 801 285 066/ 801 278	066/ 801 277 *office@centralbalkan.bg*
PIRIN NATIONAL PARK *http://www.pirin-np.com*	07443/ 82 03 0888 799933	Bansko 2770 4, Bulgaria St.	07443/ 82 04 074/ 438 206	07443/ 82 02 *pirin_np@mail.bg*
RILA NATIONAL PARK *http://www.rilanationalpark.org*	073/ 880 537 073/ 880 538	Blagoevgrad 2700 12B, Bistritsa St. PO box 56	0884 111 400	073/ 881 023 *office@rilanationalpark.org*
BASIN DEPARTMENT FOR EAST AEGEAN REGION – PLOVDIV	032/ 621 552 0889 378 187	Plovdiv 4000 26, Bulayr St.	032/ 628 063	032/ 628 063 *Bd_plovdiv@abv.bg*
BASIN DEPARTMENT FOR DANUBE REGION – PLEVEN	064/ 803 279 064/ 885 100	Pleven 5800 1, V. Levski St., 16 floor, PO box 1237	064/ 803 342	064/ 803 342 *Bd_dr_pl@yahoo.com*
WATER BUREAU – SOFIA	02/ 973 33 54	Sofia 14, G. M. Dimitrov Blvd., 4 floor	02/ 970 2070	02/ 973 3408 *Bd_dr_sf@yahoo.com*
BASIN DEPARTMENT FOR WEST AEGEAN REGION – BLAGOEVGRAD	073/ 88947 101	Blagoevgrad 2700 18, Mitropolit Boris St. PO box 441	073/ 882 992	073/ 882 993 889 47 102 *bdblg@wabd.bg*
BASIN DEPERTMENT FOR BLACK SEA REGION – VARNA *http://www.bsbd.org*	052/ 687 430 052/ 687 431	Varna 9000 33, Al. Dyakovich St.	052/ 631 447	052/ 631 448 *bdvarna@bsbd.org*

ANNEX 2:
NGOs with expertise in studying and protecting bats in Bulgaria.

ORGANIZATION	CONTACTS
Bat Research and Conservation Centre	Sofia1000 1, Tsar Osvoboditel Blvd. National Museum of Natural History – BAS Tel. 02/ 987 50 72, 987 36 80 *http://www.nmnh.bas.bg*
GREEN BALKANS Federation of Nature Conservation NGOs	Plovdiv 4000 160, Shesti Septemvri Blvd. Tel.: 032 /62 69 77, 62 69 15 Fax: 032 /63 59 21 *e-mail: office@greenbalkans.org* Stara Zagora 6000 9, Stara Planina St. Office tel.: 042 /62 24 01 *e-mail: officesz@greenbalkans.org* *http://www.greenbalkans.org*

ANNEX 3: Species composition, distribution and roosting requirements of bats in Bulgaria and methods of studying them

SPECIES	Distribution in Bulgaria	Roosts	Habitats	Methods of study
Family Rhinolophidae Horseshoe bats				
1. *Rhinolophus ferrumequinum* Greater horseshoe bat	A common species found in many places. In recent years some colonies are known to have decreased in number or disappeared	Caves, mine galleries, bunkers, rarely in basements	Prefers karstic regions with a mosaic of scrub, trees and open spaces, in mountains up to 1600 m	Inspection of caves, galleries, bunkers; analyses of owl pellets; nets, detectors; radio tracking
2. *Rhinolophus hipposideros* Lesser horseshoe bat	Widely distributed but not in high numbers	Caves, mine galleries, bunkers, drain ditches, rarely in houses	Karstic regions with vegetation, caves, in mountains regularly up to 1300 m, maximum altitude around 1600 m	Inspection of caves, galleries, bunkers; analyses of owl pellets; nets, detectors; radio tracking
3. *Rhinolophus blasii* Blasius's horseshoe bat	More common in low altitudes with a pronounced Mediterranean climate; low numbers	Caves, mine galleries, bunkers	Mostly plains and hilly karst regions covered with trees and shrubs	Inspection of caves, galleries, bunkers; nets, detectors; radio tracking
4. *Rhinolophus mehelyi* Mehely's horseshoe bat	Its discovery in NW Bulgaria marks the northern border of its distribution on the Balkan peninsula; low numbers everywhere	Only in caves, mine galleries, bunkers	Mostly plains and hilly karstic regions covered with trees and scrubs	Inspection of caves, galleries, bunkers; analyses of owl pellets; nets, detectors; radio tracking
5. *Rhinolophus euryale* Mediterranean horseshoe bat	Almost everywhere in the country with the exception of open areas; nowhere in high numbers	Caves, mine galleries, bunkers, rarely in abandoned buildings	Mostly karstic regions covered with trees and shrubs near water	Inspection of caves, galleries, bunkers; analyses of owl pellets; nets, detectors; radio tracking
Family Vespertilionidae Vespertilionid (common) bats				
6. *Myotis alcathoe* Alcathoe whiskered bat	So far it has only been found in Strandzha, Vrachanska Planina Mt, Central Balkan Mt. and Kresna Gorge	Possibly in tree hollows and crevices	Humid broadleaved and mixed forests up to 1500 m in mountains	Nets, inspection of roads, molecular methods

SPECIES	Distribution in Bulgaria	Roosts	Habitats	Methods of study
7. *Myotis aurascens* Steppe whiskered bat	Isolated findings throughout the country	Possibly in tree hollows and cracks, rarely outside forests	Mixed forests	Nets, inspection of roads, molecular methods
8. *Myotis bechsteinii* Bechstein's bat	All over the country where there are old forests; not found in the Thracian lowland; highest numbers in Strandzha Mt.	Maternity colonies in hollows, single individuals live in tree crevices	Spacious broadleaved and mixed forests; from the sea level up to 1650 m in mountains	Nets in forests and above rivers, radio tracking, bat boxes
9. *Myotis blythii* Lesser mouse-eared bat	In many different sites all over the country; good numbers	Only in caves, mine galleries, rarely in man-made structures	Karstic regions with forests or open habitats	Inspection of caves, galleries, bunkers, basements; analyses of owl pellets; nets, radio tracking
10. *Myotis brandtii* Brandt's bat	Only in the Western Rhodopes, Central and Western Stara Planina Mt. and Roussenski Lom Natural Park	Tree hollows and crevices	Mixed forests in the mid-mountain belt	Nets in cave entrances, molecular methods
11. *Myotis capaccinii* Long-fingered bat	Almost throughout the country with the exception of open spaces in the Thracian lowland and Dobrogea	Only in caves, rarely in basements of abandoned buildings	Typical for low-mountain karstic regions with caves	Inspection of caves, galleries, bunkers; nets, radio tracking
12. *Myotis dasycneme* Pond bat	Found only in one locality in the Danube area around the town of Rousse	Tree hollows, basements and bunkers near big rivers	Strips of broadleaved forests along big rivers	Nets above rivers, wetlands, detectors
13. *Myotis daubentonii* Daubenton's bat	Common around all big rivers and their tributaries	Tree hollows, sometimes under river bridges	Broadleaved forests with rivers; from the sea level up to 1400 m in the mountains	Nets above rivers, wetlands, detectors
14. *Myotis emarginatus* Geoffroy's bat	Almost all over the country; very rare in the winter	Bunkers, attics in houses, churches, cave entrance areas	Typical for low-mountain karstic and rocky regions covered with low-growing vegetation	Inspection of dry caves, galleries, bunkers; radio tracking
15. *Myotis myotis* Greater mouse-eared bat	All over the country	Only in caves, mine galleries, rarely in basements	Regions with forests and open spaces	Inspection of caves, galleries, bunkers, basements; analyses of owl pellets; nets, radio tracking

ANNEX 3: Species composition, distribution and roosting requirements of bats in Bulgaria and methods of studying them

SPECIES	Distribution in Bulgaria	Roosts	Habitats	Methods of study
16. *Myotis mystacinus* Whiskered bat	Almost throughout all the country, more often in the mountains, problematic to identify	In the summer – possibly in tree hollows, in the winter – in caves	Broadleaved and mixed forests in the mid-mountain belt	Nets at cave entrances and forest clearings, molecular methods for exact identification
17. *Myotis nattereri* Natterer's bat	Mostly in Western Bulgaria	Tree hollows and crevices	Humid broadleaved and mixed forests, in mountains up to 1500 m, by exception up to 2300 m	Nets in cave entrances and forest clearings; radio tracking
18. *Nyctalus noctula* Noctule	Migratory species observed in the whole country, sometimes in high numbers	Tree hollows, attics of buildings, joints of residential and industrial buildings and bridges	Broadleaved and mixed forests near rocks, rivers, wetlands; settlements	Inspection of residential buildings; analyses of owl pellets; nets in forests and cave entrances, detectors and evening observations; bat boxes
19. *Nyctalus lasiopterus* Giant noctule	One of the rarest bat species found in only a few localities in south Bulgaria	Tree hollows and crevices	Broadleaved and mixed forests from the sea level up to 1500 m in mountains	Nets in forests and above rivers; detectors and evening observations; analyses of owl pellets
20. *Nyctalus leisleri* Lesser noctule	Migratory species, few known localities, sometimes in high numbers	Tree hollows and crevices	Broadleaved forests in the hilly belt; rarely in settlements	Nets in forests and above rivers; analyses of owl pellets, bat boxes
21. *Eptesicus serotinus* Serotine	In the whole country, nowhere in very high numbers	Rocks, man-made structures, tree hollows and crevices	Rocky regions and forests; also common in settlements	Nets in cave entrances, inspection of residential buildings; analyses of owl pellets
22. *Eptesicus nilssonii* Northern bat	Only one locality – Rilski Ezera Hut in Rila Mt.	?	In southern Europe only in high mountains	Nets in high mountains, detectors
23. *Hypsugo savii* Savi's pipistrelle	In the whole country, rarely in the Black Sea region, the Thracian lowland and Dobrogea	Cracks in rocks, tight joints of residential buildings, bridges	Rocky regions; settlements	Nets in rocky regions; detectors and evening observations
24. *Pipistrellus kuhlii* Kuhl's pipistrelle	So far only found in the Strouma River valley, Rousse, southern Black Sea region, Plovdiv and Sofia	Residential and industrial buildings	Settlements, resorts, rarely outside urbanized territories	Detectors and evening observations around buildings in settlements

SPECIES	Distribution in Bulgaria	Roosts	Habitats	Methods of study
25. *Pipistrellus pipistrellus* Common pipistrelle	In the whole country, mostly in high numbers	Rock cracks, under roof and wall constructions in buildings, in trees	Settlements, regions with forests, rocky gorges	Detectors and evening observations around buildings in settlements; nets in forest clearings
26. *Pipistrellus pygmaeus* Pygmy/soprano pipistrelle	Similar to the above species, found in the Eastern Rhodopes, southern Black Sea region and other localities; unknown abundance	Rock cracks, under roof and wall constructions in buildings, in trees	Settlements, regions with forests, rocky gorges	Detectors and evening observations around buildings in settlements; nets in forest clearings
27. *Pipistrellus nathusii* Nathusius' pipistrelle	Migratory species found only in the spring and the autumn	Cracks in rocks, residential buildings, hollow trees	Forest regions with rocks, river valleys, settlements	Detectors and evening observations around rocky massifs; nets in forest clearings
28. *Miniopterus schreibersii* Schreiber's long-fingered bat	Many localities in karstic regions, in many places the colonies reach several thousand individuals	Underground habitats – caves, basements, colonial species	Karstic regions, river valleys with caves, in mountains up to 1500 m	Inspection of caves, galleries, bunkers; basements
29. *Plecotus auritus* Brown long-eared bat	Typically mountain dwellings, 80% of the localities are above 1000 m	Hollows, cracks and under the bark of old trees	Broadleaved and mixed forests in mountains up to 2650 m (Pirin and Rila)	Nets and inspection of caves and galleries
30. *Plecotus austriacus* Grey long-eared bat	Frequently found in lowlands and hilly regions	Hollows, under the bark of old trees, buildings, rarely in caves and galleries	Broadleaved and mixed forests, often in towns and villages	Nets and inspection of cave entrances, niches and galleries
31. *Vespertilio murinus* Particoloured bat	Mainly in mountains, in the autumn and winter also migrates to lowlands	Cracks in rocks, joints in residential buildings, mountain huts	In the high mountains above even 2900 m, during winter in settlements	Nets on mountain ridges, detectors in settlements during the autumn and spring
32. *Barbastella barbastellus* Western barbastelle	Isolated localities all over the country with the exception of the open spaces in the Thracian lowland and Dobrogea	Hollows, cracks and under the bark of old trees	Humid broadleaved and mixed forests from the sea level up to 1500 m in mountains	Nets and inspection of cave entrances, niches and galleries located in forests
Family Mollossidae Free-tailed bat				
33. *Tadarida teniotis* European free-tailed bat	Considered a rare species, 10 known localities in south Bulgaria and several in north Bulgaria	Crevices in rocks	Regions with rocks, sometimes in settlements as well	Detectors and observations in rocky regions and around settlements

ANNEX 4: Species composition of bats in the main types of habitats in Bulgaria, and the periods and methods of studying them.

FOREST HABITATS – broad-leaved, mixed and coniferous forests, fruit orchards, vegetation strips along rivers, large city parks			
Expected species *	**Best periods for study**	**Methods of study**	**Function of habitat**
1. *Myotis bechsteinii* (Bechstein's bat) **2.** *Barbastella barbastellus* (Western barbastelle) **3.** *Nyctalus noctula* (Noctule) **4.** *Nyctalus lasiopterus* (Giant noctule) **5.** *Nyctalus leisleri* (Lesser noctule) **6.** *Myotis alcathoe* (Alcathoe whiskered bat) **7.** *Pipistrellus pygmaeus* (Pygmy/soprano pipistrelle) **8.** *Pipistrellus pipistrellus* (Common pipistrelle) **9.** *Myotis aurascens* (Steppe whiskered bat) **10.** *Myotis brandtii* (Brandt's bat) **11.** *Myotis daubentonii* (Daubenton's bat) **12.** *Myotis mystacinus* (Whiskered bat) **13.** *Myotis nattereri* (Natterer's bat) **14.** *Plecotus auritus* (Brown long-eared bat) **15.** *Plecotus austriacus* (Grey long-eared bat) **16.** *Rhinolophus ferrumequinum* (Greater horseshoe bat)	• From April 20th to October 10th using all methods • Breeding colonies can be found from May 25th to August 1st • Swarming at cave's entrances and in galleries – from August 20th to October 10th, depending on the altitude	• Nets above forest clearings, over rivers and streams, entrances of isolated caves and galleries • Radio tracking for establishing presence of colonies in tree hollows and their foraging grounds • Installation and inspection of bat boxes	• Broadleaved forests are roosting and foraging habitats for almost all of these species • Trees with hollows, loose bark and crevices are of greatest importance for the roosting of these bats • Most species forage above forest streams, ponds, clearings, barrens and river strips • Abundance of some species (e.g. # 3, 5) is substantially higher during the spring and autumn migrations
OPEN HABITATS- agricultural areas, steppes, large meadows, beaches in lowlands			
Expected species *	**Best periods for study**	**Methods of study**	**Function of habitat**
1. *Nyctalus noctula* (Noctule) **2.** *Tadarida teniotis* (European free-tailed bat) **3.** *Eptesicus serotinus* (Serotine) **4.** *Myotis myotis* (Greater mouse-eared bat) **5.** *Myotis blythii* (Lesser mouse-eared bat) **6.** *Nyctalus leisleri* (Lesser noctule)	• From March to November • 5 days a month during the assessment	• Bat detectors • Evening observations in the areas with bat activity	• Hunting habitats • Migration corridors to the foraging grounds

***** only the most typical species for the respective habitat are listed

WETLANDS – large rivers, lakes, swamps, dams, flooded areas, fishing ponds			
Expected species *	**Best periods for study**	**Methods of study**	**Function of habitat**
1. *Myotis capaccinii* (Long-fingered bat) **2.** *Myotis daubentonii* (Daubenton's bat) **3.** *Myotis dasycneme* (Pond bat) **4.** *Pipistrellus nathusii* (Nathusius' pipistrelle) **5.** *Pipistrellus pipistrellus* (Common pipistrelle) **6.** *Pipistrellus pygmaeus* (Pygmy/soprano pipistrelle) **7.** *Nyctalus noctula* (Noctule) **8.** *Pipistrellus kuhlii* (Kuhl's pipistrelle)	• From April 20th to October 10th • The greatest species abundance is established during migrations in the spring (April–May) and in the autumn (September)	• Bat detectors • Evening observations for sites with greatest swarming activity of insects • Monitoring of local migration corridors	• Foraging habitats • Small bat colonies roost in isolated trees – poplars, alders, sycamores, willows, or in buildings located in wetland areas
ROCKY HABITATS – rocks, cliffs, caves, disused mine galleries, quarries in the lowlands and mountains			
Expected species *	**Best periods for study**	**Methods of study**	**Function of habitat**
1. *Tadarida teniotis* (European free-tailed bat) **2.** *Hypsugo savii* (Savi's pipistrelle) **3.** *Vespertilio murinus* (Particoloured bat) **4.** *Myotis blythii* (Lesser mouse-eared bat) **5.** *Myotis emarginatus* (Geoffroy's bat) **6.** *Myotis myotis* (Greater mouse-eared bat) **7.** *Eptesicus serotinus* (Serotine) **8.** *Rhinolophus ferrumequinum* (Greater horseshoe bat) **9.** *Rhinolophus hipposideros* (Lesser horseshoe bat) **10.** *Rhinolophus blasii* (Blasius's horseshoe bat) **11.** *Myotis capaccinii* (Long-fingered bat) **12.** *Miniopterus schreibersii* (Schreiber's long-fingered bat) **13.** *Rhinolophus mehelyi* (Mehely's horseshoe bat) **14.** *Rhinolophus euryale* (Mediterranean horseshoe bat)	• From April 20th to October 10th using all methods • Breeding: from May 25th to August 1st • Swarming around cave entrances and galleries: from August 20th to October 10th • Hibernation: from December 1st to March 30th	• Direct census of large colonies in caves and galleries • Setting nets at entrances to caves and galleries during the autumn swarming • Nets in rocky gorges and over open mountain ridges	• Primarily provides roosts for breeding, hibernation or year round roosting of single bats or large colonies • Foraging habitat for some species
SETTLEMETS – towns, villages, resorts			
Expected species *	**Best periods for study**	**Methods of study**	**Function of habitat**
1. *Pipistrellus pipistrellus* (Common pipistrelle) **2.** *Pipistrellus pygmaeus* (Pygmy/soprano pipistrelle) **3.** *Nyctalus noctula* (Noctule) **4.** *Eptesicus serotinus* (Serotine) **5.** *Hypsugo savii* (Savi's pipistrelle) **6.** *Rhinolophus hipposideros* (Lesser horseshoe bat) **7.** *Plecotus austriacus* (Grey long-eared bat) **8.** *Vespertilio murinus* (Particoloured bat)	• Year round observations	• Bat detectors • Night observations of places where bats pass by and forage • Inspection of basements, attics, wall constructions and joints	• Complex habitat – foraging ground, roost, migration corridor • Some species spend the winter in towns and the summer in nearby mountains

ANNEX 5: Applicability of the study techniques for bat assessment during different periods

METHOD / MONTH	Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		Oct		Nov		Dec	
Inspection of caves, galleries, bunkers – WINTER	!	!	!	!	x	x																		!
Inspection of caves, galleries, bunkers – SUMMER									!	!	x	x	x	x	x	!	!	!						
Setting of mist-nets								!	!	!	x	x	x	x	!	!	!	!	!	!				
Bat detectors						!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!			
Radio tracking									!	!	x	x	x	!	!	!	!	!						
Collection of traffic casualties							!	!	!	!	!	!	!	!	!	!	!	!	!					
Inspection of bat boxes								!	!	!	!	!	!	!	!	!	!							
Inspection of buildings																								

LEGEND

	The most appropriate period for study
	Appropriate period but under certain circumstances failures are possible
!	Recommended period with minimum impact
x	Not recommended, as potentially high impact

ANNEX 6: List of important bat caves and mine galleries in Bulgaria subject to monitoring under the NBMS

#	CAVE	SETTLEMENT	WINTER	SUMMER	SPECIES
	NORTHERN BULGARIA				
1.	Parnitsite	Bezhanovo village	+	+	*M. schreibersii, M. capaccinii, M. myotis/blythii, M. emarginatus, Rh. ferrumequinum, Rh. euryale/Rh. mehelyi, Rh. hipposideros*
2.	Nanin Kamak	Mousselievo village	-	+	*M. schreibersii, M. capaccinii, M. myotis/blythii, Rh. ferrumequinum, Rh. euryale/Rh. mehelyi*
3.	Sedlarkata	Rakita village	-	+	*M. schreibersii, M. capaccinii, M. myotis, Rh. ferrumequinum*
4.	Devetashkata peshtera	Devetaki village	+	+	*M. schreibersii, M. capaccinii, M. myotis, Rh. ferrumequinum, Rh. euryale, Rh. hipposideros, N. noctula*
5.	Mandrata	Alexandrovo village	+	+	*M. schreibersii, M. capaccinii, M. myotis, Rh. ferrumequinum*
6.	Morovitza	Glozhene village	+	+	*M. schreibersii, M. myotis/blythii*
7.	Lyastovitzata	Glozhene village	+	+	*M. myotis, M. schreibersii, Rh. ferrumequinum*
8.	Golyama Vodna Mikrenska cave (Mandrata)	Mikre village	+	+	*M. schreibersii, M. capaccinii, M. myotis, Rh. ferrumequinum, Rh. euryale*
9.	Orlova Chuka	Pepelina village	+	+	*Rh. euryale, Rh. blasii, Rh. ferrumequinum, Rh. mehelyi, M. schreibersii, M. capaccinii, M. myotis/blythii, Rh. hipposideros*
10.	Gabarnika	Krassen village	+	+	*M. schreibersii, M. capaccinii, M. myotis/blythii, Rh. ferrumequinum*
11.	Zorovitza	Cherven village	-	+	*Rh. euryale, M. schreibersii, M. capaccinii, Rh. ferrumequinum, Rh. mehelyi*
12.	Emenskata cave	Emen village	+	+	*M. schreibersii, M. capaccinii, Rh. ferrumequinum, Rh. hipposideros, N. noctula*
13.	Prolazkata (Derventska) cave	Prolaz village	+	+	*Rh. euryale, M. myotis, M. schreibersii, Rh. ferrumequinum*
14.	Zandana	Shoumen town	+	-	*M. schreibersii, M. capaccinii, M. myotis, Rh. ferrumequinum*
15.	Ponora	Chiren village	+	+	*M. schreibersii, M. capaccinii, M. myotis/blythii, Rh. ferrumequinum, Rh. euryale, Rh. hipposideros,*
16.	Suhi Pech	Oreshets railway station	+	+	*M. myotis/blythii, Rh. ferrumequinum*

ANNEX 6: List of important bat caves and mine galleries in Bulgaria subject to monitoring under the NBMS

#	CAVE	SETTLEMENT	WINTER	SUMMER	SPECIES
	SOUTHERN BULGARIA				
17.	Dyavolskoto Garlo	Trigrad village	+	+	*M. schreibersii, M. capaccinii*
18.	Gargina Dupka	Mostovo village	+	+	*M. schreibersii, M. capaccinii, Rh. ferrumequinum, Rh. hipposideros*
19.	Ivanova Voda	Dobrostan village	+	+	*M. myotis/blythii, M. schreibersii*
20.	Golashka mine gallery	Golak village	+	+	*M. schreibersii, M. capaccinii, M. myotis, Rh. ferrumequinum, Rh. euryale, Rh. hipposideros*
21.	Disused military bunker	Kresna gorge	-	+	*M. emarginatus, Rh. ferrumequinum*
22.	Sharaliyskata cave	Ilindentsi village	+	-	*Rh. ferrumequinum, Rh. euryale, Rh. hipposideros*
23.	Yarasa-ini	Sredna Arda railway station / Visoka Polyana village	-	+	*M. schreibersii, M. capaccinii, M. myotis/blythii*
24.	Aina-ini	Ribino village	+	+	*Rh. euryale, Rh. blasii, Rh. ferrumequinum, Rh. mehelyi, M. myotis/myotis, M. schreibersii*
25.	Karangin	Oreshari village	-	+	*M. myotis/blythii*
26.	South abrasion cave (cape Maslen Nos)	Primorsko town	-	+	*M. schreibersii, M. capaccinii, M. myotis/blythii, M. emarginatus*
	TOTAL (NORTH + SOUTH BULGARIA)		**13+6**	**15+9**	

ANNEX 7: General scoring system for assessing the bat potential of a site

1 – LOW VALUE	• Isolated site not connected by prominent linear features • A small number of possible roosts present on site • Site may contain isolated habitat that could be used by foraging bats e.g. a lone tree or area of scrub but not parkland.
2 – MODERATE VALUE	• The site is connected to the wider landscape by linear features that could be used by commuting bats e.g. lines of trees and scrub or linked back gardens • Has several potential roost features within the site, such as buildings, trees or other structures • Habitat on site that could be used by foraging bats e.g. trees, shrub, grassland or water.
3 – HIGH VALUE	• The site is connected to the wider landscape with strong linear features that would be used by commuting bats e.g. river/ stream valleys or hedgerows • The site contains buildings, trees or other structures that have features of particular significance for roosting bats • Habitat of the site is favoured by foraging bats e.g. broad-leaved woodland, tree-lined watercourses and grazed parkland.
4 – CONFIRMED ROOST	Evidence found that indicates a building, tree or other structure on the site is being used by bats • Droppings found e.g. scattered on the building/structure or below a cavity of a tree/building/structure • Bats heard «chattering» inside a feature on a warm day or at dusk • Bat(s) observed flying from the building, tree or other structure.

ANNEX 8: Conservation status of bats in Bulgaria according to national and international legislation (2008).

ORDER CHIROPTERA	BA	Bern	Bonn	EURO BATS	92/43 EEC	IUCN 2007	RDB
1. Greater horseshoe bat *Rhinolophus ferrumequinum*	2/3	II	II	+	2/4	LR	near threatened
2. Lesser horseshoe bat *Rhinolophus hipposideros*	2/3	II	II	+	2/4	LC	least concern
3. Mediterranean horseshoe bat *Rhinolophus euryale*	2/3	II	II	+	2/4	**VU**	**vulnerable**
4. Mehely's horseshoe bat *Rhinolophus mehelyi*	2/3	II	II	+	2/4	**VU**	**vulnerable**
5. Blasius's horseshoe bat *Rhinolophus blasii*	2/3	II	II	+	2/4	NT	**vulnerable**
6. Greater mouse-eared bat *Myotis myotis*	2/3	II	II	+	2/4	LR	near threatened
7. Lesser mouse-eared bat *Myotis blythii*	2/3	II	II	+	2/4	LR	near threatened
8. Bechstein's bat *Myotis bechsteinii*	2/3	II	II	+	2/4	**VU**	**vulnerable**
9. Geoffroy's bat *Myotis emarginatus*	2/3	II	II	+	2/4	**VU**	**vulnerable**
10. Long-fingered bat *Myotis capaccinii*	2/3	II	II	+	2/4	**VU**	**vulnerable**
11. Western barbastelle *Barbastella barbastellus*	2/3	II	II	+	2/4	**VU**	**vulnerable**
12. Schreiber's long-fingered bat *Miniopterus schreibersii*	2/3	II	II	+	2/4	LC	**vulnerable**
13. Natterer's bat *Myotis nattereri*	3	II	II	+	4	LR	least concern
14. Whiskered bat *Myotis mystacinus*	3	II	II	+	4	LR	least concern
15. Steppe whiskered bat *Myotis aurascens*	3	II		+	4		data deficient
16. Brandt's bat *Myotis brandtii*	3	II	II	+	4	LR	least concern
17. Alcathoe whiskered bat *Myotis alcathoe*	3	II	II	+			data deficient
18. Daubenton's bat *Myotis daubentonii*	3	II	II	+	4	LR	data deficient
19. Pond bat *Myotis dasycneme*	3	II	II	+	2/4	**VU**	–
20. Brown long-eared bat *Plecotus auritus*	3	II	II	+	4	LR	near threatened
21. Grey long-eared bat *Plecotus austriacus*	3	II	II	+	4	LR	least concern
22. Noctule *Nyctalus noctula*	3	II	II	+	4	LR	least concern

ANNEX 8: Conservation status of bats in Bulgaria according to national and international legislation (2008).

ORDER CHIROPTERA	BA	Bern	Bonn	EURO BATS	92/43 EEC	IUCN 2007	RDB
23. Giant noctule *Nyctalus lasiopterus*	3	II	II	+	4	LR	**vulnerable**
24. Lesser noctule *Nyctalus leisleri*	3	II	II	+	4	LR	**vulnerable**
25. Common pipistrelle *Pipistrellus pipistrellus*	3	III	II	+	4	LC	least concern
26. Pygmy/soprano pipistrelle *Pipistrellus pygmaeus*	3	II	II	+	4	–	–
27. Nathusius' pipistrelle *Pipistrellus nathusii*	3	II	II	+	4	LR	least concern
28. Kuhl's pipistrelle *Pipistrellus kuhlii*	3	II	II	+	4	LC	–
29. Savi's pipistrelle bat *Hypsugo savii*	3	II	II	+	4	LR	least concern
30. Serotine *Eptesicus serotinus*	3	II	II	+	4	LR	least concern
31. Northern bat *Eptesicus nilssonii*	3	II	II	+	4	LR	data deficient
32. Particoloured bat *Vespertilio murinus*	3	II	II	+	4	LR	least concern
33. European free-tailed bat *Tadarida teniotis*	3	II	II	+	4	LR	data deficient

LEGEND:

2/3, II – number of the Annex, where the species is listed

- **BA** – Biodiversity Act (SG 77/2002)
- **BERN** – Bern Convention on the Conservation of European Wildlife and Natural Habitats (SG 23/1995)
- **BONN** – The Bonn convention on migratory species of wild animals (SG 16/2000)
- **EUROBATS** – Agreement on the Conservation of Populations of European Bats (SG 16/2000)
- **92/43/EEC** – Directive 92/43/EEC on the Conservation of Natural Habitats and the Wild Flora and Fauna (HABITAT DIRECTIVE)
- **IUCN 2007** – 2007 IUCN Red List Of Threatened Species *(http://www.redlist.org):* **VU –** vulnerable, **LC –** least concern, **LR** – lower risk, **DD** – data deficient
- **RDB** – Red Data Book of Bulgaria. Vol 2, Animals (new edition).

NOTES

Why was this manual written?

- To provide a systematic synthesis of contemporary knowledge about bats in Bulgaria and specify the methods for studying them and appropriate periods to do so;
- To help conserve bats in regions where intensive changes are occurring in the landscape and more specifically in zones where there are direct conflicts of interest;
- To assist experts involved with environmental impact assessments and appropriate assessments so that their reports contain applicable measures to avoid, minimize, mitigate or compensate for negative impacts;
- To assist the different units of the Regional Inspectorates of the Ministry of Environment and Waters in their assessment of the quality of reports submitted that relate to bat conservation;
- For developers to identify and implement solutions for reducing the impact on bats in conflict zones;
- To facilitate the practical implementation of a number of laws relating to the conservation of endangered species.

For whom was this manual written?

- Experts at the Ministry of the Environment and Waters, RIEW and the Executive Environmental Agency;
- Developers and experts involved with environmental impact assessments and appropriate assessments;
- Experts from the NGO sector and others with an interest in this topic.

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